

PROCEEDINGS
6th Annual Symposium on
Graduate Research and
Scholarly Projects



April 23, 2010
Eugene Hughes Metropolitan Complex

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Ashley Braeuer, *A Preliminary Investigation of the Speech Productions of Children with Hearing Loss*, Mentor: Barbara W. Hodson, Department of Communication Sciences and Disorders

People's Choice Poster Award

Hemanth Kothuru, *Component-wise Energy Breakdown In a Laptop*, Mentor: Vinod Namboodiri, Department of Electrical Engineering and Computer Science

2010 GRASP PROGRAM

April 23, 2010 Opening Session in Lowe Auditorium	
8:00 – 8:30	Registration
8:30 – 8:45	Opening Remarks Provost & Vice President Miller
8:45 – 9:15	<p>Keynote Address</p> <p>Niall Shanks, PhD Curtis D. Gridley Distinguished Professor of History and Philosophy of Science</p> <p style="text-align: center;"><i>Good Scientific Methodology Underlies Ethical Research and Professional Practice</i></p> <p>What ethical dilemmas graduate students face during their studies and later in their professional lives?</p>
9:15 – 9:30	Refreshments and Poster Viewing in Gymnasium
9:30 – 10:30	Session 1 - Room 185
10:30 – 10:45	Break/ Viewing Posters in Gymnasium
10:45 – 11:55	Session 2 - Room 185
11:55 – 1:00	Lunch Break/ Viewing Posters in Gymnasium
1:00 – 2:20	Session 3 - Room 185
2:20 – 2:35	Break/ Viewing Posters in Gymnasium
2:35 – 3:25	Session 4 - Room 185
3:25 – 4:00	Break/ Viewing Posters in Gymnasium
4:00 - 4:30	<p>Awards – Room 132</p> <p>President Beggs Closing Remarks</p>

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ORAL PRESENTATIONS

Using 3D Modeling to Enable Students with Quadriplegia

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Faculty: Barry Badgett

School of Art & Design

Abstract.Section 504 of the American Rehabilitation Act of 1973 states, no qualified handicapped person shall, on the basis of handicap, be excluded from participation in, be denied the benefits of, or otherwise be subjected to discrimination under any program or activity which receives or benefits from Federal financial assistance. The Foundations curriculum within the School of Art & Design at WichitaStateUniversity offers structured courses that introduce students to principles and theories in visual thinking. How do instructors enable a student with quadriplegia to fulfill the requirements of a 3-dimensional design foundation course that also emphasizes learning to handle equipment and tools properly in order to realize their designs? The approach was for the student to use a 3D modeling software as a way to design and construct concepts relating to the assignments in virtual space. It was equally essential that the instructor be familiar with the concept of teaching with the modeling software. While the learning curve for designing with 3D modeling software can be steep; there are a few programs that offer intuitive tools to speed up the process of taking an idea to full visualization. 3D modeling can prove very effective for visually conveying the students' ideas in accomplishing the assignments and provides persons with quadriplegia a powerful tool for achieving design independence.

1. Introduction

Teaching a class that includes a student with quadriplegia or other impairments is an obvious difficulty for a teacher of any subject. Think about the specific difficulties that arise for art teachers who potentially have to modify almost every aspect of their syllabus for these students. In contrast, art can be one of the only educational subjects that have the capacity to engage all students, regardless of physical, emotional, or developmental abilities. The purpose of this essay is to illuminate the potential for educating design students with quadriplegia by using computer technology, intuitive 3-dimensional design software and practical assistance that provides a disabled student the opportunity to create their own designs and artwork.

Art F 189 Fundamentals of Three-Dimensional (3D) Design foundation course at Wichita State University requires students to learn the fundamental design ideas behind 3D design as well as fabricate individual and group art work utilizing a variety of materials and techniques. The fall semester of 2008 introduced a quadriplegic student into this 3D foundation course. There was no prior communication with the student or planning about how to change the course or handle the students' needs enabling him to meet the requirements of the class. This particular class consisted of an adjunct instructor (AI), a graduate teaching assistant (GTA) and approximately twelve students set within the art facilities at Henrion Hall. The AI and the GTA have a wide-ranging background in computer-aided drafting, computer generated 3D modeling, computer numerical controlled (CNC) technologies and rapid prototyping. The initial introduction with the student was on the first day of class, where the AI and GTA evaluated the students' competencies with a computer and design software. The student had decided to return to school to pursue a degree in graphic design and his attitude and desire to learn were unbounded by his disability.

2. Experiment, Results, Discussion, and Significance

The approach was for the student to use Google Sketchup¹, a 3D modeling software for creating, editing and sharing 3D models as a way to design and construct concepts relating to 3D objects. The program is free and designed to be relatively easy to learn and use as compared to other programs. 3D modeling can prove very effective for visually conveying the students' ideas in accomplishing the assignments and potentially provides persons with quadriplegia a powerful tool for achieving design independence.

"The computer allows the artist to focus more on the message, with less emphasis on the execution. The technicalities are handled so easily that it no longer becomes a question of how to do it, but indeed what to do. Making art is about making choices and establishing priorities, and the computer simply gets the encumbrances

¹<http://sketchup.google.com/>

[impairment] out of the way and lets the artist combine variables until his or her intentions are realized.” [2] Nearly all students, disabled and non-disabled learn in similar ways because they are using similar mental processes. When a student is interactive with a computer, the disability is unidentifiable and computer technology can potentially offer disabled students an inclusion in the process of art making.

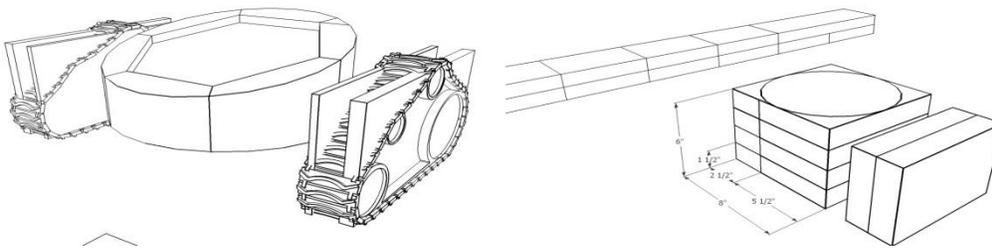
Utilizing two existing tall tables, a board to span the tables and a cordless drill case, the GTA assembled a make-shift workstation for the student in the same room as the other students. The workstation was tall enough for him to roll his electric wheelchair under and reach his laptop which was set on top of the drill case. The student provided his own laptop, roller-ball mouse and mouth stick (a pencil which he used to move the roller-ball around and navigate his computer). The GTA would set up the computer and access the software for the student. With Sketchup open, the student would virtually build his project to meet the requirements of the particular assignment and at the end of the class the GTA would pack up the students’ computer and break down the make-shift workstation. The student quickly learned Sketchup through online tutorials and practice. On occasion the GTA would demonstrate techniques with the software that the student needed in order to create his projects.

The course description explains the class as a studio class that instructs in the basics of making 3D art. The format is problem solving and assignments are given in the form of provocations to which the student gives solutions by making a 3D object. The objective of this course is to develop a working knowledge of design principles used in making 3D art and to promote experimentation in resolving ideas.[3] It was very laborious for the student to create his projects on the computer only using the mouth stick, but he worked outside of class at length to complete the assignments. In the group assignment, the student modeled the project in 3D and the other students built the project based off of his design with a few modifications. He also participated in critiques; other students were able to engage with the students’ art by having the model rotated on the computer to visibly communicate its 3D properties.

Inclusion was paramount for the student to get the full exposure of the studio class experience. He was able to communicate his initial ideas to other students and receive comments for bettering his art projects. Some experts consider this the essence of mainstreaming, an effective education process for some handicapped students. In this case, the effective mainstreaming required a student with motivation and persistence to learn, the 3D expertise of the IA and GTA and an ADA compliant facility to create an optimal teaching environment and solution.

3. Conclusions. With only one semester, there seems to be sufficient evidence to show that students with disabilities enrolling in a 3D class can benefit from computer 3D modeling in order to have greater autonomy in the creation of their art. In particular, the program Sketchup proved to be a powerful tool for self-expression without the aid of another individual. With refinement and potential university acceptance and assistance, disabled students may have the opportunity to be equipped with the skills and competencies to gain qualifications and potential employment.

4. Acknowledgements. I would like to acknowledge Steve Atwood, the adjunct instructor for the class as mentioned above. His mechanical and computer knowledge is unmatched. I would also like to acknowledge the student who was the subject of this paper. It was his tenacity and persistence to complete the course that inspired this paper and I hope that he remembers how capable he is.



Organic Machine (to be built only using one 2x6)

[2] P. Callow, Some Thoughts on the Use of Digital Media in Secondary Art and Design in Becta ICT Research. A report on the use of information and communications technology (ICT) in art and design (2003), p.17.

[3] Barry Badgett, Art F 189: Fundamentals of Three-Dimensional Design Syllabus.

Fatigue Life Estimation of notched Aluminum Sheet Specimens Subjected to Periodic Tensile Overloads

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Faculty: K. S. Raju

Department of Aerospace Engineering

Abstract. The objective of this study was to determine the applicability of an approach to predict the number of cycles of fatigue loading of a structure to failure. In the present investigation, notched structural elements were subjected to constant amplitude loading with a maximum stress of 15ksi and mean stress of 6ksi along with periodic tensile overloads of 20ksi. Miner's rule was used to estimate the cycles to failure, and a second analytical approach, that incorporated the notch residual stress caused by the first overload in the Miner's rule, was used to estimate the number of cycles of load to failure. The predicted fatigue life using the second approach agreed with the experimentally determined fatigue life better than that of the first approach.

1. Introduction

Airframes are subjected to a variety of dynamic loads, such as loads due to maneuvers and dynamic loads associated with wind gusts and storms, during the various stages of flight. It becomes necessary to know the number of cycles of loads that a structural component of the airframe can withstand before it fails to carry the operational loads it was designed for. The growth of cracks causes the eventual failure of the component.

Holes in the structural elements of airframe are necessary for a number of functions, including the attachment of other components and routing of electrical and hydraulic lines. The presence of these holes, or material flaws, gives rise to stress concentrations that influence the nature of the stress fields and subsequent deformation in the vicinity of the holes. Consequently, the existence of a hole can influence the fatigue life of the component.

This study was undertaken to examine the fatigue life of structural elements of 2024 T3 aluminum clad material with a center notch. Material in the vicinity of the notch is subjected to plastic strain due to the stress concentration. The removal of the applied load causes residual stress to remain near the notch which consequently affects the material during subsequent cyclic fatigue loading. Miner's rule [1] is a procedure developed to estimate the number of cycles of loading to failure. The procedure, based on a damage criterion of cycle ratio, is flawed by the fact that it does not account for loading sequence [2]. An attempt to circumvent this shortcoming was made in this investigation, by incorporating the notch residual stress in the Miner's rule for estimating the number of cycles to failure.

2. Experiment, Results, Discussion, and Significance

All of the experiments of this study were conducted at the National Institute for Aviation Research. The 2024 T3 aluminum clad sheet specimens had a nominal thickness of 0.09in, width of 0.75in, and the center hole had a nominal diameter of 0.161in. Constant amplitude fatigue load tests were conducted for two families of dynamic loading; one had a maximum stress level of 15ksi with a mean stress level of 6ksi and the other had a maximum stress level of 20ksi with a mean stress of 8.5ksi. A series of five different tests were conducted in which a tensile overload stress of 20ksi was applied to the first family of dynamic loading ($S_{max}=15\text{ksi}$, $S_{mean}=6\text{ksi}$) after every 10 cycles; then 50 cycles; then 100 cycles; 1,000 cycles; and finally 5,000 cycles. Anti-buckling fixture was used to prevent the buckling of the specimen during the compressive portion of the dynamic loading. Figure 1 contains a photograph of the experimental set up of the notched specimen in the anti-buckling fixture in the MTS dynamic load frame.

Miner's rule with no correction for residual stresses was used to obtain the first analytical approximation of the number of cycles of load to failure. The second analytical procedure made use of Neuber's rule [3] to determine the notch residual stress field after the first overload. Figure 2 shows the application of Neuber's rule, for a far-field applied stress of 20ksi, the notch stress is 49.44ksi. An equivalent far-field stress was then superimposed on the subsequent constant amplitude stress values. The cycles to failure for this effective constant amplitude loading was

determined from appropriate constant amplitude SN curves. Miner's rule was applied to determine the number of load cycles to failure for this effective loading. The material hardening characteristics of two extreme models of hardening were considered; these were isotropic hardening and kinematic hardening. In the absence of reverse yielding, both the hardening types provided the same value for residual stresses after the first overload.

Table 1 contains the normalized predictions of the number of cycles to failure using the direct application of Miner's rule and the modified Miner's rule with the correction for residual stresses. The predicted numbers of cycles to failure were normalized with the numbers of cycles to failure determined from the experimental phase of the study. The results provided in Table 1 indicate that the effect of the residual stresses from the first overload and consequent application of the overload after every 10 cycles does not improve the prediction of the fatigue life. For all of the other block sizes of constant amplitude loading between overloads (50-5,000 cycles), an improvement between 17% and 19% of predicted fatigue life was obtained. This is attributed to the modification of the analytical method to include the beneficial effect of the compressive residual stress at the notch after the first overload.



Figure 1. Experimental Setup.

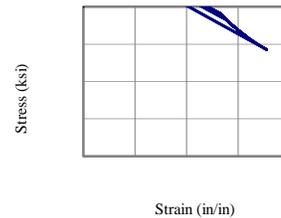


Figure 2. Graph shows estimation of notch stress using Neuber's rule. For far-field stress of 20ksi, stress at the notch is 49.44ksi.

Table 1:
Comparison of the analysis results with experimental work

Block Size	Ratio of cycles to failure by Miner's rule to Experimental	Ratio of cycles to failure by Miner's rule with residual stress correction to Experimental
10	0.99	1.13
50	0.84	0.99
100	0.78	0.93
1,000	0.71	0.84
5,000	0.68	0.81

3. Conclusions

An improvement in the fatigue life estimation by incorporating residual stresses in Miner's rule was obtained. This improvement was confirmed by experimentally obtained results for fatigue loading. An important condition is that reverse yielding at the notch during fatigue loading does not occur.

- [1] Miner, M. A., "Cumulative damage in fatigue," *Journal of Applied Mechanics*, ASME, Vol. 12, pA159-A164, 1945.
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Ecological Perspectives of Latino/Hispanic Families in a Rural School Community

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Abstract. Immigration waves from Mexico, Central and Latin America have changed demographic landscapes and in some communities, native Spanish speaking people are the majority. In schools across the U.S., growing numbers of students need English language resources and cultural supports from their schools to break the cycles associate with being the least educated ethnic group in the country. This changing ecology creates the need for understanding Hispanic/Latino populations. This study seeks to understand the worlds that the Hispanic/Latino families negotiate as they move through the interconnected ecologies of their existence: family systems, cultural norms, communities, church and school. Through qualitative methodology, researchers gathered oral narratives and cultural data from families in a rural Midwestern community to understand how Latino/Hispanic parents support their children in schools and define their relationship to their children's education.

1. Introduction

In rural southwest Kansas, large numbers of Hispanic/Latino immigrants have made their homes in several communities based on ample employment opportunities afforded to them primarily in the areas of agriculture, beef packing, and feed yards. Both schools and communities have been touched by the large influx of non-English speaking immigrants, who hail from linguistic and cultural differences. The children of immigrants enter schools and seek to become educated by teachers that speak only English and have familiarity with mostly one culture. This changing ecology has created a need for understanding the population as a whole and understanding the families and individuals that reside in these ever changing communities. This study seeks to understand the multi-cultural eco-systems that Hispanic/Latino families negotiate each day as they move through the various layers and ecologies of their day-to-day existence (Bronfenbrenner, 1979).

The need for understanding immigrant populations is at the forefront for creating teaching and learning opportunities that promote success for every student. In public schools there is a growing awareness of a need to work with language learning and cultural issues. As documented by the number of schools which require second language learning certification or knowledge of how to adapt classes for students of multiple levels of language development (Bennett, 2008; Goldenberg, 2008). These external dynamics are playing out in the internal context of the classrooms.

2. Experiment, Results, Discussion, and Significance

Theoretical Framework. Ecological theory, developed by Bronfenbrenner and the Funds of Knowledge theory developed by Moll both build from original thinking by Vygotsky who discussed the importance of internal or external environments or spheres in human development. Discussion of these environments or spheres creates a framework for understanding how families function in a Latino/Hispanic context. From this external context, a public school can understand how to better serve students and improve their performance in the internal environment. According to Bronfenbrenner, these different spheres, the individual student, the family and the school and the external environment the community are nested one in the other to make up the overall environmental context (Bronfenbrenner, 1951, 1976, 1979).

Research Design. In this study, the research team evaluated the relationships and human interactions of the internal and external environments that a student negotiated day to day. A student maneuvers between the various environmental contexts such as the family, church, community, and school. The impact of the setting cannot be understood without information on how the setting is perceived by participants. The guiding questions of the study were as follows: 1) what are practices of new immigrant Latino/Hispanic family households and how do they construct their roles in

their cultural context? 2) How does a new immigrant Latino/Hispanic family explain its work history and itself as an individual unit? 3) How does a new immigrant Latino/Hispanic family describe its interactions between schooling, neighbors, and other community institutions?

Participants were selected out of a group of thirty-two Latino/Hispanic families in a SW Kansas community comprised of 65% Latino populations. They had recently participated in a team building/communication program in conjunction with the school. Within the past twenty years, this community has transitioned from an Anglo majority to a Hispanic/Latino majority city in one generation. Over one half of the students in this Midwestern community are English Language Learners (ELL). Sixty-five percent of all students are economically disadvantaged. These participants were purposefully selected because in being a part of that program, the families demonstrated an intersection or bridge between their family and the school.

Data was collected from in-depth interviews with two families, in two separate interview session at their homes, consistent with the oral narrative tradition, to document and analyze the environmental influences of these families through first-hand accounts. The interviews consisted of open-ended and structured questions that functioned around tasks to capture the 'ecosystem' and the 'funds of knowledge' as modeled by Moll et al (1992); understanding cultural traditions, heritage, family practices, and the interaction of the these systems with the school system..

Results, Discussion, Significance. As a conceptual model and framework, ecological theory, coupled with the perspective offered by the funds of knowledge (Moll), assisted the researchers in study design, data gathering, and analyzing the data in order to understand the Latino/Hispanic family systems. The research team found data related to these areas of inquiry: time in community; language spoken in home/community; health practices/beliefs; impact of loss/grief; holidays/special events; religious/cultural institutions; education/work values; and family structure/values. The interviews gleaned information from these systems and the interactions between these systems. The research team's interviews and the interview process consisted of yet another interaction, for both the parents and the school, and from these activities, an understanding of how to build relationships across the community. Underlying themes of discrimination, lack of connection to community and fun, safety, employment issues, and transportation have emerged during the interviews.

The significance of this research lies in understanding the complexity of assimilation and acculturation of immigrants. Immigrant children often operate as ambassadors in connecting the family to the larger community through institutions such as school, churches, sports and recreation activities. Recognizing and understanding cultural differences in immigrant students may help teachers connect and create stronger learning communities.

3. Conclusions

There are implications for school settings to improve student performance by understanding family systems, cultural heritage, and community contexts, which students negotiate on a daily basis.

4. Acknowledgements

We thank Dr. Jo Bennett, research advisor.

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Analysis of Differential Glycosylation Patterns of Human FSH

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Abstract. Follicle stimulating hormone (FSH) is a glycoprotein hormone with subunits α and β , and is required for gamete development. Differential glycosylation may produce diglycosylated FSH with higher biological activity, and is suspected to be generated via the action of oligosaccharyltransferase (OST) isoforms. Signal peptide hydrophobicity of α and β may contribute to selective usage of OST, and hence modulate N-glycosylation. We hypothesize that N-glycosylation of FSH subunits is regulated via differential interactions between OST isoforms and subunit signal peptides and modulated by estrogen. To test our hypothesis, we will engineer chimeric hFSH subunits by swapping the signal peptide sequences of α and β . Constructs with the chimeric sequences will be transfected into cell lines, and expressed FSH will be examined.

1. Introduction

The hormone FSH is partially responsible for the development of follicles, which in turn are responsible for the production of viable ova at ovulation in women. FSH is composed of two subunits, an alpha (α) and beta (β) and both subunits may be decorated with oligosaccharide branches at two residues on each subunit [1]. In humans, the FSH α is continually glycosylated, whereas there seem to be detectable variations in FSH β glycosylation. Preliminary data suggests that activity of estradiol selectively inhibits FSH β glycosylation, while having no apparent effect on glycosylation patterns of FSH α . This action produces a di-glycosylated glycoform of FSH, being more biologically potent than the tetra-glycosylated form in which both subunits carry two oligosaccharides. Previous studies have indicated that a shift in the ratio of glycoforms of FSH occurs as women age, and may suggest a potential avenue by which menopause and the cessation of reproductive viability occurs [2]. In other words, as estradiol concentrations decrease in premenopausal, or menopausal women, the abundance of tetra-glycosylated FSH increases, and thereby decreasing the relative amount of highly potent FSH. Oligosaccharyltransferase (OST) is the enzyme responsible for the addition of oligosaccharide branches onto the emerging polypeptide chain as it enters the mammalian endoplasmic reticulum (ER). Studies have indicated that two isoforms of OST exist, and selective usage of each isoform is believed to be correlated to the hydrophobicity of the signal peptides of each FSH subunit [3]. Therefore, our hypothesis is that selective usage of OST isoforms is based on the signal peptide sequence of each subunit, and is modulated by activity of estradiol. To test our hypothesis, we have constructed chimeras of each FSH subunit by swapping their signal peptide sequences. These chimeras are used to transfect an immortalized rat gonadotrope cell line (GH3 cells). Once transfected cells expressing the hormone have been isolated, we will examine the hormone expression profile under different conditions, specifically various concentrations of estradiol. If our hypothesis is correct, then we should detect a non-glycosylated α subunit, and a large amount of glycosylated β subunit in the transfected cells. In addition, we should also be able to modify the amount of glycosylated α subunit by administering varying concentrations of estradiol.

2. Experiment, Results, Discussion, and Significance

Initially, expression vectors containing hFSH α (h α /pSVL), hFSH β (pKR8) and the mammalian expression vector pCI-neo purified using Qiagen midi plasmid kit were used to amplify FSH subunits for ligation into a cloning vector. The cloned subunits, after bacterial amplification, would be isolated, digested out of the cloning vector, and ligated together to form the chimeric sequences. Following ligation, these sequences would be cloned into the mammalian expression vector pCI-neo, containing a viral promoter for constitutive, or continual, expression. This expression vector would then be transfected into GH3 cells, and the expressed hormone would be released from the cell into the conditioned media and harvested. Cells were grown in medium containing G418 to select for the cells that are transfected with the selection vector. Once a stable cells have been identified, FSH-expressing GH3 cells will be incubated in the presence and absence of 17-estradiol. After two days, the conditioned medium will be collected, and replaced with fresh media. FSH concentration will be measured by RIA using National Hormone and Pituitary Program kits. FSH will be purified by immunoaffinity chromatography and the

heterodimer fraction will be separated from unassociated subunit by Superdex 75 gel filtration. Di-glycosylated and tetra-glycosylated hFSHglycoform abundance will be determined by Western blot analysis.

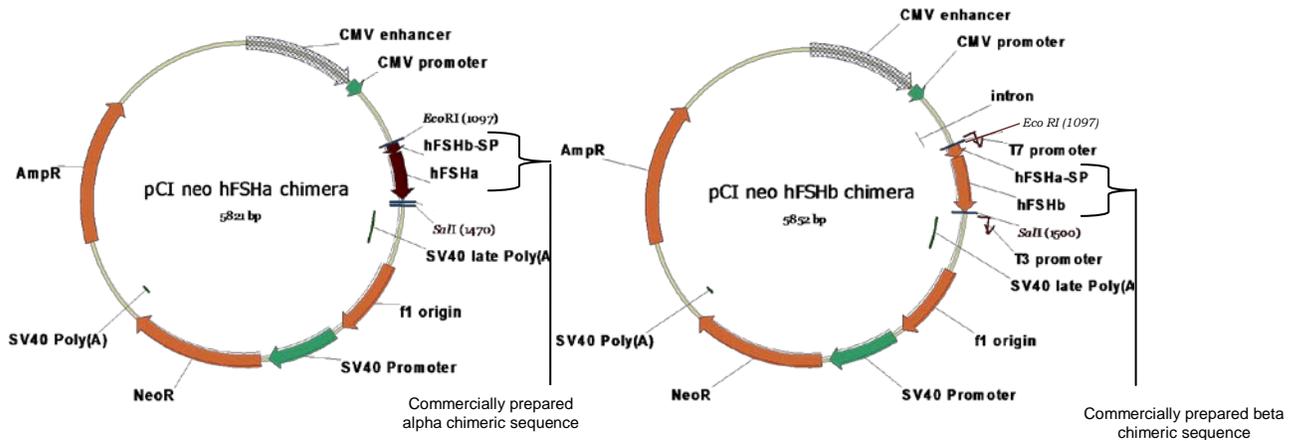


Figure 1. pCI neo containing the α chimera.

Figure 2. pCI neo containing the β chimera.

Currently, due to difficulty in traditional cloning methods, the constructs have been commercially prepared, cloned into pCI neo, and transfected into rat pituitary tumor cells (GH3) using a liposomal transfection reagent from Biontex. As mentioned previously, stable cell lines would have been isolated based on G418 resistance. However, cell loss due to gradual lack of cell adherence to the culture vessels yielded small amounts of conditioned media for analysis, so a second transfection using BD Biosciences Primaria culture flasks and plates, noted as providing increased cell adherence due to chemically treated cell culture surface, was performed. Proteins were attempted to be purified from the conditioned medium of the transfected cell lines and assayed for FSH expression via radioimmunoassay (RIA). Complications believed to be caused by the presence of serum proteins in the conditioned media have produced unreliable RIA results. Avenues to remove serum from media are currently being explored, such as removing proteins using a column, or culturing cells briefly in serum free media. Cells exposed to selection media containing G418 underwent necrosis in extremely high quantities, however some survivors seem to be currently replicating. It may be necessary to do multiple transfections concurrently to isolate enough protein for analysis if cell numbers fall again. Once protein expression is confirmed, extracts of FSH subunits will be prepared and N-glycosylation patterns analyzed. Changes of N-glycosylation in response to hormone treatment will be examined. Following confirmation that hormone is being secreted, the hormone subunits will be analyzed using immunoaffinity chromatography and Western blot.

3. Conclusion

This knowledge will ideally provide insight into the avenue by which menopause occurs, and to a more broad extent, insight into reproductive ageing. Additionally, as glycosylation exists as a means of post transcriptional modification that applies to many proteins, this experiment may give insight into a significant modification mechanism.

4. Acknowledgments

I would like to thank Dr. Mark Schneegurt for providing funding for my master's degree through the GK-12 program, something I am very privileged to be part of. I would also like to thank my committee members, Dr. Bann and Dr. May for their continued support.

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Rhetoric, Identity, and the Obama Racial Phenomenon: Exploring Obama's title as the "First Black President"

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Abstract. In 2008, a nearly 200 year U.S. historical precedent was overturned when Barack Obama was named the "first Black president." Although Obama is of mixed heritage, he adopted an almost singularly Black identity and has long been characterized by the media as Black. This study is concerned with the role that society and Obama's acceptance of the title play in identifying and portraying him as the "first Black president." This study compares Barack Obama's self-portrayal in his book, *Dreams from my Father*, to mainstream and Black media portrayals of his race. Furthermore, it researches the existence of a racially stratified society by dividing racial constructs and determining the driving force behind the rhetoric of race.

1. Introduction

My motivation for this project stems from my own experience as a Biracial individual endeavoring to establish an identity in the midst of a lack of racial clarity in society. From the colonial years to present day, U.S. society has attempted to categorize Biracial people in America, while researchers and scholars have endeavored to define race. Biracial people, historically labeled "mulattos" [4] have been variously defined by society, and placed into arbitrary categories, at times separated from the White race, at others, assimilated into the White race [2]. Biracial individuals are often caught between the two ends of the dominant race continuum [3]. With interracial relationships and Biracial births on the rise [2], it is becoming increasingly important to unpack the nature and implications of constructions of race for Biracial individuals in the U.S.

2. Experiment, Results, Discussion, and Significance

In view of past research there are many factors that influence how individuals and society understand Biracial identity in the U. S. This study compares Barack Obama's self-portrayal in his book, *Dreams from my Father*, Black media, and mainstream media portrayals of his race in order to identify common and unique themes around race and shed light on the question of whether race is viewed as a social, cultural, or physical construct. This study will allow for a better understanding of the framework within which President Obama self identifies, and the U.S media classifies him as Black, thus revealing the cultural tensions among racial stereotypes or classifications.

Based on past research, the following research question is posited:

RQ1: What unique and shared understandings of racial identity emerge from thematic analysis of media and self portrayals of President Obama as the "first Black president"?

RQ1a: How is President Obama's self portrayal as the "first Black president" reflected in his book *Dreams from my Father*?

RQ1b: How do mainstream media racially portray President Obama?

RQ1c: How do Black media racially portray President Obama?

Obama's book, *Dreams from my Father* (2004), and 14 articles, published in Black and mainstream media outlets are reviewed and evaluated to unpack the unique and common themes emergent in the current discussion over racial classification. *Dreams from my Father* will be analyzed as an autobiography of Obama's journey to seek his African heritage and find his identity. Excerpts will be compared to Rockquemore and Brunson's (2008) four identity types for Biracial people. Selections of 4 Black magazines (including *Ebony*, *Jet*, *Black Enterprise*) and 10 mainstream newspapers (including *The Washington Post*, *USA Today*, *The Los Angeles Times*, *The New York Times*) have been identified based on circulation. Articles from these media sources were selected based on titles related to the election of Obama as the 44th U.S. President and content. Priority was given to cover stories in magazines and lead stories in newspapers.

Analysis of Obama's book allowed for an assessment of the consistency and coherence of his self portrayal. Examination of how Obama is classified in mainstream and Black media articles published the day after Election Day on November 5, 2008 allowed for assessment of the coherence and consistency of media portrayals of Obama's race as well as comparison with Obama's self portrayal.

A list from the *State of the News Media* 2008 annual report will be used as a sampling frame for Black media. Due to the lack of Black newspapers, 4 magazines that are targeted towards the Black community will be chosen by looking at the highest percent of monthly circulation among Blacks will be selected. Top Black newspapers were not included because the magazines had better and more circulation. A list from the *Editor and Publisher* journal will be used as a sampling frame for selecting mainstream newspapers. This source provides the top one hundred daily newspapers in the U.S according to circulation in 2008.

Richard Boyatzis's (1998) thematic analysis approach was used to search and determine common and unique patterns in self and media portrayals of President Obama's race [1]. A "theme" is a pattern found in the information that at minimum describes and organizes the possible observations and at a maximum interprets aspects of the phenomenon [1]. A four step data analysis process was employed. First, the raw data from the narratives were truncated by content. The primary focus within the articles and narratives were words describing President Obama's ethnicity, such as "Black", "White", "Biracial", "African American", "Caucasian", etc. Furthermore, statements that generated racial portrayals were also included. Second, important themes that emerge from the data were encoded and described. The important data was condensed into key themes that encapsulated the research questions posited in this study. Third, after being immersed in the data and generating themes, codes were developed by interpreting or making sense of the information. Fourth, these interpretations were placed in the context of a conceptual framework. Information and themes were interpreted and applied to prior research and theory to contribute to the development of knowledge.

Data analyses indicate that, Obama adopts a singular identity due to his personal cultural upbringing and life experiences. This identity type is influenced by five socialization and contextual variables [3].

- Appearance
- Social network composition
- Family discussion about being multiracial
- Experiencing negative treatment from Blacks or Whites
- Geographic region.

Analysis of media portrayals indicate that both Black and mainstream media articles acknowledge Obama's election as a historical moment while at the same time noting his mixed heritage and still classifying him as the "first Black president". Black media articles justify this classification of Obama by placing his election within historical context. Mainstream media both classify Obama as the "first Black president" and note his mixed race heritage, thus making their portrayals seem based on the one-drop rule. Further mainstream media emphasizes the unique aspects of this election, eg. larger Black voter turnout rather than grounding the election in historical context.

3. Conclusions

Racial identity is not fixed or mutually exclusive, but rests on individualistic choices within structurally and culturally defined parameters [3]. The common theme in research studies is that the one-drop rule is a significant factor in socially classifying race [2&3]. Obama has primarily adopted a Black identity due to his life experiences, cultural upbringing and the effects of the one-drop rule. It is clear that racial classification has been a complex, multi-layered process in U.S. history.

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Experimental Investigation of Progressive Crushing and Load Rate Effects of Wedge Type Crush Initiators of Laminated GFRP

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Abstract. The results of an experimental investigation of the crush behavior, failure modes and rate sensitivity of axially compressed flat specimen made from Newport Nb 321/7781 composite prepreg are presented in this paper. Single bevel type trigger mechanisms were used to initiate the progressive failure mechanism. Quasi-static tests and dynamic tests were conducted at load rates ranging from 10^{-3} in/s to 10 in/s. The influence of 45° bevel angle, stacking sequence and failure modes were analyzed, to examine the brittle failure mechanisms related to crash energy absorption during compression of the flat plate specimens. Results indicate that energy absorption is highly influenced by the trigger bevel angle, load rate and stacking sequence. The peak load decreased with an increase in load rate and the failure modes varied with the stacking sequence.

1. Introduction

The ability of the structure of a vehicle to withstand a crash incident with minimum damage to the occupant is defined as crashworthiness. A review of the literature indicates that the crash energy absorption of fiber reinforced plastic (FRP) -composites can provide a desirable progressive crush mechanism [1]. This progressive crush reduces the impact on the occupant in a sudden crash. The single bevel trigger mechanism was used in the present experimental study to initiate failure. Previous investigators report that the compressive failure modes of FRP composites vary with the choice of prepreg material, specimen geometry, bevel angle and test load rate. The failure modes of fiberglass reinforced materials are generally brittle failure modes, such as the splaying mode, the fragmentation mode, the micro-buckling mode and mixed modes [2].

2. Experiment Setup

Composite specimens were fabricated with Newport NB 321/7781 E-glass, woven fabric prepreg. Specimens were cured in an oven at 270°F for three hours. After curing a 14×8 in sheet was cut and ground to produce 4×1 in specimens for testing. The two stacking

sequence used were $[0]_n$ and $[45]_n$ with a 45° bevel angle.

Quasi-static compression tests were conducted on the 12 ply specimens at load rates of 0.001 in/s and 0.1 in/s using an electromechanical load frame, with a 5 kip strain-gauge based load cell. The high speed load rate tests, with load rates of 1 in/s and 10 in/s, were conducted on a servo-hydraulic machine with 10 kip piezo-electric load cell.

The crush fixture, fully constrained the lateral movement of the beveled specimens, except for a spacer height above the base plate, where the specimen was left unsupported, allowing it to deform freely. The height between the lateral support fixture and the base-plate was the unsupported height where the crush front can form easily, Table 1.

Table: 1

Spacer dimensions used for the 12 ply tests

Ply thickness, t (in)	0.12
Spacer, l (in)	0.5
Crush Displacement (in)	0.4

3. Results

The contribution of the reinforcement fibers to the properties of the composite laminate is maximized when they are parallel to the loading direction, as in the $[0]_{12}$. In the $[\pm 45]_{12}$ the fibers were not aligned with the loading direction and transverse shear was observed, due to which the peak load is lowered than in $[0]_{12}$. The resulting load histories of the two sets of specimens presented in Fig. 1 and 2 indicate that both the peak loads and crush loads changed with stacking sequence and with load rate. This had an influence on the energy absorption and the mode of the brittle failure.

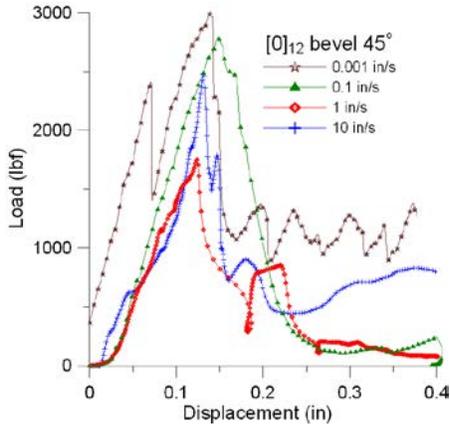


Fig 1: Load-displacement histories of the $[0]_{12}$ specimens for test speeds ranging from 0.001 in/s to 10 in/s

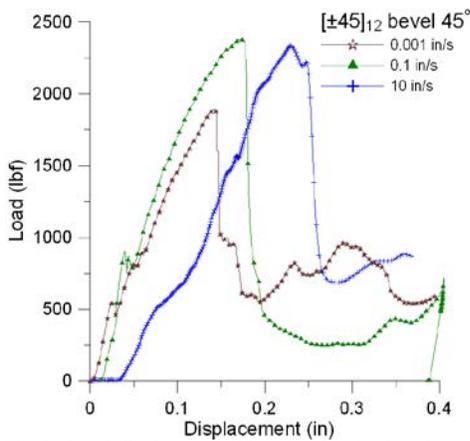


Fig 2: Load-displacement histories for the $[\pm 45]_{12}$ specimens for test speeds ranging from 0.001 in/s to 10 in/s

3.1 Failure Modes

The splaying mode was the dominant failure mode in the specimen with $[0]_{12}$ stacking sequence. A center crack was observed in this kind of failure mode along with delamination. From Fig 3, we observe the bevel tip was crushed and the splayed ends occurred on only one side.

The corresponding results for the specimens with the $[\pm 45]_{12}$ stacking sequence are illustrated in Fig 4. In the case shown, the specimen developed a bending deformation which continued until failure occurred at a peak load of 2.3 kip and an end compressive displacement of approximately 0.18 in. Bending, micro-buckling of fibers and the initiation of a center delamination crack during failure can be seen in the series of photographic results presented in Fig 4.

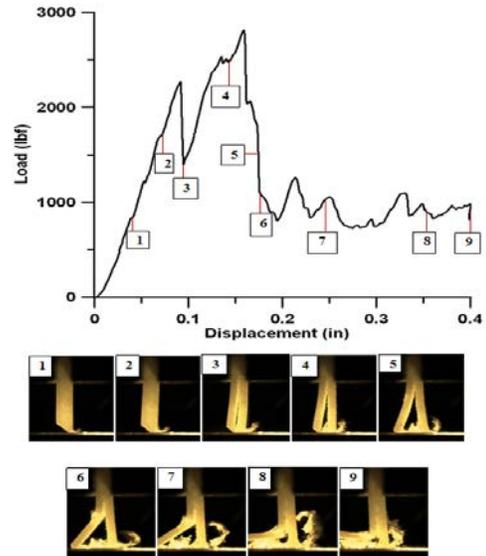


Fig 3: Failure mode observed in $[0]_{12}$ at 0.001 in/s test speed

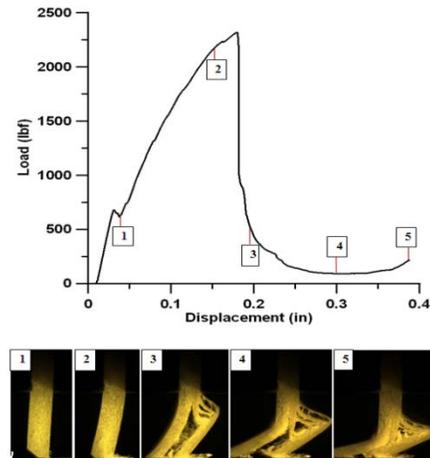


Fig 4: Failure mode observed in $[\pm 45]_{12}$ at 0.001 in/s test speed

4. Conclusions

The preliminary analysis of the test results suggest that the $[0]_{12}$ ply specimens had a greater strength and higher degree of energy absorption than that of the $[\pm 45]_{12}$ specimens. The splaying mode of brittle fracture was dominant in the $[0]_{12}$ ply specimens while the fragmentation mode was the dominant failure mode for the $[\pm 45]_{12}$ specimens. Local buckling was also present in the failure of the $[\pm 45]_{12}$ specimens. In terms of rate sensitivity, as the speed increases, from quasi-static to high speed, the peak load lowers.

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A Study of External Stakeholders' Perspectives of a Midwestern Community College

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Abstract. A Midwestern community college hired a new president in 2003. Since then, community college personnel endeavor to improve institutional effectiveness, program quality, and perceived stakeholder value. The president expressed a concern that the institution's progress remains relevant to the needs of the stakeholders. This study was designed to ascertain data from external stakeholders of the community college regarding their current perceived value of the community college, what value it could bring in the future, and suggestions about moving from the present to the future. The qualitative study participants included high school seniors to obtain the views of prospective community college students, high school counselors who advise high school seniors, and sponsoring community members who pay property taxes in support of the community college. Surveys, interviews, focus groups, and documentation were utilized to collect the data. The findings from the data are presented in this study to be used by community college officials to incorporate into their strategic plans.

Introduction

Since the founding of Joliet Junior College in 1901, America's dependence on two-year community colleges has continued to grow. Presidents Truman (Brubacher & Rudy, 1958), Johnson ("Public papers of the presidents of the United States: Lyndon B. Johnson, 1965," 1966), Nixon ("Public papers of the presidents of the United States: Richard Nixon, 1970," 1971), Clinton (Clinton, 1998), Bush (Evelyn, 2004), and most recently Obama (Lewin, 2009) declared public support for the community college as a major contributor towards the democratization of America. More students are attending community colleges than ever before. Enrollment growth in the last 10 years has increased over 20% to an enrollment in 2007 of 6.6 million students (National Center for Education Statistics, 2007). These figures represent 35% of all post secondary students who enrolled that year (Provasnik & Planty, 2008). More students recognize

the value of post secondary education. "Community colleges remain the single most important resource for economic and social gain through education" (Eaton, 1994, pp. 6-7). The general purpose of the study was to gather perspectives of external stakeholders regarding the value of a Midwestern, rural community college. Specifically, the study focuses on: (a) the perceived level of service provided by the community college; (b) a preferred level of service provided in the future; and (c) the necessary modifications needed for the community college to move towards providing a higher level of service. A mixed-methods research approach was used consisting of interviews, focus groups, survey, and document review to triangulate stakeholder perspectives. Stakeholders included high school seniors, high school counselors, and members of the supporting communities.

Experiment, Results, Discussion, and Significance

Given the economic crisis of 10.2 percent unemployment in October 2009, severe funding shortages, and high demands placed on community colleges for educating and training the unemployed and underemployed, community college officials strive to move forward with little room for error. The community college service area includes communities beyond county border. There are two campuses for this Midwestern community college. Data were collected from five communities including the host communities, communities nearby, and communities more distant from the community college. The principal methods of collecting data included a survey for high school seniors (n=176), semi-structured interviews with high school counselors and community focus groups (n=29),

and document reviews. The data were analyzed using the constant comparative method until themes and categories emerged. Particularly, this study provided an appraisal of stakeholder perspectives, allowing community college leadership to identify potential barriers in effective dialogue and to establish valuable relationships in order to provide needed services. There is evidence of differences in perspectives among stakeholder groups. Four major themes resulted from the community focus groups, counselor interviews, and the student surveys as a means to answer the three research questions. These themes were value to the service area; recruitment; outreach; and educational programming. Data garnered from these collection methods will be used by community college officials to offer guidance in the development of long term strategic plans.

Conclusions

Research indicated that to move forward, dialogue between community college representatives and stakeholders will be critical. For example, data shows that the more distant the stakeholders are from the physical location of the campus, the less engaged they are and as a result the greater the number of negative comments. "...any true understanding is dialogic in nature. Understanding is to utterance what one line of dialogue is to the next..." (Voloshinov, 1973). There are mechanisms in place for communication between the community college and its external stakeholders. Perhaps these could be ameliorated to cultivate dialogic connections for the expressed purpose of nurturing relationships. In this way, the community college could better serve its stakeholders and the stakeholders might perceive more value from the community college.

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Kansas Physician Assistants' Attitudes/Beliefs and Current Practices Regarding Implementation of Fall Prevention Strategies in Older Adults

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Abstract. Falls among older adults are a significant economic and social healthcare issue. Evidence-based fall prevention guidelines exist but are not implemented in daily practice. The purpose of this study was to evaluate attitudes/beliefs and current practices of Kansas physician assistants (PAs) regarding fall assessment and prevention strategies in older adults and barriers/facilitators to integrating strategies into daily practice. A 67-item, non-validated survey was mailed to all 760 Kansas PAs in 2009. Findings show that 100% of PAs felt fall prevention was important and 95% thought falls were preventable. Although > 90% felt a professional responsibility to implement fall prevention strategies; 50% or less actually did so routinely. PAs believe fall prevention is important but do not routinely implement strategies due to time, staffing, and feeling ill-prepared.

1. Introduction

Falls are the leading cause of injury related death and nursing home placement in older adults.[1] An estimated one in three older adults falls each year and of those, 20% - 30% will have impaired mobility and independence. Hip fractures are especially devastating; 25% will die within one year and 40% will be unable to live independently.[2] Rural-dwelling older adults face additional challenges of physical and social isolation, increased rates of poverty, reduced availability of health care and medical resources, and transportation issues making maintenance of physical independence even more necessary to independent living.[3]

Evidence-based fall prevention guidelines have been published; however, implementation has been less than optimal in daily practice.[4] The Centers for Disease Control and National Council on Aging identify four key fall prevention areas: 1) medication reviews, 2) increasing exercise, 3) vision screening/referral, and 4) home safety evaluation/modification.[2]

Although the effectiveness of fall prevention strategies have been studied in isolated situations, little is known about the translation of this evidence into clinical practice.[4] Health care providers' attitude/beliefs,

barriers to implementation and other possible reasons for underutilization in clinical practice has not been well studied. The key to answering these questions is to ask the health care providers themselves.

Study Purpose

Evaluate the attitudes/beliefs and current practices of Kansas PAs regarding fall assessment and prevention strategies in older adults as well as barriers/facilitators to integrating these strategies into daily practice.

2. Methods, Results, Significance

Methods

Study Design, Setting, and Population: This cross-sectional study attempted to survey registered PAs residing in Kansas. Mailing addresses were obtained from the Kansas Board of Healing Arts. A self-administered paper survey was mailed to 760 PAs in November 2009. Survey collection is still underway.

Survey Description: Survey content was drafted based upon fall prevention consensus guidelines and data regarding barriers/facilitators to implementation of fall prevention into daily clinical practice. The non-validated, 67-item survey asked about respondent characteristics, attitudes/beliefs, current practices, and barriers/facilitators. Attitudes/beliefs were assessed using a 4-point Likert scale ranging from "strongly agree" to "strongly disagree." A 4-point Likert scale, "never," "sometimes," "frequently," and "always" was used to assess current practices.

Data Analysis: Survey analysis is still underway; to date n=110; a 15% response rate. Data were analyzed using SPSS and *t* test, chi-square, and ANOVA as appropriate. Statistical significance was set at $p \leq 0.05$.

Results

Respondent Characteristics: Of the responding PAs, 80% were female; the mean number of years in practice

was 11 ± 9 ; 79% denied receiving specific fall prevention training; 45% worked in family practice; 33% worked in a community of $\geq 300,000$; and 28% in a community of $\leq 10,000$. Patients ≥ 65 years old comprised a mean of $44\% \pm 12\%$ of the PA practices.

Attitudes/Beliefs: Over 95% of PAs felt the incidence of falls in older adults could be reduced by routine medication reviews (97%), vision screening (94%), balance/strength exercise programs (99%), and home safety evaluation and modification (99%) and 100% felt falls were a significant health problem. The majority felt it was their professional responsibility to ask about recent and past falls (95%) and implement fall prevention practices regarding medications (95%), vision screening (87%), exercise (94%), and home safety evaluations (91%). PAs felt older adults would be compliant with medication changes (88%), vision screening (83%), exercise programs (47%), and home safety evaluation/modification (70%). See Table 1 for additional responses to attitudes/beliefs questions.

Table 1: Attitudes and Beliefs	Agree
As a physician assistant, I believe...	
Most older adults do not report falls out of a fear of losing independence	80%
Fall prevention programs, like other programs in the community should be funded by the state	63%
Screening for fall risk should be as routine as screening for other medical problems	93%
I assume the pharmacy will notify me if I order a drug that potentially increases fall risk	21%
I would appreciate being notified by pharmacy if I order a drug known to increase fall risk	77%
I believe it is difficult to provide fall-related preventive care to...	
patients with a different cultural background	43%
patients who seem healthy	65%
patients with a low socio-economic status	50%
patients rarely visiting the practice	86%
Regarding fall prevention in older adults, I would be willing to routinely...	
engage in further educational opportunities	85%
educate my patients regarding fall prevention	93%
evaluate meds with a focus on fall prevention	90%
check vision or refer to an ophthalmologist	86%
routinely ask about exercise habits	94%
recommend strength / balance exercise programs	96%
refer patients for a home safety evaluation	89%

Current Practices: PAs were least likely to address fall prevention in older adults by using strategies involving vision evaluation, home safety evaluation, and referral to fall prevention agencies/programs. Only about 40 to 50% of PAs routinely ask about falls, review and alter medications, or ask about and recommend exercise. See Table 2.

Table 2: Current Practices

Currently, I address fall prevention in my older patients by...	Always or Frequently
asking about recent and past falls	42% (46)
reviewing meds with a focus on fall prevention	47% (51)
decreasing/eliminating meds that increase fall risk	50% (54)
assuring vision evaluations	23% (25)
asking about exercise habits	51% (56)
recommending strength/balance exercise programs	43% (47)
referring for home safety evaluations	23% (25)
refer to fall prevention education/programs	22% (24)

Mean \pm standard deviation; Percent data are % (number)

Perceived Barriers: When asked why fall prevention strategies were not implemented in patient encounters, lack of time (29%), lack of support staff (27%), and feeling ill-prepared to conduct fall screening (20%) were checked as potential barriers. No PAs marked: not my responsibility, not important, or feeling ill-prepared to conduct fall focused medication reviews.

Significance

All PAs recognize the importance of fall prevention among older adults, the vast majority felt a professional responsibility to implement fall prevention strategies, and most believe the strategies are effective. However, less than half actually utilize these fall prevention strategies routinely in the care of their older patients.

Even though most PAs did not receive specific fall prevention training, it is encouraging that most are willing to engage in further educational opportunities. There were no indications that PAs felt ill-prepared to conduct medication reviews, but education in the area of conducting a fall assessment was desired. Education should also focus on assessments appropriate in the setting of limited time and support staff.

3. Conclusions

PAs are aware of the importance of fall prevention but do not routinely implement fall prevention strategies on a regular basis due to time, staffing, and feeling ill-prepared. Educational opportunities and resources regarding fall prevention should be more available.

4. Acknowledgements

Other research team members: Kayla Keuter, Gina Berg, Sue Nyberg, Ken Bethel, Kyle Herspring, and Landon Snell. *Funding:* WSU RIA Gridley-Hoover.

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Assessment of Bone Mineral Density in Forearms of Collegiate Ten-Pin Bowlers

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Abstract. This study assessed the BMD of the bowling arm compared to the non-bowling arm and the distal forearm BMD of the bowling arm compared to the non-bowling arm of elite collegiate ten-pin bowlers. Dual Energy X-ray Absorptiometry Unit (DXA) was used to assess the BMD of bilateral arms (whole body scan) and bilateral distal forearms (forearm scan) of 25 (N=13 males, N=12 females) collegiate bowlers (20.72 ± 1.46 yrs). The forearm scans showed significantly greater ($p < 0.05$) BMD in the bowling arm ($0.635 \pm .05 \text{ g}\cdot\text{cm}^{-2}$) compared to the non-bowling arm ($0.618 \pm .06 \text{ g}\cdot\text{cm}^{-2}$) of both the male and female ten-pin bowlers.

1. Introduction

The ability of bone to respond and adapt to mechanical loads has been known for over a century (Warden, Bogenschutz, Smith, & Gutierrez, 2009). Physical activities involving high impact weight bearing or high peak forces have been shown in many studies to be beneficial and necessary to building greater bone masses, especially in childhood and young adult years (Pikkarainen, et al., 2009). The weight-bearing and dynamic sports with high magnitude of strains exerted on the skeleton are positively influential on bone mass and architecture than unloaded or partly unloaded sports (Elloumi, et al., 2009). Athletes participating in unilateral dominant sports have demonstrated these skeletal responses to the mechanical loading related to the specific sport (Warden, et al., 2009). Studies on hand preference have been shown to influence bone mineral density (BMD) differences in contralateral arms in sports such as gymnasts, racquet sport players, and other athletes who are involved in habitual mechanical loads on both their upper and lower extremities, (Akar, Sivrikaya, Canikli, & Varoglu, 2002; Bareither, Grabiner, & Troy, 2008). In 2009, the Wichita State University (WSU) Shocker Bowling team was National Champions in both the men and women divisions. The WSU bowling team performs a high volume of repetitive use (~ 400-500 movements/day) of their bowling arm on a regular basis. The purpose of this study is to assess the BMD of the forearms of elite collegiate ten-pin bowlers and compare their bowling arm BMD to their non-bowling arm BMD.

2. Experiment, Results, Discussion, and Significance

Methods and Materials: The elite level collegiate ten pin bowling team consisted of 13 young adult males and 12 young adult females, of whom 23 were right-hand dominant and the other two were left-hand dominant. 22 of the 25 bowlers used their dominant hand to bowl and the remaining three bowlers used their non-dominant hand. The mean age of the collegiate bowlers was 20.72 ± 1.46 yrs. The control group comprised of age-matched seven healthy females and seven healthy males, who are not involved in physical activity affecting the dominant or non-dominant upper extremity only, with a mean age of 20.43 ± 2.10 yrs. DXA (Hologic QDR 4500W Elite Series, Bedford, Massachusetts, and Software Version 12.3) was used to assess bmd of bilateral arms (whole body scan) and bilateral distal forearms (forearm scan).

Results: Forearm scans showed significantly greater ($p < 0.05$) bmd in the bowling arm ($0.635 \pm .05 \text{ g}\cdot\text{cm}^{-2}$) compared to the non-bowling arm ($0.618 \pm .06 \text{ g}\cdot\text{cm}^{-2}$) of both male and female bowlers. However, when separated by gender, the females bowling arm showed a significantly greater difference between arms ($4.06 \pm 3.11\%$ difference, $p < 0.05$) and compared to the males ($1.48 \pm 2.62\%$ difference, $p < 0.05$). Total-body scans of the left and right arms were also assessed and similar results were observed in the bowling arm compared to the non-bowling arms of females ($4.15 \pm 2.54\%$, $p < 0.05$) and males ($3.81 \pm 5.19\%$, $p < 0.05$).

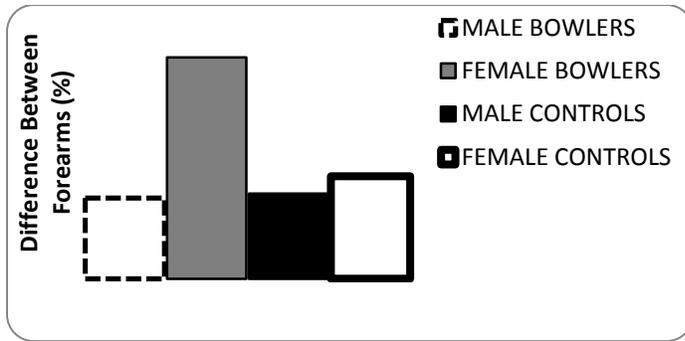


Fig 1 Relative differences between bowling and non-bowling forearm BMD: $\Delta = [(bowling \text{ forearm} - non\text{-bowling forearm})/non\text{-bowling forearm}] \times 100$.

Discussion: The effects of physical activity on bone density has been widely documented and researchers agree that participation in weight-bearing activities and impact loading are more osteogenic than those with no contact or performed in a weightless environment (Elloumi, et al., 2009). The results seen in this study are consistent with those who reported on baseball and tennis players, and volleyball; sports for which upper limbs are subject to high impact loading forces and involve asymmetrical loading patterns (Bareither, et al., 2008; McClanahan, et al., 2002). With these elite collegiate ten-pin bowlers' high volume of high intense, repetitive movements involving their bowling arm with the addition of the added impact from the bowling ball, the contralateral differences observed between their bowling arm and non-bowling arm in this study was not as high of a difference as was hypothesized. These results suggest a correlation between high volume and high intense activities and overuse of the skeleton with lower BMD (suppressed osteoblast function), which has been observed in elite cyclists and long distance runners (Kerschhan-Schindl, et al., 2009; Medelli, Shabani, Lounana, Fardellone, & Campion, 2009).

Significance: This is the first study assessing the effects of ten-pin bowling at an elite collegiate level on bmd of the bowling arm compared to the non-bowling arm.

3. Conclusions

The bowling arm of elite level collegiate ten-pin bowlers demonstrates the increased response of BMD in the bowling arm and forearm when compared to the non-bowling arm.

4. Acknowledgements

We wish to acknowledge the 2009-2010 WSU men and women's bowling teams and coaching staff for their interest and participation in this study. Thanks to Bryce Winklepleck and Ashley Hervey for assisting with this study, and to Dr. Jeremy Patterson for his invaluable time, guidance, and knowledge in assisting with this project.

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A Fuzzy multi objective model for a green generation expansion problem

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Abstract. In this paper, a comprehensive fuzzy multi-objective model is presented for generation expansion planning problem considering uncertainty in objective functions and demand constraint. The purpose of the model is determining the optimal generation amount in existing and new generation units along with calculating the transmission energy volume and required amount of imported fuel regarding emissions and environmental impacts. As the proposed model considers four fuzzy minimization objective functions, a fuzzy linear programming approach is applied to solve the proposed model by transforming the fuzzy multi-objective model to a crisp single objective optimization problem. A case study is presented to illustrate the impacts of different factors such as changes in prices and environmental risks, etc.

1. Introduction

The Generation Expansion Planning (GEP) Problem is defined as the problem of determining WHAT, WHEN and WHERE new generation units should be installed over a long-range planning horizon, to satisfy the expected energy demand. Since the demand is expected to increase in most cases, a small error in choosing the correct mix of generating facilities at assumed costs could result in a loss of hundreds of millions of dollars. The GEP problem has been one of the most studied problems as an early application of operations research. An extensive kind of methods have been proposed to solve the problem such as traditional approaches like linear, mixed-integer, non-linear, dynamic programming or metaheuristic approaches such as simulated annealing, Tabu search and evolutionary approaches [1,2]. GEP is a challenging problem for several reasons: First of all, there is uncertainty associated with the input data, such as demand forecasts of electricity and lead times. A second difficulty arises as a result of considering several objectives (often conflicting) simultaneously. Therefore presenting a comprehensive model regarding uncertainties seems a necessity.

This paper presents a simple single-period fuzzy multiobjective model for the generation expansion planning (FMGEP) problem regarding some new aspects such as environmental impacts, which considers uncertainty in both objectives and constraints of the problem.

2. Experiment, Results, Discussion, and Significance

The proposed fuzzy model is given in this section. The first objective function (f_1) seeks to minimize the sum of investment and generation costs, and the cost for additional capacity of transmission. The second objective (f_2) minimizes the aggregate Carbon Dioxide emissions (CO_2) from fossil-fuel plants. Fossil-fuel units produce CO_2 enhancing the greenhouse effect, leading to global warming, a rise in sea level and changes in rainfall. For the third objective function (f_3), minimization of imported fuel amount by the system is considered. The last objective function (f_4) addresses energy price risks. This objective seeks to minimize the exposure to fuel price volatility in the expansion decisions. Let $g_{e_{iq}}$ and $g_{n_{iq}}$ be the generation (MW) from the existing and new units of type q at node i respectively. u_k is Imported fuel (units) of type k to the system while x_{ij} is the flow (MW) through arc (i, j) . Also Δx_{ij} as the another decision variable is additional transmission capacity (MW) on arc (i, j) . D_i is the expected load (MW) at node i . I_{iq} and G_{iq} are investment and generation cost (\$/MW) of a unit of type q at node i . C_{ij} is the cost (\$/MW) for new transmission capacity in arc (i, j) . \bar{X}_{ij} is existing (MW) capacity of transmission in arc (i, j) . \bar{G}_{iq} and $\bar{G}E_{iq}$ is maximum (MW) new and existing generation capacity of units of type q at node i . V_k is cost (\$/units) of imported fuel of type k . E_q is tons of carbon dioxide emission (CO_2) per MW generated by a unit of type q . U_k is the National available amount (corresponding units) of fuel type k . W_q is the fuel needed to operate a unit of type q . r is the

percentage of operating reserve in the system. S_k is the historical coefficient of variation in prices of fuel type k . J_k is the index of units of fuel type k . The multiobjective fuzzy mathematical model can be summarized as follows:

Min the following objectives simultaneously:

$$f_1 = \sum_{i \in N} \sum_{q \in \theta} I_{iq} gn_{iq} + \sum_{i \in N} \sum_{q \in \theta} G_{iq} [ge_{iq} + gn_{iq}] + \sum_{(i,j) \in A} C_{ij} \Delta x_{ij}$$

$$f_2 = \sum_{i \in N} \sum_{q \in \theta} E_q [ge_{iq} + gn_{iq}]$$

$$f_3 = \sum_{k \in F} V_k u_k$$

$$f_4 = \sum_{k \in F} S_k \sum_{q \in J_k} \sum_{i \in N} [ge_{iq} + gn_{iq}]$$

subject to the following constraints:

$$\sum_{(j,i) \in A} x_{ji} - \sum_{(i,j) \in A} x_{ij} + \sum_{q \in \theta} [ge_{iq} + gn_{iq}] \cong D_i$$

$$x_{ij} \leq \bar{X}_{ij} + \Delta x_{ij} \tag{1}$$

$$ge_{iq} \leq \bar{G} E_{iq}$$

$$gn_{iq} \leq \bar{G}_{iq}$$

$$\sum_{i \in N} \sum_{q \in J_k} W_q [ge_{iq} + gn_{iq}] \leq U_k + u_k$$

$$ge_{iq}, gn_{iq}, \Delta x_{ij}, x_{ij}, u_k \geq 0; i \in N, q \in \theta, (i, j) \in A, k \in F$$

The first constraint shows the fuzzy node balance equation at each node, which will be replaced with two inequality constraints in the defuzzifying process as it is an equality constraint. The following constraints are limits for the transmission amount on each arc, capacity for existing generation units, capacity for new generation units and the limit for fuel consumption in the system respectively. The way to solve this problem is based on the fuzzy linear programming technique [3]. By applying fuzzy linear programming, a new variable of λ is defined as the coordination level. In the given analysis the effects of different changes like some of objective functions elimination or parameter changes are examined on this parameter [4].

When one or more objective functions is not considered (i.e. f_1, f_2, f_3 or f_4 is removed from the formulation), generally the value of λ (the satisfaction degree of the model) increases. Another analysis that has been done is on the effect of changes of some parameters like investment cost or emission factor on decision variables such as the generation amount in existing and new units. Furthermore, the given model can be used to analyze the impact of degree of uncertainty (fuzziness) on model outputs and objective function values. It has been observed that increasing the uncertainty interval for objective functions or demand constraints will provide more flexibility level for the model causing the satisfaction level (λ) to increase resulting in an increase in the total value of each objective function.

3. Conclusions

In this research a single-period fuzzy multiobjective model for the generation expansion planning problem (FMGEP) has been proposed, which considers aspects that previous models have not included. The incorporation of more than three criteria in the fuzzy multi-objective model, the importance given to renewable generation technologies, and the geographical location of the new generation units are some features of the FMGEP which have not been considered simultaneously in the literature. The (FMGEP) model considers the uncertainty in both objectives and constraints of the problem. The fuzzy linear programming technique is applied to solve FMGEP. A comprehensive sensitivity analysis is performed to illustrate the effect of changes on models under six scenarios. In the given scenarios, the effects of changes of parameters and objective function elimination on model outputs are discussed.

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Synthesis of Highly Ordered Titanium Dioxide (TiO₂) Nanotubes: Impact of Process Parameters

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Abstract. Highly ordered arrays of Titanium dioxide (TiO₂) nanotubes were synthesized from Titanium foil substrate using the electrochemical anodization process in an etching solution consisting of Ammonium Fluoride (NH₄F), Ethylene Glycol and nanopure water. The topologies (lengths and diameter) of the synthesized TiO₂ were found to be governed by two main process parameters, applied voltage and etching solution concentration. The applied voltage was varied between 55V DC to 65V DC. The concentration of the etching solution was altered by varying the weight % of the NH₄F between 0.3 to 0.5%. By varying the process parameters, TiO₂ nanotubes with diameters between 176 to 227 nanometers and lengths between 74 and 103 nanometers were obtained.

1. Introduction

Titanium dioxide (TiO₂) has generated a lot of interest recently due to its versatile properties in optics, electronics, photochemistry, biology and high compressive strength [1]. TiO₂ can be used in a wide variety of applications such as photocatalyst, photovoltaic material, gas sensor and nanocomposite applications [2]. The properties of TiO₂ nanotubes are known to depend on their topographies (lengths and diameters) [2]. Electrochemical anodization is a technique that can be used to synthesize TiO₂ nanotubes. This paper describes the electrochemical anodization of Titanium substrate in an electrolytic solution of NH₄F, Ethylene Glycol and nanopure water under constant voltage conditions to produce highly ordered nanotubes of TiO₂ which have high aspect ratios. TiO₂ nanotubes of larger diameters and lengths were synthesized by varying the important process parameters such as voltage and etching solution concentration. The applied DC voltage was varied between 55V to 65V. The etching solution concentration was varied by increasing the weight % of Ammonium Fluoride between 0.3 to 0.5%. The longer nanotubes have higher surface area to volume ratio which exhibit enhanced photo catalytic activity which can be used to produce Dye Sensitized Solar Cell with improved efficiency [3].

2. Experiment, Results, Discussion, and Significance

The electrochemical anodization process involves the application of a voltage between two parallel electrodes dipped in an electrolyte. For the synthesis of TiO₂ nanotubes using electrochemical anodization process, Titanium foil is used as the Anode while Platinum foil of exact same dimensions is used as the Cathode. The electrolyte is a mix of Ammonium Fluoride (NH₄F), Ethylene Glycol and nanopure water. The Titanium and Platinum foils were degreased by rinsing in nanopure water and acetone. Then the two electrodes were placed parallel at a distance of 38 mm and dipped in the electrolyte. A voltage between 55V to 65V was then applied to the two electrodes to carry out the anodization process. All the experimental trials were carried out at room temperature. Each trial run of the anodization process was carried out for 24 hours. After the anodization process, the synthesized TiO₂ nanotubes were rinsed in nanopure water, and dried at room temperature before being characterized. The overall reactions for the anodization of titanium can be represented as follows:



Initially, a layer of TiO₂ forms on the titanium surface [2]. The presence of fluoride ions the oxide causes the dissolution of the oxide layer and nanotubes begin to form when the fluoride ions start to etch nano pits in the oxide layer [2].

The anodization process was carried out in different configuration of applied voltage and electrolyte concentration. In this paper, three different configurations have been explained. In first configuration, the applied voltage was 55V DC with 0.3% weight concentration of NH₄. In second configuration, the applied voltage was 55V DC +/- 5V AC with 0.35% weight concentration of NH₄. In third

configuration, applied voltage was 60 V DC with 0.4% weight concentration of NH_4F .

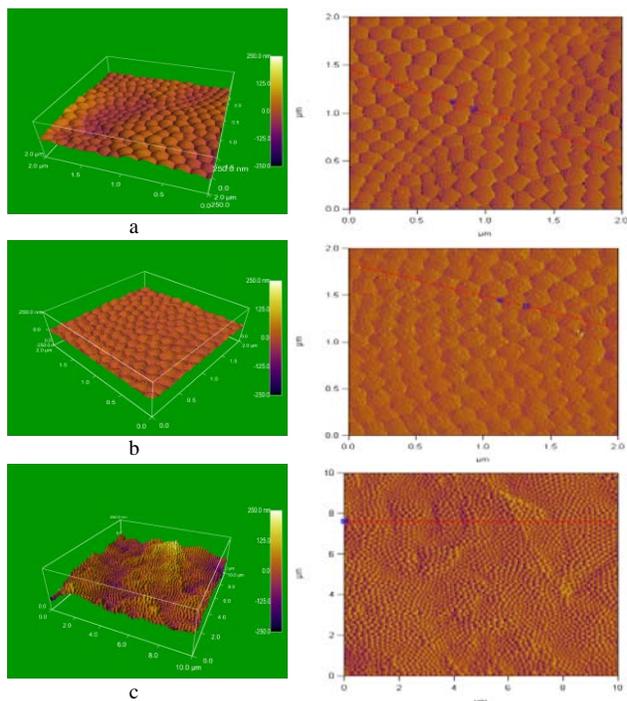


Fig 1. AFM images of TiO_2 obtained with different voltages and electrolyte concentrations: (a) 55V DC with 0.3% weight NH_4F , (b) 55V DC +/-5V AC with 0.35% weight NH_4F , (c) 60 V DC with 0.4% weight NH_4F

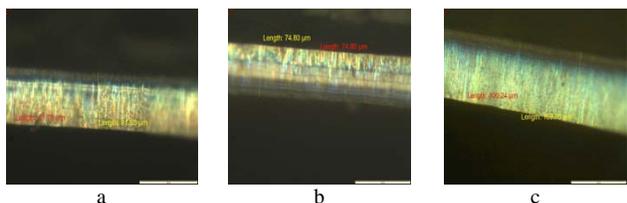


Fig. 2 Microscope measurement of TiO_2 lengths: (a) 81 μm (b) 74 μm (c) 103 μm

The TiO_2 topography varies with applied voltage because it affects the etching rate. An increase in the magnitude of applied voltage causes an increase in nanotube diameter and length as shown in Fig. 1 and Fig. 2. The variation of TiO_2 diameter with voltage is shown in Table 1. The increase in NH_4F concentration also caused an increase in TiO_2 nanotube diameter. The variation of TiO_2 nanotube diameter with NH_4F weight concentration is shown in Table 1.

Table: 1 Effect of voltage and electrolyte concentration on TiO_2 nanotube diameter

	Electrolyte			Voltage (V)	TiO_2 diameter (nm)
	NH_4F	E. Glycol	Water		
Sample a	0.3	97.5	2.2	55	176
Sample b	0.35	97.45	2.2	55 +/- 5	204
Sample c	0.4	97.4	2.2	60	227

Initially the anodization current was seen to be high. As the anodization progresses, the Titanium electrode gets passivated due to the formation of a thin film of TiO_2 . This causes the anodization current to drop with the advancement of anodization. Fig. 3 shows the drop of current as a function of anodization time.

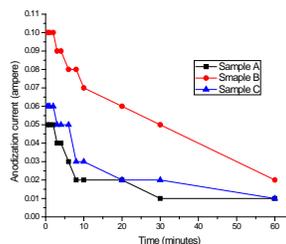


Fig. 3. Anodization current versus anodization time at constant voltage

3. Conclusion

The influences of applied voltage and electrolyte conditions on the synthesis of highly ordered TiO_2 nanotubes were studied. The results indicated that as applied voltage increased, the TiO_2 nanotube length and diameter increased. Similarly, increasing the etching solution concentration also increased the TiO_2 nanotube length and diameter. The larger nanotubes are known to have higher surface area with improved photo catalytic activity. The percentage increase in efficiency of the Dye Sensitized Cells (DSSC) fabricated with the larger TiO_2 nanotubes will be dealt with in future research.

4. Acknowledgements

I acknowledge the support of Dr. Ramazan Asmatulu for his guidance to the research.

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Empowering Settings in Nicaragua: Hearing Some of the Voices of Nicaraguan Youth

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Abstract. With high rates of poverty and a remarkably young population, Nicaragua is a nation in which the challenges of the future lie in the empowerment of its youth. The role of empowering settings in the development of individual empowerment is well-documented, yet most of this research has been conducted in Western, developed nations. A total of 29 Nicaraguan youth were interviewed to gather information about their aspirations and the settings in which they interact. Participants identified three key community settings and several resource assets and deficits which contribute to the empowerment capacity of these settings. These themes are compared to existing models of empowering settings and adolescent empowerment programs revealing some applicability of these theories.

1. Introduction (Describe your idea)

Empowerment is an often-used concept with many definitions. Empowered individuals are described in the literature as having increased access to resources, improved goal achievement, control over the narrative of individual and communal life, and decreased marginalization [1,2,3,4]. Empowerment outcomes can be expressed at multiple levels (i.e. psychological, organizational, and community), vary across contexts, and may mean different things to different people [3,5,6].

A number of recent studies have explored the qualities of settings that generate empowerment. Empowering settings are environments in which empowering processes take place and empowering outcomes are achieved among members of the setting [4]. Several researchers have presented characteristics of empowering settings [4,7], but most of these have been developed in a Western context. This study uses qualitative data to explore the nature of empowering settings in a different culture. Data was obtained in cooperation with Trees for Life, an international non-governmental organization (NGO) based in Wichita, KS, whose work includes helping small libraries in Nicaragua obtain books.

2. Experiment, Results, Discussion, and Significance (Describe how you developed your idea)

In March 2009, the student researcher traveled to rural Nicaragua. Semi-structured interviews were conducted in Nicaragua in collaboration with Nicaraguan partners. Twenty-nine participants from one rural community were interviewed. The participants ranged in age from 11 to 24 with a median age of 16. Seventeen of the participants were female. The interviews were recorded, transcribed, and coded for analysis. Table 1 displays a report of the data for each setting.

Table 1
Themes from the Analysis

Setting	Interpersonal Resources	Material Resources	Aesthetic Resources
La Escuela	Good teachers (+) Student Involvement (+)	Computer Lab (+)	Beautiful, well-maintained building (+)
La Comunidad	Nice, happy people (+) Strong traditions (+)	New Sewer Project (+)	Dirty Streets (-) Disrepair of Tourist Attraction and Park (-)
La Biblioteca	Peer relationships (+)	Lack of Books (-) No computers (-) No activities (-)	Cracked paint (-) Holes in Ceiling (-) Broken Door (-)

Three settings were identified by the participants: La Escuela (a public high school), La Comunidad (the

town in general), and La Biblioteca (the municipal library). Participants identified several assets and liabilities present within each of these settings. These resources were coded as interpersonal, material, and aesthetic. Table 2 compares these themes to the existing models.

Based on these results, the three settings explored in this analysis emerged with varying degrees of empowerment capacity. La Escuela is an example of a highly empowering setting. Participants reported high availability of all three types of resources and few deficits. Aspirations of the participants were centered around this educational environment and success in school was seen as critical for the ultimate goal of becoming “a professional.” La Comunidad was determined to be a moderately empowering setting. Participants readily identified key assets within the community and cited relational resources and a sense of improvement. However, many deficits were mentioned by the participants and paths to adolescent involvement in bringing change to the community were unclear. Finally, La Biblioteca was seen as a minimally empowering setting. While a relational atmosphere existed, the lack of material resources (i.e. books, computers) and the depressed aesthetics of the location appeared to minimize the possible impact of the library as an empowering setting for youth. Participants clearly expressed the need for this setting to improve and connected this to their future aspirations for success.

As demonstrated in Table 2, the results fit well within Maton’s model of empowering settings [4] as the key characteristics are more actively visible in settings with increased empowerment capacity. This suggests that Maton’s model may have cross-cultural applicability. A deeper exploration of how adolescent and adult roles differ between cultures is needed, in addition to key characteristics of relational environments among non-Western societies.

3. Conclusions

As demonstrated, the ability of settings to generate empowerment among members can be enhanced or limited by the amount and type of resources available in each setting. Youth in Nicaragua are often exposed to settings which may be under-resourced. Using existing models, future work can focus on building the capacity of these settings to provide increased opportunity for youth to be empowered and take steps toward a better future.

Table 2
Applying Maton’s Characteristics of Empowering Settings

Characteristics	Setting Characteristics
Group-based beliefs	La Escuela: Shared Vision, Salient Goals (“become a professional”) La Biblioteca: Little shared vision.
Relational Environment	La Escuela and La Biblioteca: Caring peer and adult relationships, sense of community
Core activities	La Escuela: Quality instruction, meaningful activities La Biblioteca: Frustrated activities due to lack of resources
Opportunity Role Structure	La Escuela: Student Involvement La Biblioteca: Opportunities unclear.

Maton (2008)

4. Acknowledgements

Special thanks to Balbir Mathur, David Kimble, and Octavio Robleto for their assistance with this project. The great work of Trees for Life in Nicaragua and around the world made this possible. Thanks to Dr. Lewis-Moss for her wonderful mentoring and support.

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The Preparation of Charged Anion Receptors to Bind Anionic Components of Bacterial Membranes

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Abstract. A receptor able to selectively bind a phosphatidylglycerol (PPG) head group is an attractive synthetic target as a modular component of an antimicrobial therapeutic. The major challenge to the preparation of such receptors, able to exclusively recognize this bacterial membrane component, is to create a binding motif that will complex a phosphorus anion, along with hydroxyl functionality, strongly and selectively in an aqueous environment. Herein we report the synthesis and binding studies of a family of charged hydrogen bonding receptors, with phosphate anion and with PPG anion monitored with proton NMR spectroscopy and Isothermal Calorimetry (ITC) to reveal the best fit with the anionic phosphate head group of the PPG.

1. Introduction

Following the discovery of antimicrobial peptides, which are small molecular weight proteins with broad spectrum antimicrobial activity against bacteria, viruses, and fungi, attention has been paid to developing simpler and smaller compounds that mimic the activities of those endogenous peptide antibiotics for potential clinical use and to aid in the elucidation of how small molecules disrupt bacterial membranes. PPG is a unique anionic phospholipid found in prokaryotic membranes (inner membrane's outer leaflet) and not in eukaryotic membranes. The objective of our work is to prepare receptors that target these PPG anions. The receptor is envisioned as a component part of an antibiotic; receptors specific for PPG can mimic antimicrobial peptide activity more selectively, thereby reducing bacterial MIC, which in turn eliminates the toxicity problems associated with higher concentrations of the membrane disrupting compounds. There is one precedent of a small-molecule synthetic receptor specific for bacterial membrane phospholipids reported to kill gram-positive bacteria *in vitro*. [1] The mechanism of action of that receptor was thought to involve the interaction of Zinc cations with bacterial anionic wall components.

The target receptors shown below are model systems, providing insight to the correct pocket size for the receptor molecule. They are controls for

comparison to receptors with modified R functionality, allowing us to determine the receptor structure necessary for the most effective specific binding of PPG

2. Experiment, Results, and Discussion

The synthesis started with the linkage of 2 paracrysol molecules with the appropriate dibromo alkane to furnish **2** which was then subjected to Duff reaction [2] to yield **3**.

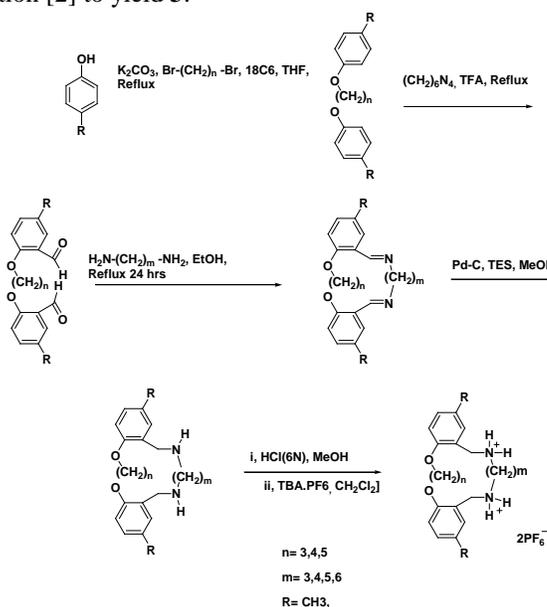


Fig 1. Synthetic scheme of the charged receptor systems

Refluxing of **3** in the presence of the appropriate bis-amines in ethanol [3] yielded the bis-imines **4** which were then subjected to reduction with Pd-C in the presence of triethylsilane [4] to furnish the bis amines **5**. The charge introduction was done in two steps: Stirring of **5** with 6M HCl at room temperature in the presence of methanol gave the molecules with two positive charges with Cl⁻ as the counter ion. Stirring that with more than 30 eq. of NH₄PF₆ at room temperature [5] furnished **1** with PF₆⁻ as the

counter ion, which makes the charged systems soluble in organic solvents.

Following the isolation of the charged systems, they were titrated with inorganic H_2PO_4^- and were followed with ^1H NMR and ITC.

Table 1: NMR titration data with H_2PO_4^-

n	m	Binding	K/mol ⁻¹	error
5	4	1 : 1	4.22 x 10 ²	5.5 x 10 ¹
5	3	1 : 1	6.42 x 10 ²	1.4 x 10 ²
4	6	2 : 1	-	-
4	5	mix	-	-
4	4	1 : 1	6.94 x 10 ²	6.6 x 10 ¹
3	6	2 : 1	-	-
3	5	mix	-	-

Table 1 summarizes the results of the NMR studies and the table 2 gives results of ITC titrations with inorganic H_2PO_4^- . These results suggest that the number of CH_2 units between the two ammonium groups is the factor which determines the stoichiometry of binding between the receptor and the anion.

Table 2: ITC titration data with H_2PO_4^-

n	m	K mol ⁻¹	error	ΔH cal/mol	error	ΔS cal/mol/°C
5	4	1.06 x 10 ⁵	9.6 x 10 ³	4972	62	39.4
5	3	1.01 x 10 ⁵	5.6 x 10 ³	7318	52	47
4	6	6.60 x 10 ⁵	1.7 x 10 ⁵	4024	59	39.9
		1.84 x 10 ⁴	5.0 x 10 ³	439.3	37	21
4	4	4.67 x 10 ⁴	4.6 x 10 ³	11960	279	60.8
3	6	1.38 x 10 ⁵	3.3 x 10 ⁴	5551	152	41.8
		5.77 x 10 ³	1.2 x 10 ³	1501	503	22.2

ITC data give thermodynamic information such as ΔH and ΔS in addition to the K. K values determined from ^1H NMR and ITC titrations differ by 2 or more orders of magnitude. This was expected as the NMR reports thermodynamic properties of the specific receptor-anion complex, while ITC looks at the entire system including solvent effects, counter ion effects, and unspecific binding processes. Therefore ITC data may be more predictive for receptor-anion binding in in-vivo systems, NMR data provides insight into the structural characteristics required for binding selectivity of the synthetic receptors for the anion.

Both above methods confirmed that when n=3 or 4, the systems show 1:1 binding with inorganic

phosphate anions. Having this information in hand, the receptors with n=3, 4 and 5 were titrated with PPG to determine the best fit with the PPG anions.

The NMR titration data in table 3 shows that n=3 and 4 both give 1:1 binding with PPG as well. When n=5, system was not well behaved, so n=6 system was not titrated with PPG.

Table 3: NMR Titration data with PPG

n	m	Binding	WINEQ NMR	
			K/mol ⁻¹	\pm
5	3	1 : 1	2.02x10 ²	5.9x10 ¹
4	5	mix	-	-
4	4	1 : 1	2.61x10 ²	4.4x10 ¹

3. Conclusions

The correct pocket size for the receptors with different R functionality has been identified. The fully functionalized receptors with n=3 and 4 will be tested on membranes in-vitro and in-vivo.

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Improving Adolescent Health Promotion

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Abstract. Adolescent patients often do not seek regular, preventive healthcare visits because they are essentially healthy. This makes it difficult to promote preventive healthcare with this population. New interventions are needed. This project sought to determine if use of a prompting tool improved coverage of health promotion topics with adolescent patients. The design was an intervention study using a pre and post chart review of adolescent patients seen in a rural family practice clinic. The intervention was a health promotion prompting tool, which included six key topic areas: alcohol/drug use; injury/violence; tobacco use; nutrition; physical activity and sexual risk behaviors. The results of this project found that the prompting tool can improve coverage of health promotion and disease prevention topics.

1. Introduction

Adolescence is widely defined as a time in life when the developing individual attains the skills and attributes necessary to become a productive and reproductive adult [1]. Most of the world's adolescents make it through the milestones of change with few problems. Even those adolescents who have no significant personal problems or acute health-care issues will have stressors and require help, support and guidance while making the transition from childhood to adulthood.

Despite the challenges that adolescents face today, health care providers need to consider this time in adolescents lives as an opportunity to help them make positive changes. Many of the behavioral patterns acquired during adolescence will last a lifetime. These may include gender relations, sexual conduct, use of tobacco, drugs and alcohol, eating habits and conflict resolution and risks. That is why this is an ideal time to intervene and encourage health promotion whenever possible. Fortunately, most adolescents are receptive to new ideas. They are eager to take on the responsibility for making decisions about their lives. Their curiosity and interest are a wonderful opening for mentors to foster personal responsibility for health [2].

2. Methods: Design, Sample, Setting, Intervention, and Data Collection

This project was an intervention study using a pre (2008) and post (2009) chart review of adolescent patients seen in a family practice setting during a designated period of time. The intervention was a new prompting tool that was implemented in a rural health clinic June 2009. The chart review utilized a prompting tool that focused on health promotion and disease prevention topics relevant to adolescence. Adolescents do not seek regular, preventive healthcare visits because they are essentially healthy. New interventions that can increase adolescent health promotion must be identified, such as the prompting tool. It was expected that if the adolescent's health care provider uses a prompting tool when seeing the adolescent, health promotion topics will be more likely to be discussed.

The sample for this project was a convenience sample of adolescent patients, age 11 to 21, seen in a rural, family practice clinic during June and July of 2008, and June and July of 2009. All adolescent patients were eligible for inclusion in the project regardless of the reason for their visit. The time frame designated was also selected for evaluation because this was a time when a higher than normal number of adolescent patients were seen in the clinic for back to school exams, sports physicals, college physicals, etc.

The prompting tool utilized for this project was an original tool developed by the author, based on the literature review and input from the providers in the primary care clinic where the project was to take place. Information for the tool came from the literature and from input from clinic providers. The tool also included data that was not used for this project, such as: Family history, Personal health history, and Immunizations. The health promotion and disease prevention topics were: Alcohol and Drug use; Injury and Violence; Tobacco use; Nutrition; Physical Activity and Sexual Risk Behaviors. Data was collected to identify how often these topics were covered during the selected visits.

The first step in the project was to select 40 random charts for the pre-prompting tool chart review from adolescent patients seen in the clinic from June 1, 2008 through July 31, 2008 (n=315). Patients were excluded from the project if they did not meet the age criteria (age 11-21 years) or if they had been seen by the author of this project. The sample in the pre-prompting tool chart review had a mean age of 17 years old. 60% (n=24) were female and 40% (n=16) were male.

The next step was to introduce the provider prompting tool to the clinic providers. These in-service sessions took place during the week of May 25 to May 29, 2009. A brief, general orientation was given to the providers using the tool, to nursing staff and to the front office staff. The tools were placed in the chart by either the front office staff that checked the patient into the clinic or by the nursing staff member escorting the patient to the exam room. The prompting tool was color coded purple and placed as the first sheet in the patient chart. After the orientation sessions, the clinic began using the tool on June 1, 2009.

On August 1, 2009, 40 random charts were selected from all adolescent patients seen during the time of June 1 through July 31, 2009 (n=299) for the post-prompting tool chart review. Again, patients were excluded if they did not meet the age criteria, if they had been seen by the author and during this chart review; they were also excluded if the prompting tool was not placed in their chart. The sample in the post-prompting tool chart review also had a mean age of 17 years old. 53% (n=21) were female and 48% (n=21) were male. The final chart review took place August 1 through August 14, 2009. The same chart review/data collection process was used, collecting the same data.

3. Results

Results revealed that there was a significant increase in the coverage of Alcohol and drug use topics ($p=.034$), Tobacco use topics ($p=.014$) and Nutrition topics ($p=.003$) pre and post prompting tool. There was not a significant difference in coverage of Injury and violence ($p=1.00$), Physical activity ($p=.366$) or Sexual risk behaviors ($p=1.00$). In evaluating the overall coverage of all topics when using the prompting tool, it was found that there was a significant increase in health promotion discussion by providers with adolescent patients after the initiation of the prompting tool (t score= 0.325, Critical $t = 2.015$).

4. Conclusions

The prompting tool has shown to be a valuable tool when working with patients of any age. Providers can adapt existing tools or develop their own to meet their individual needs and their patient's needs. Health care providers need to look for and seize opportunities to reach patients with their specific needs in mind. Patients rely on their health care provider to treat and teach them about their health and prevention of disease. A prompting tool may be helpful and may make the health care provider's job easier. The results of this project found that a prompting tool can improve selected coverage of health promotion and disease prevention topics in one group of adolescent patients. Ideally this may decrease their risk factors later in life. Since health promotion and disease prevention topics are not being discussed as frequently as is recommended, health care providers need to explore ways to provide more thorough care of adolescent patients.

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A Fornberg-like Method for the Numerical Conformal Mapping of Bounded Multiply Connected Domains

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Abstract. A new Fornberg-like method is presented for computing conformal maps from the interior of the unit disk with $m > 1$ circular holes to the interior of a smooth closed curve with m holes bounded by smooth curves. The method is a Newton-like method for computing the boundary correspondences and the conformal moduli (centers and radii of the circles). The inner linear systems are derived from conditions for analytic extension of functions defined on the circles to the interior domain. These systems are N -point trigonometric discretizations of the identity plus a compact operator and are solved efficiently with the conjugate gradient method at a cost of $O(N^2)$ per step.

1. Introduction

A conformal map is a mathematical function that transforms an open region of the complex plane in such a way that angles are preserved. Given any two lines that lay in the domain of a conformal map, which intersect with a given angle between the two lines, the image of these two lines under a conformal map will intersect with the exact same angle. Although these maps possess a certain beauty mathematically, this often does not provide enough explanation in way of justification of their study.

Mathematical models of a wide variety of physical systems, especially those defined by a potential such as electrical or gravimetric fields, can be expressed in terms of the Laplacian operator. Such functions are said to be harmonic, and it turns out that under a conformal transformation a harmonic function remains so. The advantage gained under a conformal map is generally related to the geometry of the problem. In the case of maps considered in this research one can do calculations in a circular domain, and then map the results conformally to a domain that is less-than-circular where the same calculations would have been much more onerous. A numerical example of such a map is given in Figure 1.

Although existence proofs of conformal maps for many types of regions, simply and multiply connected, have been around for a while (Bernhard Riemann stated his famous mapping theorem in his 1851 PhD thesis), closed expressions have been available for only a very small subset of these. Expressions for conformal maps involving infinite sums or products have also been known for a good deal of time, but were computationally unwieldy. The advent of computers, and as importantly efficient computational algorithms, allowed for expanded research in this area. The interested reader may consult [1] for many of the early computational methods. In 1980 Fornberg proposed a method for mapping the interior of the unit circle to the interior of a region bounded by a smooth, closed curve [2]. DeLillo and others have extended this map to the doubly-connected case, and the unbounded multiply-connected case [3,4,5]. This research extends this method to the bounded, multiply-connected case.

2. Discussion

An amazing property of harmonic functions in the complex plane is given by Cauchy's integral formula, which says that the values of a harmonic function on the boundary of a region completely determine the behavior of the function in the region itself. The determination of a conformal map then in almost all cases reduces to finding the boundary correspondence between the boundary in the domain and the boundary in the image of the map.

To find this boundary correspondence we use a result shown for the simply connected case in [1] that expresses a relationship between Cauchy's integral formula and points in the complement of the domain with its boundary. With this information it is possible to formulate the map in terms of its Fourier coefficients and centers and radii of the circle domain, as well as a system of equations which shows the relationship the coefficients and the centers and radii of the circle domain must possess – we call this system of equations the *analyticity conditions* of the map. Conformal maps of multiply connected domains are uniquely determined by what are called conformal moduli,

in this case the centers and radii of the circle domain, and thus the boundary correspondence for this mapping problem is reduced to finding the proper centers and radii as well as the Fourier coefficients given by the analyticity conditions.

These conformal moduli and Fourier coefficients are found by an iterative, Newton-like method. We start with an initial guess for the boundary correspondence using N Fourier points on the boundary of the circle domain. The analyticity conditions are converted to a discrete system of equations along side a linearization of the boundary correspondence, which together give an expression in terms of a linear system of the iterative updates to this boundary correspondence. The nature of this linear system is such that it may be solved by the conjugate gradient method, and convergence of the Newton iteration to the desired map is superlinear. Given convergence, the map function is easily constructed (via N -point trigonometric interpolation), and may be evaluated given any point in the circular domain. An example is given in Figure 1. Use of the fast Fourier transform normally allows problems of this nature to be computed in $O(N \log N)$ time, but construction of the analyticity matrices has to this point only been reduced to the level of $O(N^2)$.

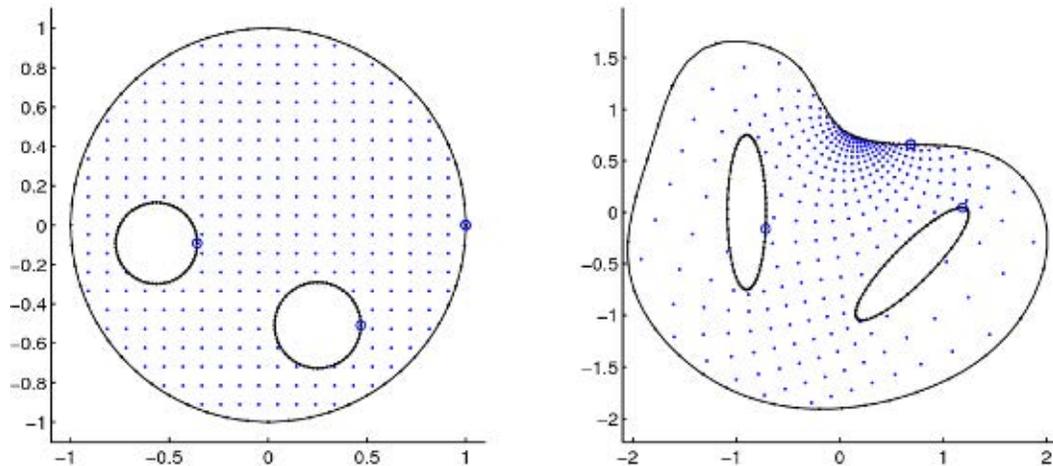


Figure 1: A numerical example of the map.

3. Conclusions

The result of this research is a numerical implementation of a Fornberg-like method which maps a region bounded by the unit circle punctured by m circular holes, to a region bounded by a smooth curve punctured by m holes with smooth boundaries.

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[**Acknowledgment.**I would like to thank my advisor, Thomas DeLillo. His advice and support were, and continue to be, invaluable.]

Energy-Efficient Data Redistribution in Sensor Networks

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Abstract. We tackle the data redistribution problem in data intensive sensor networks, which concerns how to redistribute the large volume of sensory data into the sensor networks wherein sensor nodes have limited storage space and battery energy. The goal of the problem is to minimize the energy consumption incurred by data redistribution, while fully utilizing the storage capacity in the DISNs. We first show that this problem is equivalent to the balanced assignment problem, which can be solved by the well-known Hungarian algorithm. However, there are two limitations of this approach. First, the Hungarian algorithm gives $O(Nm)$ time complexity where N is the total number of sensor nodes in the network and m is the average storage capacity of each node. Second, Hungarian algorithm is a centralized algorithm, which cannot be easily implemented in a distributed manner. In our work, we design a fully distributed, highly scalable, and efficient data distributed mechanism. Using our own simulator (written in C language) we show that our distributed algorithm outperforms the existing data redistribution techniques in sensor networks in terms of energy consumption for data redistribution.

1. Introduction

In data intensive sensor networks (DISNs), large amount of monitoring or scientific data are generated from some sensor nodes (called data generators), stored in the network first, and collected later for further analysis. When the storage capacity of a sensor is reached, the data has to be redistributed / offloaded to other nodes with free storage space. Such data redistribution, if not managed well, could be a serious energy drain not only to the data generators' battery power, but to other sensor nodes involved in the redistribution process. Therefore, a major challenge in DISNs is how to store the massive amount of data inside the sensor network of limited storage capacity and battery power.

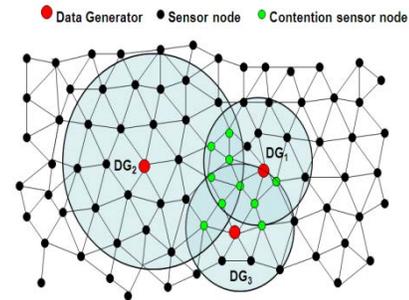


Figure 1.

The sensor nodes which store the offloaded data are called the *offloading area* of data generators and are represented as circles in Fig. 1. However, when data generators are close to each other, or the amount of generated data is comparable to the amount of available storage space in the networks, redistribution contention arises. Fig. 1 shows three data generators DG1, DG2, and DG3 with overlapping offloading areas. The challenge is how to resolve such contention while still achieving energy efficient data redistribution. We study how to redistribute the large amount of data into the network to fully utilize the storage capacity of all the sensor nodes, while at the same time, minimizing energy consumption incurred by the data redistribution.

2. Experiment, Results, Discussion, and Significance

Problem Formulation: We first show that our data redistributed problem is essentially the balanced assignment problem (Assigning n individuals to n jobs while minimizing the total cost of assignment).
Theorem 1: The data redistribution problem is equivalent to assignment problem.

Proof: There are p data generators in the sensor network, with s_1, s_2, \dots, s_p data items respectively. For a network with N nodes, there are $q = N - p$ regular sensor nodes that has available storage space, with m_1, m_2, \dots, m_q storage space respectively. We do the following transformations. First, since each data item has one unit memory space, we subdivide data

generator node i into s_i (number of data items it has) nodes, each corresponding to one of its data items to redistribute. Second, for each sensor node i that has m_i units of available storage spaces, we subdivide node i into m_i number of nodes, each corresponding to one unit memory space of node i . We get a bipartite graph, where the left hand side is the set of data items and the right hand side is the set of available unit storage spaces. There is an edge between any node (data item) on the left and any node (unit memory space) on the right (we do not plot them for clarity), and the distance between them is the shortest distance (in terms of number of hops) between each data item's data generator and the regular sensor node the unit memory space belongs to. If the number of data items is less than the number of the total available memory spaces in the sensor nodes, we add dummy nodes on the left with edge cost zero to make it balanced assignment problem, which can be solved by Hungarian algorithm [1].

Potential field model: We study the data redistribution using the analogy that the whole sensor network is an electric potential field, wherein each data generator is an electric charge. For data generator S_i with s_i data items to offload, it has a positive electric charge of s_i . PDA takes place in iterations and each iteration consists of 3 stages.

1) Advertisement Stage: Data generator that has data items to offload floods its ID and number of data items to offload.

2) Storage Commitment Stage: Each sensor node j calculates its potential value due to the data generator S_i , $\emptyset(i,j) = \frac{s_k}{d_{s_kj}}$, total potential $\emptyset(j)$ and finds S_i with maximum potential value and commits it one unit of storage to it. Suppose such data generator is S_k , that is, $k = \text{argmax}_{1 \leq i \leq p} \emptyset(i,j)$. Commits one unit of storage space to S_k . Sends a message to each data generator which it committed storage space to, says s_i , with the number of storage space it committed, C_{ij} .

3) Data Offloading Stage: We denote set of sensor nodes who commit storage to S_i as C_i . Each data generator compares the total number of received commitments with current number of data items to offload, s_i . If total number of commitments $> s_i$, S_i offloads data to the closest, say sensor node k , among all the committed sensors and updates $s_i = s_i - 1$ and if still has data to redistribute it re-computes,

$$\emptyset(j) = \emptyset(j) - \frac{1}{d_{s_i j}}$$

PDA stops when all the data generators have offloaded their data items. We see from above that in each iteration, each sensor commits all its storage space.

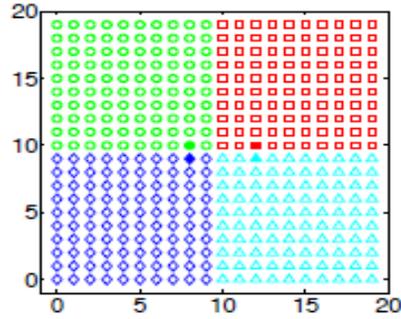


Figure 2. Hungarian (Redistribution cost = 3160)

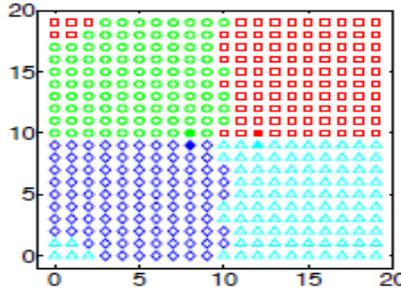


Figure 3. PDA (Redistribution cost = 3205)

Discussion: PDA is a fully distributed, highly scalable, and efficient data distributed mechanism, with the following characteristics.

- PDA is an online distributed algorithm and applicable to environment where data generation occurs dynamically. It does not require the data generators to communicate with each other for redistribution contention resolution. The contention is solved during the storage commitment stage by the sensor nodes.
- In PDA, data generators do not need to have the knowledge of the remaining storage capacity of other sensor nodes. In addition, the sensor nodes do not have knowledge of the data generator's redistribution needs.

3. Conclusions

We study the data redistribution problem in sensor networks. Our results are two-fold. First, we show that the data redistribution problem is equivalent to the classic assignment problem, which can be solved optimally in a centralized manner. Second, for a distributed algorithm, we have applied the idea of electrostatic potential field to develop a distributed data redistribution mechanism. Through our own simulation, we show that our distributed algorithm performs very close to the optimal centralized solution.

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Does the Use of Interest Rate Swaps Matter?

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Abstract. This project analyzes the effectiveness of employing interest rate swaps to weather U.S. monetary announcement effects. This study presents the evidence that there are benefits for fixed-rate payers when the Fed tightens the money supply, but the expected adverse effects on floating-rate payers are not observed. First, this paper shows that assets prices react to the surprising component of the federal funds rate changes rather than the raw interest fluctuations. Second, this paper illustrates the heterogeneous stock returns in response to monetary surprises at both industry and firm levels. Finally, this study explains the sensitivities of the stock returns by companies' balance sheet information in conjunction with their positions in interest rate swaps contracts.

1. Introduction

Derivatives have been blamed for the recent financial crisis on the Wall Street. The ramification of this financial debacle is being experienced by all of us. Graduating students find themselves ever more difficult to find reasonable jobs; department chairs might feel pinched when it comes to budgeting. However, have those exotic financial innovation brought us any good? Have interest rate swaps as one of the financial instruments invented in earlier 80s for interest risk hedging served its invented purpose? While scholars heavily investigate the impact of monetary policies on assets prices in great details, the differences of stock reactions caused by using financial derivatives are overlooked. Looking from a policy markers' view point, has the monetary authority lost its grip on the desired monetary impact due to the innovations of these derivatives?

2. Experiment, Results, Discussion, and Significance

The first stage of the project employs an event study like methodology to generate the magnitudes of individual company's and industry's reactions to the monetary announcements. The subsequent magnitudes are stored as dependent variable observations for the second stage cross-sectional analysis.

Table 1 displays the S & P 500 index reactions to federal funds rate (FFR) changes during the 81 event days. The columns (a) and (c) of Table 1 correspond to equation (1), including all the announcements and excluding the unscheduled meetings, respectively. In both cases, the official target FFR changes do not demonstrate statistical significance to equity prices. The counterintuitive observations of these results are the positive coefficients. A possible explanation for this result might be a market over-anxiousness about the FFR announcements preceding the event days. In other words, investors are biased to be pessimistic about the monetary environments, and FOMC statements are served as a form of relief regardless of the directions of interest rate movements. However, by decomposing FFR changes into anticipated and unanticipated changes, the equation (1) does reveal the significance of the unanticipated FFR changes.

$$prtm_t = \alpha + \beta_1 \Delta_t^u + \beta_2 \Delta_t^e + \varepsilon_t \quad (1)$$

Where Δ_t^u denotes the unexpected component of FFR changes on day t and Δ_t^e represents the expected portion of the changes.

The following equation (2) captures the different responses to monetary shocks across various industries. Among the 56 industries classified by 2-digit standard industry code, the financial service sector reacts to the monetary shocks most aggressively, followed by durable goods industries. These results are in line with the cost channel theory. Financial firms are more capital intensive than most of other sectors involved in this research. The cost of financing is relevant to consumers' purchasing decision-making. In contrast, non-cyclical industry such as utilities', health services', and education services' reactions are marginal compared to any other cyclical business.

$$Indret_{i,t} = \alpha_i + \beta_1 \Delta i_t^u + \varepsilon_{i,t} \quad (2)$$

Where $Indret_{i,t}$ denotes stock price returns of each firms i that belong to the same industry on day t .

To identify the different reactions between fixed-rate payers and floating-rate payers, the equation (3) is employed.

$$reaction_j = \alpha + \beta_1 X_j + \beta_2 D(fixed_j) + \beta_2 D(fixed_j) \times X_j + \beta_3 D(floating_j) + \beta_4 D(floating_j) \times X_j + \varepsilon \quad (3)$$

Where $reaction_j$ is the average magnitude of each stock price reactions to monetary surprises obtained without including index changes. $D(fixed_j) \times X_j$ and $D(floating_j) \times X_j$ are the interaction dummies for fixed and floating-rate payers, respectively, where X_j denotes industry characteristics *operating risk* and *operating margin*.

As the model allows slope to be different between fixed-rate payer and non-fixed rate payers, the coefficient of the interaction term $D(fixed-rate\ payer)X$ (*Operating risk*) shows that the higher a company's operating risk, the less sensitive the company to the monetary surprises. This finding was counter intuitive. However, as in the process of identifying the companies' swap contract positions, I learned risky firms were more likely to be fixed-rate payers. This result shows the overwhelming benefits by being fixed-rate payers in an interest swap contract.

3. Conclusions

This paper investigated the effectiveness of employing interest rate swaps to moderate the impacts of U.S. monetary policy surprises in the period of 1997 to 2006. Results confirm the general finding that stock returns only react to the surprises in the FFR rather than expected changes. This paper also shows an interesting outcome that fixed-rate payers generally experience stock price increases when there is a positive monetary surprise (bad news).

4. Acknowledgements

I thank Chu-Ping Vijverberg and Philip Hersch for their valuable comments and suggestions. Also I thank the authors of forthcoming paper, the Effects of Federal Funds Target Rate Changes on S&P100 Stock Returns, Volatilities, and Correlations, for their data on the monetary "surprises" measurements.

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Table 1
Responses of equities to federal funds target rate changes

	All FOMC Meetings		Excluding Conference Calls	
	(a)	(b)	(c)	(d)
Federal funds rate change	0.0969 (1.16)		0.0183 (0.30)	
Surprise Change		-6.662*** (-3.98)		-6.402* (-2.57)
Expected Change		1.342 (1.94)		1.032 (1.99)
Intercept	0.0768 (-0.21)	0.148 (1.01)	0.135 (0.52)	0.166 (1.52)
N	80	80	76	76
adj. R^2	0.004	0.170	-0.012	0.103

Notes: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

-The dependent variable is the one-day S & P index returns, in percent. Parentheses contain t -statistics, calculated using heteroskedasticity-consistent estimates of the standard errors. Serial correlation does not exist according to Durbin-Watson test.

Crucial Edge Detection in Sensor Systems under Energy Constraints

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Abstract. Although the wireless sensor nodes available today may be equipped with rechargeable batteries, the minimal energy capacity and low recharge rates hinder the sensor's lifetime and achievable performance. Sensor loses energy predominantly because of the redundant transmissions of sensed data. To avoid this, a sensor is modeled to transmit only the changes sensed in the event occurrence process, referred to as *Transitions* or *Crucial Edges*. For the proposed sensor model, we have developed a near-optimal decision-making policy. The policy, designed for a single rechargeable sensor, addresses the question "how long should the sensor sleep, and how long to stay active?"

1. Introduction

Wireless sensor networks have varied and important applications, such as military surveillance and habitat monitoring. Generally, these devices are small, low-cost and operate in remote conditions with seldom human intervention. Hence, these devices are expected to have long lifetime, and perform efficiently and reliably. However, due to the low energy capacity of the sensor this is seemingly not possible. The usage of rechargeable sensors does help but the lower recharge rates, due to the vulnerable environmental conditions, is a constraint. Hence, the sensor must operate judiciously in order to efficiently utilize the available energy. Also, sensors are generally known to make redundant transmissions of sensed data which consumes substantial amount of energy. By avoiding these redundant transmissions we can ensure energy conservation, and usage when required.

Consider rainfall occurrence as the monitored event process, Figure 1. It is raining when the event process is ON, and there is no rain if event process is OFF. For instance, we may observe rain between $t_1=8$ and $t_2=12$, and no rain between $t_2=12$ and $t_3=15$. For a monitoring station, the information required is the time at which rain starts and stops, which may be used to study the rainfall phenomenon in the area. The sensor model, considered in past and related work [1],

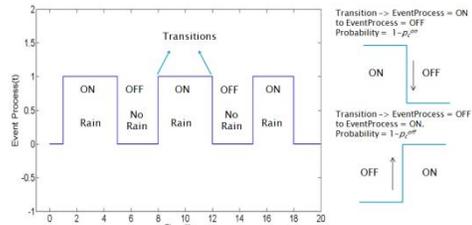


Fig. 1. Event Occurrence Process, example of Rainfall.

would generally transmit the state of the event process every time slot between $t_1=8$ and $t_2=12$ and loose significant energy. We suggest that the sensor should only transmit the information at $t_1=8$ and $t_2=12$, since this information is enough to know the duration of rainfall. This information sensed and transmitted by the sensor is referred to as *transition* or *crucial edge* in the event occurrence process, marked by the change in state of event process.

The sensor must deactivate itself when appropriate, since an active sensor loses energy continuously. With reference to the above example, the sensor must be ideally active at time instants $t_1=8$ and $t_2=12$ and sleep between the two instants. But this is not simple as the above time instants are random. In order to perform efficiently and detect maximum number of transitions, the sensor must choose an appropriate sleep interval. Also, sensor must choose an optimum active interval, since longer activity means better chance of detecting transitions but at the cost of the available energy. The choice of sleep interval should be optimum since an inactive sensor is not capable of sensing, and may miss transitions. Practically, the sensor may miss one or more transitions but intelligently the sensor should realize and transmit the missed transition. Although this information is transmitted late, we believe a late transmission is better than no transmission.

The logic behind realizing a missed transition may be clear with the following analogy. Assume you decide to sleep while it is raining and rain has stopped before waking up. If the question asked is "how many times did rain stop/start while you were asleep", the obvious answer is at least once the rain stopped but not sure if the cycle repeated. From this example and Figure 2 the logic is very much clear.

The sensor will realize and transmit the last missed transition if an odd number of transitions occur while inactive.

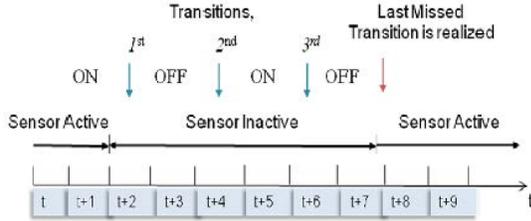


Fig. 2. Realizing a Missed Transition.

2. Experiment, Results, Discussion, and Significance

The sensor is modeled as a queuing system, with recharge quanta of energy as arriving entity following Bernoulli process, and an event driven energy discharge process. An active sensor loses energy continuously and additional energy is lost for any sensing performed during ON period. No additional energy is spent for sensing during OFF period. In addition to this, each transmission made by the sensor consumes the highest amount of energy. If an active sensor detects and transmits a transition, it fetches a maximum reward of 1. If the sensor is late in realizing and transmitting a missed transition, then a reduced reward is fetched. The reward function is an exponentially decreasing function and depends on the time taken by the sensor to transmit the last transition, in $t+6$ (Fig. 2), from the time of occurrence. For example, the reward fetched after transmitting the third transition, Fig. 2, is e^{-2} (< 1). If the sensor was active in time slot $t+6$, then reward is 1 (e^0).

The design of a decision-making policy, which is completely intuitive and the key to this research, is as follows:

- Sensor decides to activate and remains active for AI time slots, if sufficient energy is available.
- If the sensor is active and transition occurs, the sensor decides to sleep for SI time slots, since the next transition is expected to occur after some time and meanwhile the sensor may get recharged. However, an active sensor may also decide to sleep if sufficient energy is not available.
- If sufficient energy is not available, to activate, the sensor eventually dies. To activate, sensor must possess energy greater than the threshold level.
- As soon as the sensor is activated it first checks for any missed transition by comparing the observation made before deactivating and the current observation.

Any decision-making policy should decide the required Active Interval (AI) and Sleep Interval (SI), and is an event process based decision. Hence, during ON (OFF) period $AI=AI_{ON}(AI_{OFF})$, and $SI=SI_{ON}(SI_{OFF})$.

The best decision-making policy is a *Four-Timer* policy, and possesses a unique property called Toggle for ON and Vary for OFF (*TOVO*). The optimal values of AI/SI are $AI_{ON}=SI_{ON}=1$, $AI_{OFF}=AI^*(\geq 1)$, and $SI_{OFF}=SI^*(\geq 1)$. Since AI_{ON} and SI_{ON} are equal to 1, we consider them to toggle between each other. AI^* and SI^* are the optimal values of AI_{OFF} and SI_{OFF} , respectively. This property is observed to hold for various system parameters. The performance of this policy can be characterized using a loose upper bound, and a tight lower bound, Figure. 3. By operating at optimal values, the sensor is able to have an energy balance in the given interval and the energy recharged will \geq energy discharged, Figure. 4.

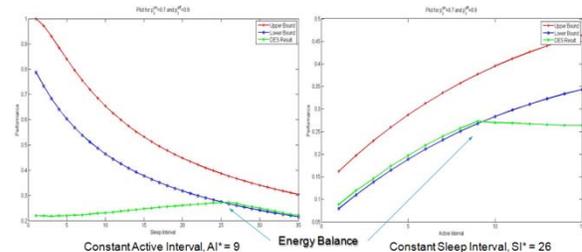


Fig. 3. Performance of four-timer policy for optimal values.

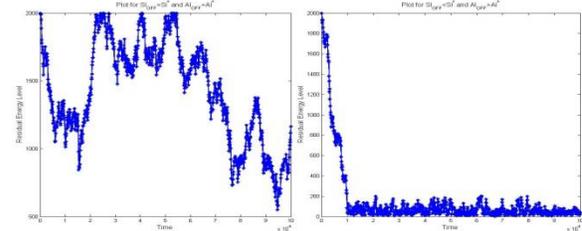


Fig. 4. Energy balance for optimal values of AI and SI.

3. Conclusions

We have developed a novel, intuitive and simple decision-making policy for a single rechargeable sensor that achieves high performance under energy constraints.

4. Acknowledgements

I am very thankful to Dr. Neeraj Jaggi for his guidance, encouragement, support and the confidence he had in me, throughout this research.

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Pediatric Adverse Drug Event Occurrence in a Community Hospital

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Abstract

Hospitalized children are at greater risk for adverse drug events (ADEs) due to varying size, development and lack of pediatric specific dosing. The project determined ADE rate for 40 randomly selected pediatric hospitalized inpatients utilizing the Pediatric-Focused Trigger Tool in a retrospective review. 171 triggers revealed 10 unique ADEs involving 8 patients, including ICU, general unit, and ER. Mean ADE rates were 25/100, 47.84/1000 days and 28.01/1000 medication doses, 50% preventable. Constipation and oversedation were common. Opiates and benzodiazepines/anti-epilepsy medications were associated with ADEs. Thirty percent required initial or prolonged hospitalization. ADE rates in a community hospital were higher than the rates reported for children's hospitals. This rate will serve as a benchmark as new safety measures are implemented.

1. Introduction

Hospitalized children are at greater risk for adverse drug events (ADEs) due to varying size, development and lack of pediatric specific dosing and dosage forms. Little is known about the rate of ADEs in community hospitals. The purpose of this project was to determine the ADE rate among children admitted to a community hospital utilizing the Pediatric-Focused Trigger Tool [1]. Reason's theory of error was used to frame the project and to determine potential causes of harm [2].

2. Experiment, Results, Discussion, and Significance

The prevalence of publicized medication errors led to the publication of a Sentinel Event Alert by The Joint Commission. This important program calls on all providers caring for pediatric patients to make changes to prevent medication-related harm. A variety of efforts to reduce the risk of medication errors and resultant harm have been studied. Adverse drug events are more likely to inspire changes in practice rather than meaningless error rates, not correlated with specific harm to a patient. Trigger tools have been found to find a 50 fold increase in ADE when compared to traditional reporting methods such as incident reports [3]. Trigger tools are the most efficient and cost effective method of obtaining information about ADEs [3,1].

Forty children from a Midwestern community hospital were randomly selected for retrospective chart review. The type of error, process problem, preventability, outcome and intervention was collected for all ADEs identified by triggers. Only ADEs verified by a second reviewer, a pediatric pharmacist, were included. Data were analyzed using confidence intervals, exact binomial distribution for proportions, Poisson distribution for rates, and proportion comparison using Chi square with Yeat's correction. A total of 171 triggers (4.28 per patient) and 10 unique ADEs involving eight patients were revealed. Mean ADE rates were 25 per 100 patients, 47.84 per 1000 patient days and 28.01 per 1000 medication doses. Fifty percent were determined to be preventable. Constipation and oversedation were most common ADEs. Opiates and benzodiazepines/antiepilepsy medications were commonly associated with ADEs. Event occurrence included: three patients in PICU (4 events); four patients on the general pediatric unit (4 events); and two infants required intubation after seizure treatment in the Emergency Department. Temporary harm occurred in 70% of patients and 30% required initial/prolonged hospitalization. The prescribing/ordering medication process stage was most frequently associated with harm.

3. Conclusions

This study identified 10 ADE, occurring in 8 patients, for overall rates of 25 ADE per 100 patients, 47.84 ADE per 1000 patient days, 28.01 ADE per 1000 medications and 4.68 ADE per 1000 doses. One in five patients in this

sample had an ADE. While none of these ADE were life threatening, the goal for all pediatric medication delivery is to increase safety and decrease harm.

Of the preventable ADE discovered, some solutions exist to decrease patient harm. Constipation from opiates was the most common ADE. One patient was an oncology patient; the other three were orthopedic patients. Opioid induced constipation is related to the inhibition of gastric emptying, decreased rate of intestinal transit, and decrease in gut fluid reabsorption. While constipation may be considered by some a non significant adverse event, it causes discomfort and pain from abdominal distention, bloating, and hard stool in the rectum and can be severe enough to require additional hospital days [4]. Sharek and others reported on an initiative involving forty two children's hospitals to decrease opioid related ADE [5]. They found rates of 33-51% opioid related ADE. Constipation rates were decreased at these children's hospitals by the initiation of a "change package" which included recommending proactive routine stool softeners and laxatives when opiates are utilized. Treatment after constipation occurs is less effective than prophylactic treatment [6]. A similar opportunity exists to decrease constipation ADE in the non children's hospital pediatric patients by adopting this practice and adding a laxative and/or stool softener order to pediatric trauma and individual orthopedic surgeon pre printed order sets. If computerized order entry is available, a weight appropriate dosage may be automatically suggested to reduce omission of this important preventative treatment [7].

The other preventable ADE found by trigger tool was a medication level in excess of the target serum concentration. The result was present on the paper chart for more than 48 hours before the medication was stopped. A barcode medication administration system was implemented in September of 2009 in the community hospital. It contains a laboratory section that shows serum concentration results which may help to notify nurses of a non therapeutic level prior to administration of the medication. The follow up of this study, planned for March of 2010 will document ADE after implementation of both a smart pump system and barcode medication administration. When compared to the Takata study of 960 children hospitalized in 12 children's hospital, the non-children's hospital group had an older population, shorter LOS, and fewer medications and doses per patient.

4. Acknowledgements

The author appreciates the advice and information received from CHCA staff member Tina Logsdon and Via Christi Hospital statistician Teresa Jones. Lela Fung, PharmD, Pediatric Specialist served as the second reviewer and provided invaluable insight.

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Determining if Factors Affecting NHL Attendance Are Equal Across Geographical Regions

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Abstract. This paper estimates a nightly demand model for National Hockey League attendance for five teams from different divisions. The magnitudes of the coefficients are compared for each team to determine if factors that influence attendance affect each team the same. All variables except games played in October were found to be statistically different between at least two teams. Games played between division opponents and previous season success had the largest regional variation while “calendar” variables (weekend and games played in March and April) have the lowest regional differences. The analysis shows that a general attendance model of the NHL is inaccurate and can cause misleading interpretations for purposes of marketing and profit maximization.

1. Introduction

Professional sports attendance has been a widely studied issue. The majority of the literature for National Hockey League (NHL) attendance estimates a general model for average nightly attendance demand for the entire league. The only distinction between the teams is US and Canadian. If the factors that affect demand vary from region to region, a general model for the entire league is inaccurate. For this analysis, only US teams were considered. The hypothesis of the experiment is that there are regional differences in factors that affect the demand for NHL attendance. In this research, whether or not the coefficients of the demand models are statistically significant is not the goal. The purpose of this paper is to determine if the magnitude of the coefficients of the individual demand models are statistically different.

2. Results

The NHL divides their divisions by geographic region. One team from five of the six divisions was taken for the sample. Ideally, a model with every team would make the analysis complete, however, if differences are found using only one team from each division, that is enough to conclude there are differences in how demand is affected in different regions. No team was selected from the Northwest division. The only two American teams in that division are the Minnesota Wild and the Colorado Avalanche. The Wild have sold out every home game in their existence and the Avalanche sold out every game from 1997-2007. The same model for teams that always sell out cannot be applied to teams that have fluctuation in attendance.

The teams chosen were the Anaheim Ducks, Chicago Blackhawks, Boston Bruins, Carolina Hurricanes and New Jersey Devils. Boston and Chicago were chosen because they are two of the original six NHL teams. Carolina and Anaheim were chosen because they are non-traditional hockey cities. New Jersey was chosen because they are in a large market, have been very successful and do not sell out regularly.

The Zellner Method for Seemingly Unrelated Regressions (SUR) was used for the model. The teams cannot be treated independently despite being in different cities. A factor that affects demand for the NHL as a whole will affect demand in both Boston and Anaheim. The SUR method takes this into account and pools the errors for better estimation. A Wald statistic was used to determine if the magnitude of each coefficient was the same in the two cities being compared. The example statistic below follows a Chi-squared distribution with one degree of freedom.

$$\text{Wald} = (\beta_{1\text{Anaheim}} - \beta_{1\text{Boston}}) / \text{Var}(\beta_{1\text{Anaheim}} - \beta_{1\text{Boston}}) \sim \chi^2(1)(1)$$

The sample period was for home games of each team between the 1997-98 season and 2008-09 season. Four of the teams had 451 observations. Chicago played one home game away from their home arena and thus had only 450 observations. Each team will be compared against each other team for a total of ten tests.

Arenas in the NHL have different capacities. Therefore, utilized capacity per game was used as the dependent variable rather than absolute attendance. The data used was reported paid attendance. For example, if Anaheim had

paid attendance of 14,300 out of the 17,100 capacity, the value of the dependent variable in this case would be 0.836. The independent variables in the model were chosen because they are generally significant in the literature models. The variables are: Division game, Goals-for Per Game, Goals-against Per Game, October Game, March or April Game, Weekend Game, Opening Night, Point Total in the Previous Season, Points-per-Game in Current Season, Playoffs Reached in Previous Season and Round Two of the Playoffs Reached in the Previous Season. In order to get the best possible comparison, the same model was used for each team regardless of whether or not the variable significantly affects attendance in a specific model. There were two exceptions. New Jersey reached the playoffs every year and Chicago never made it to round two of the playoffs in any year of the sample. Attempting to run a regression with these models would result in a singular matrix and the analysis could not be done. The model is below where $\beta = (\beta_1, \beta_2, \dots, \beta_n)$ and $\mathbf{X} = (\text{Division, Goals-per-game, October game, } \dots, \text{Opening Night})$.

$$\text{Capacity}_i = \beta_0 + \beta_i \mathbf{X}'_i + e_i \quad (2)$$

The results of the SUR and Wald tests confirm the hypothesis that significant differences exist between teams with respect to all factors tested except for October games. This is surprising because October is when baseball season is ending. Baseball will likely take attendance away from hockey. Anaheim and Boston have had successful baseball teams, whereas Carolina does not have a baseball team. A city with a baseball team should have hockey attendance affected differently during baseball season than a city without a team but that was not the case.

Success in the previous season and whether or not a team was playing a divisional game were significantly different for six out of the ten tests. Goals-against per game was different for five tests. Weekend, March and April games and opening night games were different for only two tests. Current season points per game and goals-for per game were different in three tests. Due to the problem of singular matrices, reaching the playoffs in the previous year and reaching round two in the previous year's playoffs only had six tests instead of ten. Making it to round two of the playoffs was different for three tests and reaching the playoffs in the previous season differed for only one test.

Finding significant differences in all but one of the twelve factors shows a general attendance model that treats teams as homogenous firms is inaccurate. This has two relevant implications. The first is in the individual team's front office decision making. If a general manager wants to acquire a high priced player to boost a team's goal scoring, he has to decide if the expected increase in attendance will be more than the cost of the player. If he uses what another team experienced as a guide, the results may be different than what is expected.

The second implication is for the NHL's marketing efforts. If a general model of attendance is inaccurate, general marketing techniques for the entire league will also be inaccurate. Once regional differences of these factors are established, better marketing plans can be developed to expand national interest in the game.

3. Conclusion

This research has shown that the traditional general attendance models for the NHL are inaccurate because the magnitudes of several factors that affect nightly attendance vary from region to region. There are relevant profit maximizing implications for individual teams knowing that their attendance demand is not necessarily the same as the average NHL team. The NHL would benefit from this insight as a way to market the game in a unique way to different geographical regions.

4. Acknowledgements

I would like to thank Dr. Jenchi Cheng, Dr. Philip Hersch, Dr. Jodi Pelkowski and Brenda Lehman for their assistance and suggestions for this research.

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The Effects of Hamstring Stretching on Vertical Jump in Healthy Young Adults

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Abstract. In physical therapy, a large portion of the patient population consists of non-athletic individuals. The purpose of the study was to achieve a better understanding about the use of a stretching program prior to activities non-athletes perform that require power. Twenty-seven non-athletic individuals were measured for hamstring flexibility, performed a vertical jump, and were divided into control and treatment groups. The treatment group was assigned a 6 week stretching program while the control group continued normal activities. Pre and post sit and reach measurements were obtained for all participants. No significant correlation was found between jump height and flexibility. Hamstring flexibility and jump height did not change significantly ($p \geq 0.05$).

1. Introduction

In physical therapy, a large portion of the patient population consists of non-athletic individuals. These individuals use power on a daily basis, such as climbing stairs, lifting objects, and running. Therefore, power activities are not only seen in sport settings, but are also used in the home and work place. Several authors have evaluated power production within the athletic population [1,2,3]; however, power is rarely explored in non-athletic populations.

2. Experiment, Results, Discussion, and Significance

Subjects were a sample of convenience. The first individual was randomly assigned to the control group or to the exercise group based on the flip of a coin; every successive person was placed in the opposite group. For the pre- and post-tests, subjects performed the following: a 5 minute warm-up on a stationary bike; 3 sit- and-reach trials with shoes removed and feet flat against the box; 3 counter movement jumps. At the final testing session, subjects in the stretching group returned compliance calendars.

The Vertec[®] jump system was used to test vertical jump because of its high validity and test-retest reliability [4]. During testing sessions, subjects performed 3 countermovement jumps, a type of vertical jump. These jumps primarily use movement by quickly flexing the knees prior to the jump. Subjects were instructed to “bend your knees then quickly jump as high as you can, hitting the highest vane that you can”, which was demonstrated once.

Subjects in the stretching group were instructed to lie supine on a flat surface to stretch the right hamstrings. The right hip actively flexed to 90°, the knee actively extended, and foot flexed with hands behind the knee. The opposite lower extremity remained flat on the surface. This active self-stretch, which was “strong but tolerable”, was maintained for 30 seconds [5]. The same procedure was performed with the opposite leg. Stretching was repeated 3 times a day, 5 days a week for 6 weeks [6].

Mean range of motion and vertical height were determined from each of the 3 trials. Hamstring flexibility and vertical jump was not significantly different between the control and stretching group from pre test to posttest. No correlation between change in flexibility and vertical jump height was found.

There is some debate over the optimal duration and frequency required to induce a significant difference in hamstring range of motion. Bandy and Irion found that subjects who held the stretch for 30 to 60 seconds for 5 days per week for 6 weeks, showed greater gains in range of motion when compared to subjects who stretched for a lesser amount of time [7,8]. Davis et al also examined time duration for stretching and found that when one static stretch was held for 30 seconds 3 days a week for 4 weeks, hamstring length increased significantly [5]. Ford et al found that, when following a daily static stretching protocol for five weeks, passive knee extension range of motion increased for all ranges using 30 to 120 second stretch durations [9].

No significant difference between the control and stretching groups could be due to the participants not doing the stretches correctly. The subjects were only given a handout and were instructed by an investigator on

proper technique after the pretest session. Ford et al required that each subject in the intervention group return each week for a review of the stretching protocol [9]. Davis et al had subjects perform the stretch under the supervision of an investigator [5]. Other researchers supervised each stretching session [7,10]. However, Bazett-Jones et al also observed the stretching protocols that the subjects performed on their own and their results showed no significant difference in hamstring flexibility [11].

The results suggest that a 6 week static stretching program may not be adequate for significantly increasing hamstring flexibility and, therefore, power output in the non-athletic population. In future studies that examine the non-athletic population, members of the stretching group should be supervised at least weekly to ensure that the stretching protocol is being followed correctly. When selecting participants, it would be advised that inclusion criteria be set to eliminate the possibility of a ceiling effect for hamstring flexibility.

3. Conclusions

The purpose of this study was to achieve a better understanding about the use of stretching program prior to performing activities for power output like vertical jump. After a 6 week stretching program was completed, all subjects' hamstrings and vertical jump measurements were taken to determine the effects of the program. This study found no significant difference between hamstring length for pre and post stretching in either group and, therefore, it was not expected to have a significant difference in power output in the form of a vertical jump. More research needs to be conducted to further understand the effects of stretching on power production.

4. Acknowledgements

We would like to thank Wichita State University faculty, staff, and students. With a special thanks to Jeremy Patterson, PhD for his valued time and outstanding advice.

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Biomimetic Solar Cells

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Abstract: Eco friendly energy resources are becoming important due to the predicted oil depletion and soared CO₂ emission. Of available alternatives, solar energy finds special attention due to its vast availability and high power density of 1000 watts per square meter. Various mechanisms have been carefully employed to harvest the solar power including semiconductor silicon based photovoltaic, inorganic/organic dye sensitized or bulk heterojunction solar devices. Some of the latter devices utilize donor-acceptor supramolecular systems designed based on natural photosynthesis. Here, self-assembly of energy donor and acceptor are proved to be an important criterion. In the present study, we demonstrate an elegant method of self-assembly to modify TiO₂ surface using coordinating ligands followed by immobilization of a variety of photosensitizers and dyads. In this method, in addition of testing the photoelectrochemical behavior of different zinc tetrapyrroles, it also allowed us to introduce fairly complex structures involving more than one donor entities. Of all macrocycles studied, zinc porphyrin-ferrocene dyad markedly improved the current-voltage performance of the photoelectrochemical cell due to an electron transfer-hole migration mechanism. Incident photon-to-current efficiency values up to 37%, highest values ever reported for this type of electrodes was obtained for the electrode modified with the dyad, highlighting the importance of photocells built based on biomimetic principles for efficient harvesting of solar energy.

Introduction: Natural photosynthesis, common phenomenon occurring in plants wherein sunlight is absorbed by different pigments and energy is transferred to the reaction centre to create charge separated states (electrons & holes) leading to conversion of carbon dioxide to sugar. Pigments (macrocyclic tetrapyrrole based molecules) mostly are self assembled effectively on lipid bilayer to perform the aforementioned process. In order to mimic this natural process, self assembly of organic macrocyclic compounds to form charge separated states have been widely reported in solution level studies.¹ Dye sensitized solar cells are made out of titanium dioxide (TiO₂) nano particles which do not absorb visible due to their high band energy (3.0eV) but they are good electron conductors². In order to overcome this, dye molecules (similar to pigment) are adsorbed onto TiO₂ thin films. As shown in the Fig. 1a dyes absorb the sunlight energy and inject electrons into TiO₂ film on the conducting glass surface resulting in generation of photocurrent. Important criteria for dyes to get adsorbed on TiO₂ surface is it should contain an acid functional group. But we propose here a different approach called *axial ligation* in which it is possible to modify TiO₂ surface with the dyes that does not have acid group. Thus our bio mimicking approach opens up the possibility to modify TiO₂ surface with different types of dye molecules that could cover visible regions (400-800nm).

Experiment:

Thin films of TiO₂ on conducting glass surface was developed using Doctorblade technique. TiO₂ are immersed different nitrogen containing ligand carboxylic acids (1-5 in figure. 1b) containing solutions for 18-24 hours. After washing with clean ethanol, axial ligation was established by dipping the ligand immobilized TiO₂ in different dye solution (6-8 in figure. 1b) for 20 minutes. Unbound dye molecules were removed by washing the electrode in clean dichlorobenzene (DCB) solution. Photoelectrochemical cells were constructed using dye containing electrode as working electrode platinized ITO as counter electrode in noncoordinating DCB containing a 0.5 M (*n*-Bu₄)NI and 0.03 M I₂ as redox mediator. The photocurrent-photovoltage characteristics of the solar cells were measured using a Model 2400 Current/Voltage Source Meter under illumination with an AM 1.5 solar Simulator of Newport Corp. (Irvine, CA). The light

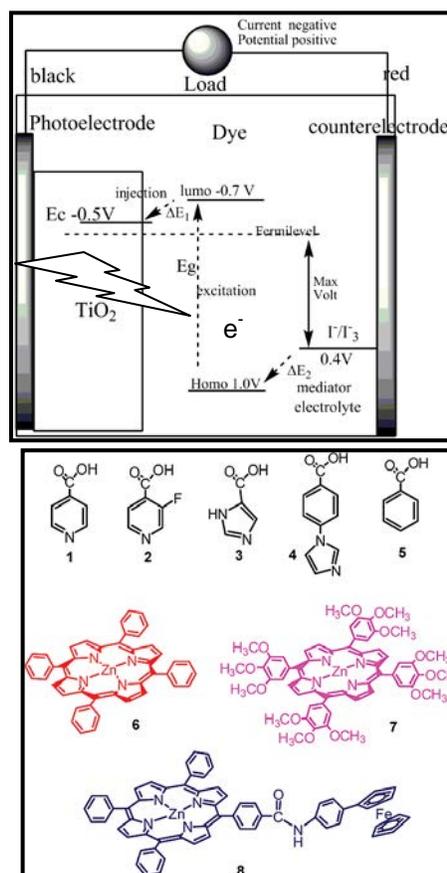


Figure 2 (a) schematic diagram of a Dye Sensitized Solarcell (b) coordinating ligands & zn tetrapyrrole macrocycles

intensity was monitored by using an Optical Model 1916-C Power Meter of Newport.

Results and Discussion:

Heterocyclic molecules such as imidazole, pyridine has a lone pair of electrons can coordinate with different metal atom containing macrocycle (like pigments) by axial ligation. Using this concept upon modifying the surface of TiO₂ with carboxylic acid containing ligand (1-4 in fig-1b), modified zinc tetrapyrrolemacrocycles (6-8 in fig-1b) can be self assembled conveniently. This was clearly shown (4:6, 4:7 & 4:8 in fig-2a) in which electrode looks green upon modification. When TiO₂ was modified with 5 lacking the axially coordinating ligand, some adsorption of the sensitizer was seen and surface color (5:8 in fig-2a) appears similar to the solution unlike the other surface emphasizing the importance of axial ligation. UV-spectroscopy study also confirmed the existence of axial ligation thereby proving the effective immobilization via axial coordination of the zinc tetrapyrroles in the case of TiO₂ surfaces modified with 1-4. We chose four nitrogenous bases with different pKa values to modify the TiO₂ surface, two zinc tetrapyrroles (6 and 7 in Fig-1b) having slightly different spectral and redox behaviors to demonstrate the versatility of the present method, and a zinc porphyrin-ferrocene (ZnP-Fc) [(donor)₁-(donor)₂] type dyad (8) to exhibit improved photoelectrochemical behavior as a result of an electron transfer-hole migration mechanism.

Photoelectrochemical study involved two experiment calculations of energy efficiency and quantum efficiency of the given photoelectrode. Figure 2b shows typical *I-V* plots for sensitizers bound to 4-modified TiO₂. Similar-looking *I-V* plots with lower photocurrents were obtained for electrodes modified with surface modifiers 1-3. The photocurrents (*I*_{SC}) generated for 4:6- and 4:7-modified electrodes were nearly an order of magnitude smaller than that obtained for the dyad 4:8-modified electrode. The photovoltages (*V*_{OC}) were also found to be smaller for the former electrodes. For the 4:8-modified electrode, the *V*_{OC} and *I*_{SC} were found to be 0.67 V and 1.6 mA per cm², respectively. Furthermore, the performance of this dyad was tested for other surface modifiers. As shown in Figure 2c, higher currents were obtained for each of these electrodes than for those modified with simple sensitizers. For a given zinc tetrapyrrole, the *I-V* performance for the various surface modifiers followed the order 4 > 2 > 3 > 1 > 5, that is, it largely followed the ligand binding constants of a given zinc tetrapyrrole. The incident-photon-to-current efficiency (IPCE) plots for the electrodes used in Figure 2c were shown in Figure 2d. The shapes resembled those of the absorbance spectra of the sensitizers, suggesting that they were indeed responsible for the photovoltaic behavior. The IPCEs at the Soret band (425 nm) locations were found to be 37, 28, 26, 14, and 6%, respectively, for the electrodes with 4:8-, 2:8-, 3:8-, 1:8-, and 5:8-modified surfaces. For the 4:8-modified photocell, the fill-factor and conversion efficiencies were found to be 47% and 0.56, respectively. Following formulae were used in evaluating the performance of the photoelectrodes.

$$IPCE(\%) = \frac{I_{sc}(A) \times 1240}{P_{in}(W) \times \lambda (nm)} \times 100$$

Energy conversion efficiency ($\eta\%$) = $\frac{V_{max} \times I_{max}}{V_{oc} \times I_{sc} \times P_{inc}} \times 100$ Where *I*_{sc} and *I*_{max} were short circuit current (A) and maximum current (A), *V*_{oc}(V) and *V*_{max} (V) are open circuit voltage and maximum voltage, *P*_{inc} is incident light power density respectively.

Conclusion:

In summary, we have devised an elegant and method of self-assembly for modification of TiO₂ surface using coordinating ligands followed by immobilization of variety of sensitizers and a dyad. A maximum IPCE value of 37% was achieved for the TiO₂ electrode modified with 4:8 was achieved.

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Acknowledgement: NSF-EPSCOR, NSF for funding and WSU.

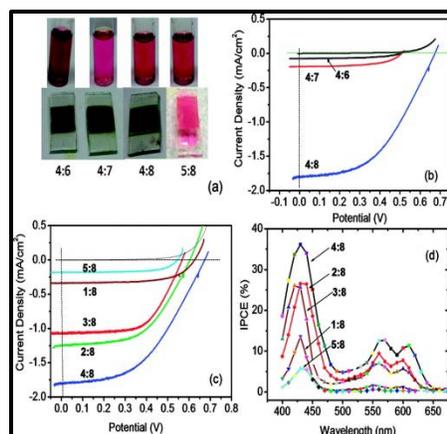


Figure 3 (a) Pictures of sensitizers in solution (b) CV characteristics showing the effect of different sensitizers bound to 4-modified TiO₂. (c) LSV characteristics showing the effect of different surface modifiers, (d) IPCE curves for the electrodes used in (c).

Customer Service in Financial, Communications and Business Service Companies in Nigeria: Impressions of Lagos Industry Executives

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Abstract: Nigeria is the eighth largest oil producer in the world, and the largest in Africa. Yet, instead of transforming the country into one of the most prosperous in the continent, Nigeria's abundant natural resources have enriched a small minority while the vast majority remains impoverished. Violence and instability in the oil-rich Niger-Delta region coupled with the capriciousness of oil prices has stimulated the nation's quest for economic diversification. Service sector growth is particularly promising. Increased privatization, foreign investment and globalization have stimulated growth in service companies. This study explores customer service in service companies located in Lagos, Nigeria and how customer service practices are evolving in response to changes in the service economy.

1. Introduction

Customer service involves a wide range of practices that might not readily be described as "communication". However, the performance of customer service activities and the manner in which they are rendered, communicates a strong message about an organization to its customers. So it can be said that customer service is a communicative act; and like any type of communication, the definition and scope of customer service is affected by the context in which it occurs.

The Nigerian service sector offers a unique economic context from which to study customer service. Economic reforms, globalization, foreign investment and privatization of previously government-run service organizations have all served to stimulate growth and competition in the service sector. Telecommunication and financial companies are some of the fastest growing service organizations in the country (Oshikoya, 2008). Consequently, business services such as securities and technology services that support the operation of these organizations have increased as well. As a result, this study investigates customer service in financial, communications and business service companies located in Lagos, the financial, economic and business capital of Nigeria, and how customer service practices are emerging in response to changes in the service economy.

There is an abundance of literature on customer service, service marketing and other related concepts. However, there is very little research on customer service practices in Nigeria, which pointed to the appropriateness of an exploratory, research question based approach (Frey, Botan, Friedman & Gary, 1992, p. 16). The purpose of this study was not generalizability, but to gain a better understanding of the context in order to ground future research endeavors.

2. Experiment, Results, Discussion, and Significance

Five research questions were posed:

RQ1: How do Nigerian service sector leaders conceptualize quality customer?

RQ2: Do Nigerian service sector leaders view quality customer service as important to their organizations? The service sector? The economy as a whole?

RQ3: In what ways, if any, do customer service practices support the accomplishment of customer service goals?

RQ4: How do Nigerian service sector leaders experience customer service as individual and organizational consumers?

RQ5: Are there any major barriers to the development of a quality customer service culture in the country?

Qualitative methodology was utilized in this study, specifically key informant interviews as a means of data collection (Krishna, 1989; USAID, 1996, UWEX, 2002), and thematic analysis was utilized to analyze research data (Boyatzis, 1998).

Key informant interviews involve interviewing a select group of individuals who are likely to provide needed information, ideas, and insights on a particular subject (Krishna, 1989). Key informant interviews were appropriate for this study for the following reasons:

- Preliminary information is needed to design a comprehensive quantitative study (USAID 1996)
- When a researcher is new to a community and/or specific issue, key informant interviews serve to provide an initial overview of major issues in the community, and details about these issues. This allows the researcher to check assumptions about the issue against what is really going on (The Access Project, 1999)

It is important for key informants to possess above average knowledge about the particular area of interest (The Access Project, 1999). Hence, the ten key informants utilized for this study were upper level managers and above in their companies. Key informants were recruited from three different service company categories: financial services (banks, insurance and investments), communications services (telecommunications) and business services (securities, legal services, internet service provider's, technology services and other services that support business activities). A network sample was utilized, i.e. each participant was asked to recommend another participant in the target population. Data collection occurred in two phases. In phase one, four pilot interviews were conducted, and these interviews pointed to further revision of the initial set of twelve interview questions. In phase two, interview questions were refined and three more questions added to better address research questions. Revised interview questions covered three broad areas: 1) Conceptualization and implementation of customer service, 2) Evaluation and Planning within the organization, and 3) Perspectives on Nigerian Customer Service. Interviews were conducted via telephone or Skype and recorded for note-taking accuracy.

A six-step data analysis process was undertaken to address the research questions posed. These steps were loosely guided by procedures presented by Boyatzis (1998) for the conduction of an inductive thematic analysis. First, within twenty-four hours of each interview, comprehensive data files were created and double-checked for accuracy. Second, comprehensive data files were organized by interview question and reduced into concise data files for ease of analysis. Third, four master files were created: 1) Phase one master file with all responses color coded by interviewee and organized by interview question, 2) Phase one master file with all responses organized by research question, 3) Phase two master file with all responses color coded by interviewee and organized by research question, and 4) Phase two master file with all responses organized by research question. Phase one and two were analyzed separately. Fourth, content within each research question was carefully examined for emergent themes. Fifth, related patterns formed the basis for sub-themes, and codes were constructed to highlight differences in sub-themes. Sixth, themes were applied to address research questions.

Results

Key informants emphasized the importance of meeting and exceeding customer expectations in their conceptualizations of quality customer service, describing customer service as crucial to the success of their organizations and the continued progress of Nigeria's economy, especially in the realm of attracting more foreign investment. They were confident that the customer service practices in their organizations were in sync with their organizational goals, often giving examples of how quality customer service had positively affected their bottom line and the loyalty of their customers. The stated barriers to the development of customer service in their organizations and the country as a whole were largely cultural and external. Infrastructural issues such as power supply, telecommunications and transportation and cultural issues such as lack of education were stated. However, key informants still concluded that these were not excuses for poor service.

3. Conclusion

Contrary to popular thought, customer service practices are rapidly evolving and have been enhanced by technology and increased partnership with global entities; and these developments have occurred in the midst of major economic, political and socio-cultural challenges.

4. Acknowledgements

Many thanks to Dr. Gaunt and Dr. Ballard-Reisch for their expertise, knowledge and advice at every step of this project, and for thinking about those things that I would never have thought of myself.

*POSTER
PRESENTATIONS*

Review on Heat Affected Zone (HAZ) in Laser Machining

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Abstract. Laser machining being a non-contact process possesses several advantages such as no tool wear or damage and no contact force induced problems. Laser cutting involves thermal process and it does not depend on the strength and hardness of the work piece, thus making it ideal for cutting non-homogeneous material. In this research work several papers related to the heat affected zone (HAZ) of laser machining of CFRP and GFRP are reviewed. It was found that laser parameters such as specific laser energy, laser power, repetition rate, work piece temperature determine the extent of HAZ. In CFRP HAZ in perpendicular laser grooving is much higher than that in parallel grooving. Presence of nitrogen jet decreases the work piece temperature leading to lower HAZ. Observations of the HAZ area of CFRP material revealed fiber swelling of 50 or 60% and fibers near the top are seen to curl up. In case of GFRP charred black material called shell and melted glass fibers are observed in the HAZ. It is also observed that the extent of HAZ affect the static tensile and bending strengths of CFRP. Tensile strength reduces linearly as HAZ increases. A comparison of laser cutting on CFRP using three types of laser is also presented here. Nd:YAG laser cutting on CFRP at optimized parameters has produced least HAZ and highest bending strength.

1. Introduction

Laser machining being a non-contact process possesses several advantages such as no tool wear or damage and no contact-force- induced problems. Contact processes are accompanied by crack or mechanical degradation of the material being machined. Laser cutting involves thermal process and it does not depend on the strength and hardness of the work piece, thus making it ideal for cutting non-homogeneous material. Laser delivers high power-density beam which upon impact on the work piece is converted into heat. As the impact zone is very small very high temperature capable of melting or volatilizing the material can be attained. This leads to material removal. Laser cutting can be optimized by adjusting several parameters. Laser drilling which is a non-contact process produce small holes in various materials having high degree of precision and reproducibility. Due to the anisotropic nature of composites distorted holes and HAZ may result. In this work, papers involving HAZ formed due to laser machining were reviewed.

2. Literature Review

A lot of researches were undertaken regarding the heat affected zone (HAZ) in laser cutting. Hocheng and Pan represented HAZ by sectional area [1]. They used unidirectional carbon/PEEK composite with 60% fiber volume fraction for laser cutting. Carbon dioxide laser was employed. For cooling, a jet of liquid nitrogen (N_2) with 100kPa and 200kPa was utilized. It also created an inert atmosphere to carry out the laser cutting. They showed by dimensional and experimental analysis that,

$A = \text{function}(\text{const. } SQ/F)$,

where A represented section area of thermal damage, peak power (S), pulse duty (Q) and traverse speed (F).

The term 'SQ/F' is called laser energy per unit length or specific laser energy. They found out that the section area of HAZ (A) increased with decrease in traverse speed (F) and increase in specific laser energy. It was also seen that HAZ is less when nitrogen pressure, P is high. Thermal conductivity is higher along the fiber direction compared to that normal to the fiber direction causing HAZ to be larger for cutting perpendicular to the fiber. They carried out a series of research on HAZ of CFRP. In all those research works they developed a numerical model considering the composite to be anisotropic and they also carried out experimental studies [2, 3]. In their second research paper they used section area to represent the HAZ. Here also they found that HAZ is proportional to the specific laser energy, PQ/V which is consistent with all three of their papers. In their third research work they developed a more advanced model which incorporated temperature dependence of thermal conductivity [3]. Here instead of using section area to represent HAZ they used, w_d which was maximum width of HAZ at $T = T_c$ (char temperature of matrix). They carried out the grooving at 0° , 30° , 60° and 90° to the fiber axis. In contrast to previous research work the simulated result with temperature dependent k, in perpendicular grooving

is much closer to the experimental one. They also developed a mathematical model for grooving in off principal material axes. It was seen that maximum HAZ was found for grooving perpendicular to the fiber axis and least for parallel grooving. Laser drilling was carried out on APC-2 (PEEK and 61% carbon fiber) composite [4]. The laser used was Nd:YAG pulsed laser. They observed that the matrix melted and volatilized from around the hole. Appreciable swelling of carbon fiber of the order of 50% could be seen in the region around the hole as shown in Figure 1.

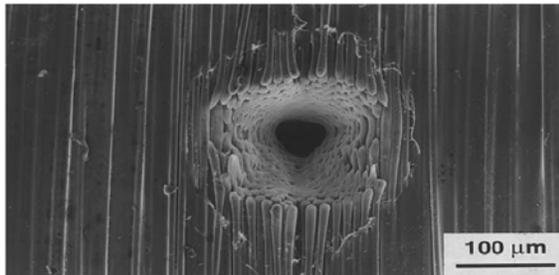


Fig. 1. SEM of laser drilled hole in composite showing matrix volatilization and fiber swelling [4]. Voisey et al. suggested a mechanism of fiber swelling [5]. Authors have concluded that the extent of fiber swelling depended on the impurities in carbon fibers used. They used three types of carbon fibers, T300 (low modulus), high modulus (HM) and P100 with polymeric matrix. They used these fiber composites with and without heat treatment. Heat treatment was carried out for 12h at 2000°C in an argon atmosphere. Nd:YAG was used for drilling. They found that maximum swelling occurred with T300 fibers and fiber swelling in HM fibers was very little and in P100 fibers there was almost no swelling. Thus a swelling of the order of 60% was observed. When the same materials had undergone heat treatment prior to laser drilling, only slight swelling is observed in them. Heat treatment increases carbon content by reducing impurities. When the carbon fiber composites are heated rapidly as in laser drilling the impurities evaporate creating high gas pressure. This high pressure leads to swelling of the fibers within the HAZ which are retained even when the material cools down and returns to normal pressure. Further investigation on HAZ of composite was carried out using GFRP [6]. The laser used was Nd:YAG. Charred materials are seen at the hole wall. A mechanism for HAZ formation was proposed. During laser drilling epoxy resin volatilized into gas and decomposed into carbon, whereas the glass fiber is melted and does not become gas. Some melted material sticks to the fiber close to the hole along with carbon which forms the 'shell' during ejection. An equivalent width, w_0 to represent the HAZ was also proposed as shown below,

$w_0 = A/L$, A is total section area and L is the length of the profile.

They found that w_0 increased with increase in average power. It was also seen that w_0 increased with repetition rate until 7kHz. After that it began to decrease. It is also observed that the extent of HAZ affect the static tensile and bending strengths of CFRP [7]. Laser cutting on the specimen was carried out using three high power laser sources which were Nd:YAG laser, disk laser and CO₂ laser at optimum laser parameters. The pulsed Nd:YAG generated smallest HAZ where as CO₂ the largest HAZ. Static tensile testing on the specimens revealed that the specimen for abrasive water jet possessed maximum ultimate tensile strength and that for milling was closer to that for Nd:YAG laser cutting. Among the specimens from the three laser cutting processes, CO₂ laser cut specimen exhibited least ultimate tensile strength.

3. Conclusions

Several articles regarding the heat affected zone (HAZ) in laser machining were reviewed. The parameters affecting the extent of HAZ are observed. HAZ is affected by parameters such as specific laser energy, repetition rate, nitrogen jet. Several mathematical models were reviewed. Matrix volatilization and fiber swelling are apparent in the region near the laser drilled hole which form HAZ. Mechanism for fiber swelling in carbon fibers was also reviewed. Several magnitudes for extent of HAZ has been discussed. The extent of HAZ in laser cutting influences mechanical properties [7].

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Translating Vortex Pairs with Prescribed Profiles

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Abstract. We generate translating vortex pairs with smooth or more arbitrary profiles that reflect modern vortex pairs being generated using prescribed domains of vorticity. Instead of prescribing the domain, we fix the area of the vorticity and iteratively generate the vortex by prescribing the profile function defining the vorticity, which as a side effect produces a domain of vorticity dependent on the profile function and area. A large class of previously developed and new translating vortex pairs is developed for almost arbitrary vortex profiles using this methodology. This is further enhanced to produce solutions for flows on a rotating sphere.

1. Introduction

Two-dimensional, incompressible, inviscid fluid flow is generally represented by a stream function. Streamlines represent paths the flow follows, along which the stream function is constant. We follow the methodology in [1], which finds vortical flow past a cylinder (a circle in 2D flow). Vorticity of a flow represents the rotation of the fluid. The vorticity is determined by the Laplacian (Δ) operator applied to the stream function, which in general is a function (the profile) of the value of the stream function at a point. We generalize the approach in [1] in which vorticity is constant inside the vortex region, by making it instead follow a prescribed profile function. In this manner, we can obtain easily more arbitrary vortex regions by finding the profile function, rather than specifying the exact region of vorticity.

The f-plane is the term for flow on a flat surface for which we initially produce results from the method in [1]. In real life though, most flow is on the surface of a rotating sphere, Earth, which is numerically represented by an additional vorticity factor, βy , where y is the distance from the equator. This surface is called the β -plane, and extending this method to it is also presented.

2. Numerical Procedure

As was introduced, we use the methodology from [1].

In general, we make the circular block arbitrarily small so that our solutions represent unobstructed flow, though it can also be applied to flow past a larger cylinder. The general procedure is a two-stage iterative process. In the outer iteration, we solve for a new stream function, ψ , given the previous stream function, as

$$\Delta\psi_{n+1} = \omega_{n+1} F(\psi_n - \alpha). \quad (1)$$

We solve this in the upper half plane, and the vortex pair is simply the reflection of this solution onto the lower half plane. On the inner iteration, ω_{n+1} is varied in order to fix the area of the vortical domain to the prescribed area. The vortical domain is generally given by the region in which $F(\psi)$ is non-zero. For the profile functions we will be using, $F(\psi)$ is non-zero in the region where $\psi < \alpha$. The stream function is assumed to be zero on the boundary (the bottom edge of the upper half plane), so that when $\alpha < 0$, we have a translating vortex dipole that is detached from the center.

To account for the β -plane, we change the form of equation (1) to get similar results by solving

$$\Delta\psi + \beta y = \beta\psi + \omega F(\psi). \quad (2)$$

3. Vortex Dipoles

The initial purpose of this research was to duplicate efforts in [2] to create smooth dipoles in the f-plane. By taking $F(\psi)$ to be twice differentiable, the vorticity will vary smoothly between the rotational and irrotational components of the flow. The general form we take is

$$F(\psi) = H(-\psi) (-\psi)^\lambda.$$

$H(-\psi)$ is the Heaviside function, and will be 1 when $\psi < 0$, and zero elsewhere. When $\lambda > 2$, we see that F is twice differentiable. The resulting stream functions are similar to those produced in [2], pictured in figure

1. (The black half ellipse represents the boundary between irrotational and rotational flow, where vorticity is non-zero.)

If we do not require the profile function to be smooth, we can get other results, including the Lamb-Chaplygn dipole, which has a linear profile function corresponding to $\lambda = 1$, as shown in figure 2, with a circular boundary.

In general, the vortex region becomes more elongated for smaller λ closer to zero, and is taller for larger λ .

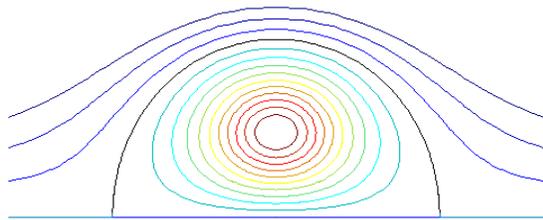


Fig. 1. Streamlines for smooth solution using $\lambda = 3$

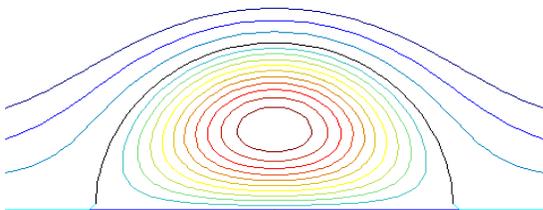


Fig. 2. Circular (Lamb-Chaplygn) dipole using $\lambda = 1$

Another interesting result comes from matching the steep vortex profile function in [3], shown in figure 3, with a concave vorticity surface in the center using

$$F(\psi) = H(-\psi) (-\delta\psi) e^{\delta\psi}.$$

In the β -plane, the $\beta\psi$ linear term in smooth solutions creates what is known as a shielded vortex similar to those in [4]. Notably, two opposing rotations inside the vortex flow exist since the vorticity can be both positive and negative inside the vortex region as seen in figure 4 (the black inner circle represents the change in rotation.)

4. Stability and Convergence

Although an arbitrary profile function can be designated in the algorithm, only some of these converge in a reasonable amount of time to a solution. In the examples above, for large λ or δ , the convergence will slow. General limits have not been found, however, since the results in general do not become unstable for more dramatic profile functions. Also, the algorithm depends very little on the initial

guess, and will adapt in just a few iterations to almost the right solution even with a bad initial guess for the vorticity domain.

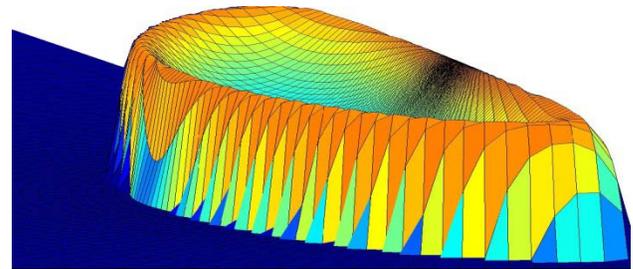


Fig. 3. Surface plot of vorticity similar to [3] for $\delta = 3$

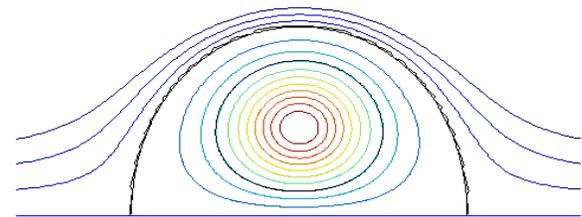


Fig. 4. β -plane shielded vortex solution with $\beta = 0.2$

The β -plane solutions tend to have less robust solutions, and convergence is not as stable for larger beta, or an unbalanced initial guess; for smaller β , which would reflect flow on a slowly rotating object, such as the Earth, the stability is closer to that of the f -plane.

5. Conclusion

In short, we have introduced a new method for creating a large class of vortex dipoles given prescribed profiles. Presented were example profile functions that produced dipoles similar to those in recent research. There are more results than those presented here using different profile functions, detaching the vortices from the center, or reintroducing the cylindrical obstacle. The robustness of this method creates a stable algorithm that converges for a wide range of functions, even with little knowledge beforehand of the solution.

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Synthesis of Asymmetrically Substituted Push-Pull Phthalocyanines as Potential Photodynamic Therapy Agent

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Abstract. Over the past decade, photodynamic therapy (PDT) has begun to gain worldwide attention either as a primary or as an alternate treatment for solid cancers.¹ The success of the treatment largely depends upon the tumor-selectivity and photosensitizing properties of the photosensitizer used. Phthalocyanines with absorption extending well into the near-IR region have been considered to be potential PDT agents. In the present study, the synthesis of asymmetrically substituted phthalocyanine has been described. In order to avoid the tedious separation of a mixture of phthalocyanines prepared by statistical method, Kobayashi's ring expansion of boron subphthalocyanine route² has been used. This route produces exclusively 3:1 asymmetrical phthalocyanine. Fluorinated boron subphthalocyanine and diiminoisoindoline of glycol chain substituted phthalonitrile were used as reagents. Mild reaction conditions were employed using dimethylaminoethanol as the solvent. The compound has been characterized by optical absorption and emission (steady-state and time-resolved), ¹H and ¹⁹F NMR, and mass spectroscopic analysis. Studies on singlet oxygen yield and other studies are in progress.

1. Introduction

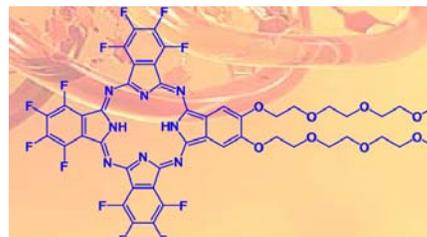
As an alternate treatment for cancer photodynamic therapy has gained attention for the treatment of solid cancers. Photodynamic therapy requires a photosensitizer, light to irradiate this photosensitizer and tissue oxygen for generation of singlet oxygen which kills the tumor cells. In this project photosensitizers as possible photodynamic agents have been synthesized and characterized and their

effectiveness in generating singlet oxygen has been studied.

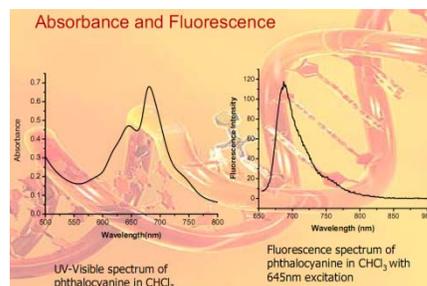
2. Experiment, Results, Discussion, and Significance

The following two compounds were synthesized and characterized.

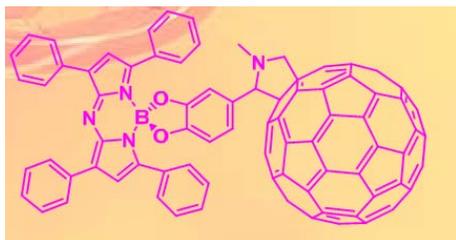
Phthalocyanine



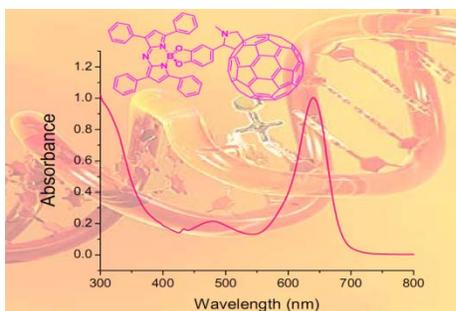
The graph below shows absorbance and fluorescence spectra of phthalocyanine



Azadipyromethene-Fullerene Dyad



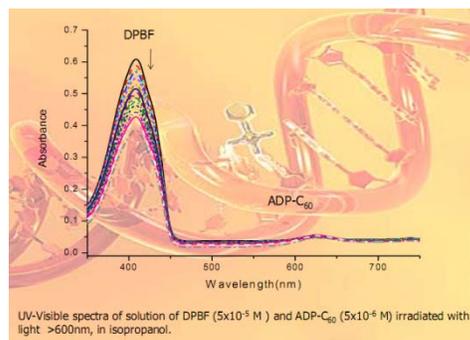
The graph below shows absorption spectrum of Azadipyromethene-Fullerene Dyad



Experiments were carried out which show that singlet oxygen generated by these compounds was accepted by the singlet oxygen acceptor diphenylisobenzofuran (DPBF).

Generation of singlet oxygen was shown by disappearance of 410 nm absorption band of (DPBF).

Below is the optical absorbance studies of Singlet Oxygen Generation Studies of Azadipyromethene-Fullerene dyad



3. Conclusions

Asymmetrically substituted phthalocyanine, azadipyromethene-fullerene dyad have been newly synthesized and characterized.

The synthesized phthalocyanine and the dyad were found to generate singlet oxygen with strong absorbance in the red region.

Further modifications of these compounds to make them more effective in generating singlet oxygen and water soluble are in progress.

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4. Acknowledgements

Research Advisor
Dr. Francis D'Souza

Labmate
Eranda Maligaspe

\$\$\$ Flossie West Foundation

Perceptions of U.S. Physician Assistants (PAs), PA Faculty and Physicians Regarding the Entry-Level Doctoral Degree in Physician Assistant Education

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Abstract. The purpose of this study was to compare the perceptions of physicians with PAs and PA faculty regarding an entry level Doctorate of Physician Assistant (DPA) degree. This 2009 cross-sectional study surveyed representative samples of physicians, PAs and PA faculty in the U.S. The response rate was 15% (n=832; PA=351, PA faculty=302 and Physician=179). Chi-square analyses showed that physician responses were less congruent with PA and PA faculty responses ($p < .001$). For example, PAs (79.1%), PA Faculty (95.1%) and physicians (56.2%) agreed that the master's degree was sufficient for PA practice. Physician assistants and PA faculty were not supportive of the DPA. However, the results raise some questions about the perceptions of physicians. If the move to the DPA is considered in the future, information and data from this study may be beneficial.

1. Introduction

With the movement of many health profession educational programs to the doctoral level, the Physician Assistant (PA) profession feels pressure to consider doing the same. It is an especially critical topic in recent years since the nursing field recommended a transition from the master of nurse practitioner degree to the entry-level doctorate of nursing practice (DNP) by the year 2015.(2,3,4) Anecdotally, some PAs consider nurse practitioners as their competition and have begun evaluating whether doctoral-level education would be beneficial to the profession.(1) Since the idea of doctoral PA educational program is a new concept, research is limited. Disciplines that have made the move to doctoral programs are nurse practitioner, physical therapy, psychology, optometry, pharmacy, audiology, chiropractic, and podiatry. (4,5)

2. Experiment, Results, Discussion and Significance

This cross-sectional study was a follow-up to Ohlemeier and Muma's study published in 2008 about U.S. PA perceptions of the DPA (data collected in 2007). Ohlemeier and Muma's data was added to a 2009 sampling of U.S. PA faculty and physicians. The research question was as follows: In regard to the DPA, how do the physician perceptions compare to the perceptions of U.S. PAs and PA faculty?

From the American Academy of Physician Assistants (in 2007) and the American Medical Association (in 2009), random samples were obtained. For PA educational faculty, the Physician Assistant Education Association (PAEA) membership was surveyed (in 2009).

Frequency counts were conducted to determine age, practice setting, and perceptions about the DPA. Chi-square analyses were performed to determine possible significant relationships in regard to perceptions about the DPA among all groups.

Overall, physician responses were less congruent with PA and PA faculty responses. Only 56 percent of physicians believed the master degree was sufficient and 44.1 percent either agreed or were neutral on whether the DPA should be the entry-level degree. Practicing PAs and PA faculty perceived that PAs (at baccalaureate or master level of training) already were delivering the highest level of care and a DPA was not needed in order to improve this. However, a smaller than expected percent of physicians (56.5%) agreed with PAs and PA faculty on this issue. Physician assistant faculty and PAs were opposed to the DPA as a way to compete with NPs. Physicians were

uncertain as to whether the DPA was necessary to compete with NPs. Sixty percent of physicians either agreed or were neutral that a DPA was necessary to compete. As far as whether a DPA is necessary to increase PA income, PA faculty were clear in their responses to this statement: eighty-five percent disagreed with this statement, as compared to 42.9 percent of physicians and 69.6 percent of PAs.

3. Conclusions

This study further illustrates the perceptions of those in and around the PA profession, in particular among PAs and PA faculty who were not supportive of the DPA. However, the results raise some questions as to perceptions of physicians. They appear to be uncertain as to whether the DPA would be necessary for future PA practice. If the move to the DPA is considered, information and data from this study may be beneficial.

4. Acknowledgements

We would like to thank our family and friends for their continued support throughout our education. We would also like to thank Drs. Richard Muma and Barbara Smith for their guidance during this project.

Permission was granted by Dr. Muma to use previous data from Ohlemeier's paper entitled *Perceptions of US Physician Assistants Regarding Entry-Level Doctoral Degree in PA Education*.

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Comparative Binding Studies with a Tetraurea Picket Porphyrin Receptor using ^1H NMR and Isothermal Titration Calorimetry

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Abstract. The $(\alpha, \alpha, \alpha, \alpha)$ -5,10,15,20-tetrakis(2-(4-fluorophenyl)urea)phenylporphyrin binds strongly ($K(M^{-1}) > 10^4$) to chloride anion, and close to 2-3 orders of magnitude less to acetate anion, in DMSO-d_6 as revealed by ^1H NMR titration studies. However, acetate anion showed stronger binding than chloride anion when ITC analyses were done. Thus, the binding studies' results vary with the use of instrumental method. Other significant differences and similarities observed in the behavior of anion binding with the porphyrin receptor when using the two probes will also be addressed in this report.

1. Introduction

ITC: Isothermal Titration Calorimetry (ITC) has been largely used in the pharmaceutical industry for drug discovery and development. It has been used to investigate protein-ligand binding in buffered solutions. Recently, a few supramolecular chemists have utilized this method to understand the host-guest binding behavior of anionic receptors in organic solvent. The host-guest interactions involve bonding interactions that invariably produce heat effects. The measurement of the heat change (calorimetry), depending on the composition of the system, constitutes a direct and universal means to investigate intermolecular complexation in solution. ^1H NMR titration studies determine the specific binding of the ligand to the receptor whereas ITC reports the thermodynamic events of the entire system, including solvation effects on anions and counterions. This sets the stage to employ the framework of thermodynamics for a full energetic characterization of the system under study- ΔH , ΔS and K_a in one experiment. By reporting on all specific and unspecific binding processes, ITC is potentially predictive of in vivo systems. ITC is very sensitive, fast and a convenient instrumental method for determining thermodynamic state functions.

Buried Solvent Effects: The porphyrin receptor binds a DMSO molecule and utilizes it as a participant in its anion recognition unit, in a manner similar to enzymes that bind water for use as part of their substrate recognition unit. The bound solvent molecule determines the anion-binding affinity, selectivity, and stoichiometry of binding. With a bound DMSO molecule, the tetraurea picket porphyrin is a highly selective receptor for chloride anion and binds all anions with a 1:1 binding stoichiometry. Absent the buried DMSO molecule, the receptor is selective for phosphate anion and binds chloride and phosphate anions with both 1:1 and 1:2 receptor-anion stoichiometries (Figure 3).

The results demonstrate that anion complexation with hydrogen-bonding receptors in a competitive solvent can be enhanced when a ubiquitous solvent molecule is incorporated into the binding motif. In this way, competitive solvent adds to the overall complexation energy and thereby strengthens binding rather than weakens it. The results may be pertinent to drug design, for they suggest that pharmaceuticals need not be completely desolvated to selectively bind to their biological target when water can be included in the binding motif.

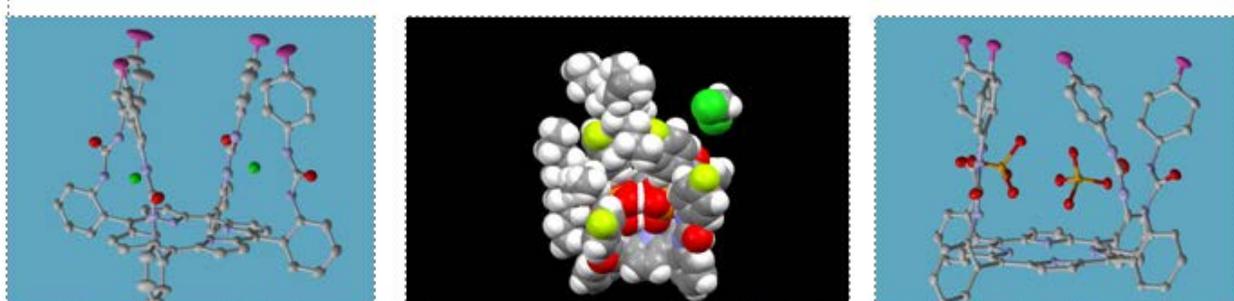


Figure 3. (left) X-ray crystal structure of porphyrin 1c plus 2 Cl^- grown from CH_2Cl_2 ; (middle) Space-filling crystal structure of bis-dihydrogenphosphate anions (tetrabutylammonium counterions and one dichloromethane solvent molecule are also shown); (right) X-ray crystal structure of porphyrin 1c plus 2 H_2PO_4^- grown from CH_2Cl_2 .

2. Experiment, Results, Discussion, and Significance

Our previous work has shown the porphyrin receptor binds a DMSO molecule in DMSO-d₆, whereby the buried solvent molecule is part of the binding motif, helping to stabilize anion binding, and determining the stoichiometry of anion binding (Scheme 1, Chart 1). In this regard, ITC analyses corroborate what was observed in ¹H NMR with anion titrations in DMSO, where 1: 1 anion: receptor binding stoichiometries were observed. ITC also corroborate the ¹H NMR titration results in CH₂Cl₂, where absent the buried DMSO molecule, 2:1 anion: receptor binding stoichiometries were observed. (Figures 4-9, Tables 1-2).

Results obtained with ITC were in agreement with ¹H NMR titrations except the case of phosphate salt in DMSO. A second binding site wasn't observed initially when our receptor was titrated with the phosphate salt, whereas it has been shown in ITC analysis. However, a redone Job plot (Figure 10) using ¹H NMR has shown that there are indeed 2 binding sites, which complemented the ITC results. Apparently, the bulkiness of the nitrate group prevents another molecule from binding to a third and fourth urea picket. This exception was seen in titrations done in both solvents, and with both instrumental methods.

Overall, ITC results show little selectivity between anion binding— less than 1 order of magnitude (except for the nitrate anion). Conversely, NMR results shows large selectivity in anion binding with differences of 2-3 orders of magnitude. In general, the ITC reports a higher affinity in binding constants when compared to ¹H NMR titration.

3. Conclusions

Whether or not ITC binding data are in line with other physical measurements (NMR) depends on the whole system and the sensitivity and the capacity of the probe to reflect the entire association process. ITC is more general in assessing thermodynamic properties and will faithfully report on all specific and unspecific binding processes quite unlike a typical NMR probe, which only focuses on specific binding using a particular nuclei. Thus, differences of several orders of magnitude in K_a are frequently observed between instrumental methods, with ITC binding constants reporting a higher affinity, and differences in results in the selectivity of binding may be expected.

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Testing homogeneity of a parameter matrix with some rows constrained by synchronized order restrictions

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Abstract. A multivariate linear regression model $Y \sim N(\beta M', \Sigma)$ is considered where some of the rows in the coefficient matrix β are constrained by synchronized order restrictions. A test scheme is derived for the homogeneity of the coefficient matrix using the likelihood-ratio test procedure under the assumption that the coefficient matrix Σ is known. When Σ is unknown, a new ad-hoc test statistic $T_H(Y)$ is proposed by replacing the covariance matrix with its estimator, where H is a non-empty subset of the row-index space $\{1, 2, \dots, p\}$. The properties of $T_H(Y)$ are studied and a theorem is also stated on the distribution of $T_H(Y)$ which eventually helps us to estimate p-values using the Monte-Carlo method by simulation.

1. Introduction

Bartholomew(1959) derived a LRT for testing the homogeneity of univariate independent normal means $\mu_i, i=1, 2, \dots, k$ against simple order restrictions $\mu_1 \leq \mu_2 \leq \dots \leq \mu_k$ that share a common variance. Sasabuchi et al.(2003) extended the problem to a multivariate setting where the $\mu_i, i=1, 2, \dots, k$ are the means of p -variate normal vectors with a common covariance matrix, and $\mu_i \leq \mu_j$ is interpreted as "componentwise less than or equal to". The model restriction is later generalized by Hu(2009) to $\mu_i \preceq \mu_j$ for $(i, j) \in B$, where \preceq is a reflexive and transitive binary relation of vectors in R^p .

In this paper, a multivariate linear regression model $Y = X\beta + \varepsilon$ is considered, where some rows of the unknown coefficient matrix β in $R^{p \times q}$ are under synchronized order restrictions. When the common covariance matrix is unknown, an ad-hoc test statistic $T_H(Y)$ is obtained where H is a subset of row index space $\{1, 2, \dots, p\}$ such that the row $i \in H$ is under an order restriction. The properties of this statistic and its distribution are studied to some extent in the following section.

2. Model, test statistic and its properties

2.1 The model.

We consider a multivariate linear regression model $Y \sim N(\beta M', \Sigma)$ where $\beta^{p \times q}$ = unknown parameter matrix, $M^{n \times q}$ = a known matrix of full column rank. We define $m(Y) = Y M (M' M)^{-1}$, $v(Y) = Y [I - M (M' M)^{-1} M'] Y'$. Then, $m(Y)$ is the MLE and also an UE for β ; $v(Y)/n$ is the MLE for Σ and $v(Y)/(n-q)$ is an UE for Σ .

2.2 Order restrictions on β and the testing problem

For the parameter matrix $\beta^{p \times q}$, let \ll be a partial order in the column index space $\Omega = \{1, 2, \dots, q\}$ and let $r(\cdot)$ be a mapping from the row index space $\{1, \dots, p\}$ to $\{\leq, \geq\}$. A vector $u = (u_1, \dots, u_q)'$ in R^q is isotonic with respect to \ll and $r(k)$ if $i \ll j$ implies $u_i r(k) u_j$. The collection of all vectors satisfying this restriction is a convex cone in R^q denoted by $C_{(k)}$. The restrictions, with $k=1, \dots, p$ are synchronized order restrictions because they are all based on the same \ll . We assume that some of the rows of the parameter matrix $\beta^{p \times q} = (\beta_{(1)}, \dots, \beta_{(p)})'$ are under synchronized order restrictions. The collection of all such matrices, denoted by C_H , is a convex cone in $R^{p \times q}$. The model, along with $\beta \in C_H$, is called a multivariate isotonic regression model and it covers many interesting practical problems. An example is given by Hu(2009), where some rows of the parameter matrix of interest are under synchronized order restrictions. Thus, our testing problem is $H_0: \beta \in L$ against $H_1: \beta \in C_H$, where L is the collection of homogeneous matrices in $R^{p \times q}$.

2.3 The test statistic and its properties

We consider a positive definite matrix $V^{p \times p}$, and for matrices A and B in $R^{p \times q}$, we define an inner product for A and B as $\langle A, B \rangle = \text{tr}[A' V^{-1} B M' M]$. With respect to the norm $\|\cdot\|_V$ induced from this inner product, C_H is a closed convex

cone. Thus for $A \in \mathbb{R}^{p \times q}$, there exists a unique matrix in C_H that minimizes the distance to A over all matrices in C_H . This matrix is known as the projection of A onto C_H and is denoted by $P_V(A|C_H)$. Since L is also a closed convex cone, $P_V(A|L)$ can be defined analogously.

When Σ is known, it can be shown that $\|P_{\Sigma}(m(Y)|L) - P_{\Sigma}(m(Y)|C_H)\|^2$ is a likelihood ratio test statistic. Now, when Σ is unknown, we can replace it by the UE and MLE of Σ to derive ad-hoc test statistics. But, it is seen that the statistics obtained by replacing Σ by its MLE and UE are proportional to the one obtained by replacing it by $v(Y)$. Hence

$$T_H(Y) = \|P_{v(Y)}(m(Y)|L) - P_{v(Y)}(m(Y)|C_H)\|_{v(Y)}^2 \quad (1)$$

is proposed as a test statistic and we reject the null hypothesis for large values of this statistic.

The test statistic has some interesting properties, which are listed in the following lemma.

Lemma: (a) If $\beta \in L$, $T_H(Y - \beta M) = T_H(Y)$.

(b) If $D^{-1}C_H = C_H$, then $T_H(DY) = T_H(Y)$ for a $(p \times p)$ non-singular matrix D .

(c) For any non-empty subset H^* of H , $T_H(Y) \leq T_{H^*}(Y)$.

(d) If $i \in H$, then $T_H(D^{[-N]}Y) \rightarrow T_i(Y)$ as $N \rightarrow \infty$ for an integer N .

The following theorem gives the results about the distribution of $T_H(Y)$. Since the distribution of $T_H(Y)$ depends on β and Σ , we denote the distribution by $T_H(\beta, \Sigma)$.

Theorem: (a) If $\beta \in L$, then $T_H(\beta, \Sigma) = T_H(0, \Sigma)$.

(b) If $i \in \{1, \dots, p\}$ and $\Sigma > 0$, then $T_i(0, \Sigma) = T_i(0, I)$.

(c) For any non-empty subset H^* of H , $T_H(\beta, \Sigma) \leq T_{H^*}(\beta, \Sigma)$ stochastically.

(d) $\sup\{P(T_H(\beta, \Sigma) > t) : \beta \in L, \Sigma > 0\} = P(T_i(0, I) > t)$ for all i in $\{1, \dots, p\}$.

3. Conclusions

The proposed test statistic $T_H(Y)$ is useful in the sense that from (d) of our Theorem, we get a simple expression for the p-value or significance level of the test. It can be estimated using the Monte Carlo method by simulating observations from $T_i(0, I)$.

4. Acknowledgements

I am grateful to my advisor Dr. Xiaomi Hu for his help and cooperation.

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Contextual Characteristics of Physical Activity in Children with Intellectual Disability Through Accelerometry and Time Diaries, Weekday vs. Weekend MVPA

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Abstract. Moderate-to-vigorous physical activity (MVPA) during childhood is vital for development. Youth with intellectual disabilities (ID) are suggested to be less active, and no measure of intensity and time spent in MVPA has been made outside school. The purpose of this study was to determine the feasibility of monitoring contextual characteristics (CC) of PA of youth with ID over 7-days using Telephone Time Diaries (TTD). Three children with mild ID participated in this study which analyzed PA time spent in different intensity levels and settings. Objective PA was gathered using ActiGraph GT1M accelerometers, subjective PA with TTD. Data showed mean weekend MVPA > weekdays. TTD were found feasible for monitoring CC of PA of children with ID.

1. Introduction

Attempts at describing the contextual characteristics of physical activity of children with ID using the accelerometer have focused on the specific activity settings during the school day and not after school or during the weekends [1]. However, during after-school hours and on the weekends, numerous activities can take place. Therefore, new contextual techniques are required to match an objective measurement of movement (accelerometry) to time assessments methods that identify the where (i.e., school, afterschool, weekends) of activity. Time diaries would provide precise information regarding the beginning and ending of preschool, school, and afterschool physical activity. To date, no studies have reported on the use of time diaries, in conjunction with objectively monitored physical activity, to investigate contextual characteristics. Therefore, the purpose of this study is to determine the feasibility of monitoring the contextual characteristics of physical activity of children with ID over a 7 day period using time diaries of the child completed by parents/guardians.

2. Experiment, Results, Discussion, and Significance

Physical Activity Measures. Physical activity was collected using the ActiGraph GT1M accelerometer (Shalimar, FL). The GT1M is designed to detect vertical accelerations ranging in magnitude from 0.05 to 2.00g. The acceleration signal is integrated through a user-specified interval called an epoch. At the end of each epoch, the summed value or “activity count” is stored in memory[2]. The epoch for this study was set to collect counts in 15 sec intervals. Activity intensity levels were classified according an accepted regression equation developed for children [3]. Cut-off points for moderate- and vigorous-intensity physical activity were identified at 420 counts/15 s and 842 counts/15 s [3].

Accelerometer Protocol. The accelerometer protocol used in this study was adapted from the Framingham Children’s Study [4]. The participants wore an accelerometer attached to an elastic belt, affixed at the waist, for 7 days (5 weekdays and 2 weekend days). All participants wore the accelerometer from morning until bedtime. The monitors were removed during water-related activities (e.g. swimming, bathing) and the exact time of removal was recorded in the telephone time diaries (see below).

Telephone Time Diary. The telephone time diary (TTD) provided a detailed account of the location of activities sampled over the course of the day. Three children (ages 6-9 yrs) with mild intellectual disability (ID) participated. The setting of each event/activity was categorized into the following places: 1-school; 2-before school, after school, evenings; 3-weekends; 4-sleep/bathing/swimming.

Statistical Analysis. Given the descriptive purpose of this study, no formal hypothesis testing was performed. For physical activity, descriptive statistical analyses were conducted that detail: a) the time spent being physically active for each intensity level b) settings where the child was active. This descriptive analysis is consistent with prior time use studies [5]. Total (mins•day⁻¹) moderate-to-vigorous physical activity (MVPA) for three weekdays (Tuesday, Wednesday, and Friday) and weekends (Saturday and Sunday) are found in Figure 1. The mean MVPA recorded on Sunday (61.3± 42.4 min) was highest recorded for all five days, with Tuesday demonstrating the lowest mean MVPA (44.7±4.0 min) of all five days .Total (mins•day⁻¹) moderate-to-vigorous physical activity (MVPA) for the weekdays in and out of school are found in Figure 2. Mean minutes spent in MVPA in school and out of school were similar for two of the three days.

3. Conclusions

Collection of contextual data over a seven day period occurred for two out of three participants. Accelerometer data was not recorded for participant three on two out of seven days. Overall, the time diaries were found to be a feasible method of monitoring the contextual characteristics of the physical activity of children with ID.

4. Acknowledgements

The research team would like to thank Dr. Michael Beets, M.P.H., Ph.D. and the participating school district and families for their help on this research project.

Figure 1.

Moderate/Vigorous Physical Activity: Total					
	Tuesday	Wednesday	Friday	Saturday	Sunday
1	40	57	74	54	109
2	47	46	66	59	47
3	47	50	41	59	28
Mean± Std Dev	44.7±4.0	51.0±5.6	60.3±17.2	57.3±2.9	61.3±42.4

Figure 2.

Moderate/Vigorous Physical Activity: In School vs. Out of School						
	Tuesday		Wednesday		Friday	
	In	Out	In	Out	In	Out
1	22	18	21	36	39	35
2	28	19	13	33	23	43
3	29	18	44	6	28	13
Mean± Std Dev	26.3±2.2	18.3±.5	26.0±16	25.0±16.	30.0±8.	30.3±15.
	2	8	.1	5	2	5

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The Effect of Hippotherapy on Children with Developmental Delay

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Abstract. The purpose of this study was to determine the effect(s) hippotherapy has on children diagnosed with developmental delay as measured by the Pediatric Evaluation of Disability Inventory (PEDI). Although researchers have shown the benefits of hippotherapy on children with cerebral palsy, these benefits cannot be generalized to children diagnosed with developmental delay. Subjects included three children ages two to six years with a diagnosis of developmental delay who were enrolled in a 10-week hippotherapy session. The results were analyzed descriptively due to the small sample size and a floor effect. It was hypothesized that hippotherapy would improve functional abilities in this population. The children made some increases in their functional abilities; however the results did not show significant overall improvement.

1. Introduction

Hippotherapy is one type of horse assisted therapy, and can be defined as “a physical, occupational, and speech-therapy strategy that utilizes equine movement as part of an integrated intervention program to achieve functional outcomes”[1]. Developmental delay is defined as the “failure of a child to reach developmental milestones of gross motor, fine motor, language, and social-adaptive skills at anticipated ages” [2]. Known effects of hippotherapy on children that have been diagnosed with developmental delay are limited because research in this field has primarily focused on children diagnosed with cerebral palsy (CP). Current research about hippotherapy shows that people with disabilities, specifically CP, benefit from equine assisted therapy [3, 4, 5, 6, 7, 8, 9, 10]. However, these results cannot be accurately generalized to children with other disabilities without further evidentiary support.

The purpose of this study was to investigate the effects of hippotherapy on three children ranging from ages two to six years old who have been diagnosed with developmental delay. It was hypothesized that the use of hippotherapy would improve the functional abilities, specifically self-care, mobility, and social function as measured by the Pediatric Evaluation of Disabilities Inventory (PEDI), in children with developmental delay.

2. Experiment, Results, Discussion and Significance

A convenience sample of three participants was recruited through hippotherapy riding services offered at Prairie Meadows Therapeutic Riding Center (PMTRC) in Goddard, KS. The inclusion criteria to participate in the study were: (1) receiving hippotherapy services from PMTRC, (2) a primary diagnosis of developmental delay and (3) parental commitment to complete all aspects of the research project and allow their child’s participation. A licensed Occupational Therapist who has practiced hippotherapy for 10 years provided all treatments and approved each subject to participate in hippotherapy sessions.

Each parent was asked to complete the PEDI on their child to assess each participant’s functional level at the beginning and end of the 10 week hippotherapy session. The PEDI is a comprehensive clinical assessment instrument that was designed for functional evaluation of children ages six months to 7 ½ years. The PEDI measures both capability and performance of functional activities in the areas of self-care, mobility, and social function [11]. These activities are measured on two different scales: functional skills and caregiver assistance.

The three participants took part in a 10-week session of hippotherapy that met once weekly for 45 minutes. The hippotherapy treatment was unchanged by participation in this study. Each treatment session was individualized and focused on activities that would help to meet each child's long term goals as established by the occupational therapist. The children participated in a variety of active exercises while riding the horse to achieve their specific goals.

As hypothesized, the children made some small increases in their functional abilities; however with a sample of children whose functional abilities vary daily, it was difficult to determine overall improvement. Of nine raw scores, seven indicated that the children required less caregiver assistance and two indicated no change in required caregiver assistance. In the functional skills category, Subject 1 demonstrated improvements in social function and required less caregiver assistance for self care and social function. Unanticipated decreases were seen in functional skills self care and no changes were noted in this subject's functional skills mobility or caregiver assistance of

mobility. Subject 2 improved in self care and mobility in the functional skills category. He also required less caregiver assistance in self care and social function. Unexpectedly, Subject 2 displayed a decrease in functional skills social function and there was no change in caregiver assistance for mobility. In the functional skills category, Subject 3 improved in the area of social function and she required less caregiver assistance in all three measured categories. This subject demonstrated an unpredicted decrease in the area of mobility for functional skills, but she required less assistance from her caregiver. Additionally, the functional skills self care score did not change for this subject.

The use of the PEDI to measure functional skills in this population was a limitation to this study because small gains or partial improvement in functional abilities were not able to be displayed. The PEDI may not have been the best instrument to use with a severely disabled population that did not fall within the normative standard score as set by the PEDI. Due to the children's multiple disabilities and delays in development, they did not show changes as quickly as a child who develops at a rate falling within normative standards [11]. Additionally, the 10-week time frame may have been too short to show notable changes. The small changes shown did not allow for a trend to be identified due to the limited sample size. It is unknown if each child's previous experience with hippotherapy impacted their functional changes shown during the study. Also, the diagnosis of developmental delay covers a wide variety of disabilities which creates a patient population that is homogenous in name yet not in presentation. The variety of disabilities causes each child to develop at different rates in different areas making it difficult to draw conclusions about the diagnosis in general. Although definitive overall improvements in each child's functional ability were not shown, anecdotal accounts from the parents & therapist suggest that hippotherapy may still be a useful tool in the treatment of developmentally delayed children. More research is needed to demonstrate the specific effects of hippotherapy on this population.

3. Conclusion

Although each subject improved in at least one area, the improvements were inconsistent and therefore not able to be generalized as overall improvements as a result of hippotherapy treatments. Further research should consist of larger sample sizes, a different tool that can measure smaller changes in development, a longer time frame and subjects that are new to hippotherapy.

4. Acknowledgements

The authors wish to thank Candy Bahner, PT, DPT for her support throughout the course of this study. We would also like to thank Barbara S. Smith, PhD, PT for her assistance with data analysis. This study would not have been possible without Kori Turney, OTR/L and her willingness to participate and assist in this study. Also, a special thanks is extended to the subjects and their parents for their participation in this study.

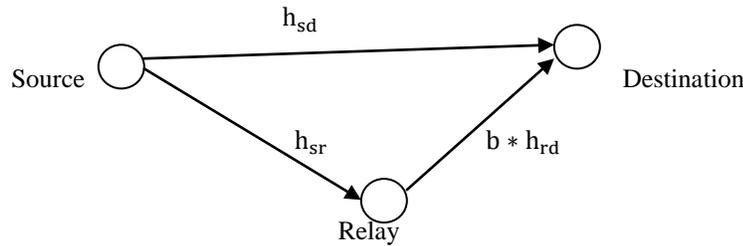
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Ergodic Channel Capacity for amplify-and-forward (AF) Half-duplex Cooperative Systems

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1 System Model:



In this model, relay node assists the transmission from source node to the destination. The channel gain h_{sd} , h_{sr} , h_{rd} are zero mean circular Gaussian. And the noise at relay and destination node is assumed i.i.d. zero-mean circular Gaussian with variance σ^2 . Since the cooperative system involves the product of Gaussian random variables, which is no longer Gaussian, we cannot use the conventional way to get the channel capacity. Today I will show a new method to get the channel capacity.

1.1 Transmitted data block

$$X_1 = [X_I^T, X_{II}^T]^T = [x(1) \ x(2) \ \dots \ x(T) \ x(T+1) \ \dots \ x(2T)]^T$$

Here, $X_I = [x(1) \ x(2) \ \dots \ x(T)]^T$ is transmitted data at 1st time slot

$X_{II} = [x(T+1) \ x(T+2) \ \dots \ x(2T)]^T$ is transmitted data at 2nd time slot.

1.2 Transmitted Model

$$1) \text{ At } 1^{\text{st}} \text{ time slot, } \begin{cases} S \rightarrow D, & \mathbf{r}_{I,D} = X_I^T * h_{sd} + \mathbf{n}_{I,D}^T \\ S \rightarrow R, & \mathbf{r}_{I,R} = X_I^T * h_{sr} + \mathbf{n}_{I,R}^T \end{cases} \dots (1)$$

At 2nd time slot, the received signal at destination is

$$\begin{aligned} \mathbf{r}_{II,D} &= X_{II}^T * h_{sd} + b h_{rd} * \mathbf{r}_{I,R} + \mathbf{n}_{II,D}^T \\ &= X_{II}^T * h_{sd} + b h_{rd} h_{sr} * X_I^T + (b h_{rd} \mathbf{n}_{I,R}^T + \mathbf{n}_{II,D}^T) \\ &= X_{II}^T * h_{sd} + b h_{rd} h_{sr} * X_I^T + \mathbf{n}_{II,D}^T \dots (2) \end{aligned}$$

2) The covariance at destination: (when T=1)

$$\begin{aligned} \text{Cov}(\mathbf{n}_1) &= E \left[\begin{pmatrix} \mathbf{n}_{I,D} \\ \mathbf{n}_{II,D} \end{pmatrix} \begin{pmatrix} \mathbf{n}_{I,D}^* & \mathbf{n}_{II,D}^* \end{pmatrix} \right] \\ &= E \left[\begin{pmatrix} \mathbf{n}_{I,D} \\ b h_{rd} \mathbf{n}_{I,R} + \mathbf{n}_{II,D} \end{pmatrix} \begin{pmatrix} \mathbf{n}_{I,D}^* & (b h_{rd} \mathbf{n}_{I,R} + \mathbf{n}_{II,D})^* \end{pmatrix} \right] \\ &= \begin{bmatrix} E[|\mathbf{n}_{I,D}|^2] & 0 \\ 0 & E[|b h_{rd} \mathbf{n}_{I,R} + \mathbf{n}_{II,D}|^2 + |\mathbf{n}_{II,D}|^2] \end{bmatrix} \\ &= \begin{bmatrix} \sigma^2 & 0 \\ 0 & b^2 |h_{rd}|^2 \sigma^2 + \sigma^2 \end{bmatrix} \dots (6) \\ \text{Assume } \Sigma_1 &= \begin{bmatrix} 1 & 0 \\ 0 & b^2 |h_{rd}|^2 + 1 \end{bmatrix}, \text{ then } \text{Cov}(\mathbf{n}_1) = \sigma^2 \Sigma_1 \end{aligned}$$

3) Amplification coefficient b

$$b \cdot E[|\mathbf{r}_{1,R}|^2] \leq P_R \text{ (} P_R \text{ is Power Constraint at Relay)}$$

$$\text{When } T=P_R=1, b \cdot E[(x(1)h_{sr} + n_{1,R})(x(1)h_{sr} + n_{1,R})^*] \leq 1$$

$$\Rightarrow \begin{cases} \text{average constrained coefficient: } b \leq \sqrt{\frac{1}{E[|h_{sr}|^2]E[|x(1)|^2] + \sigma^2}} \\ \text{instantaneous constrained coefficient: } b \leq \sqrt{\frac{1}{|h_{sr}|^2 E[|x(1)|^2] + \sigma^2}} \end{cases} \dots (7)$$

Assume $E[|x(1)|^2] = q_{11}$, then

$$\Rightarrow \begin{cases} \text{average constrained coefficient: } b \leq \sqrt{\frac{1}{E[|h_{sr}|^2]q_{11} + \sigma^2}} \dots (8) \\ \text{instantaneous constrained coefficient: } b \leq \sqrt{\frac{1}{|h_{sr}|^2 q_{11} + \sigma^2}} \dots (9) \end{cases}$$

2 Channel Capacity when T=1

2.1 Gaussian mutual information $I(x_1, r_1 | h_1, b)$

1) Received signal: $\mathbf{r}_1 = H_1 \mathbf{x}_1 + \mathbf{n}_1 = \begin{pmatrix} h_{sd} & 0 \\ b h_{sr} h_{sd} & h_{sd} \end{pmatrix} \begin{pmatrix} x(1) \\ x(2) \end{pmatrix} + \begin{pmatrix} n_{1,D} \\ n_{1,I,D} \end{pmatrix}$,

2) Gaussian mutual information $I(x_1, r_1 | h_1, b) = \log \det(I_2 + \rho H_1^H \Sigma_1^{-1} H_1 Q_1) \dots (11)$

Here, $\rho = 1/\sigma^2$ represents the signal-to-noise ratio(SNR)

2.2 Channel Capacity

$$C = \frac{1}{2} \max_{b_1, \text{tr}(Q_1) \leq 2} E_{h_1} [\log \det(I_2 + \rho H_1^H \Sigma_1^{-1} H_1 Q_1)] \dots (12)$$

We can get the capacity as follows:

$$C = \frac{1}{2} \max_{b_1, \text{tr}(Q_1) \leq 2} E_{h_1} [\log \det(I_2 + \rho H_1^H \Sigma_1^{-1} H_1 Q_1)] \\ = \frac{1}{2} \max_{b_1, q_{11} + q_{22} \leq 2} E_{h_{sd}, h_{sr}, h_{rd}} \left[\log \left((1 + \rho |h_{sd}|^2 q_{11}) \left(1 + \rho \frac{|h_{sd}|^2 q_{22}}{1 + b_1^2 |h_{rd}|^2} + \rho \frac{b_1^2 |h_{sr} h_{rd}|^2 q_{11}}{1 + b_1^2 |h_{rd}|^2} \right) \right) \right] \dots (20)$$

Impact of Lower Extremity Muscle Fatigue on Performance of the Star Excursion Balance Test in Healthy Volunteers

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Abstract. Examining the effects of lower extremity muscle fatigue in regards to performance on the Star Excursion Balance Test (SEBT) is the purpose of this study. The SEBT requires participants to reach in eight directions. An isokinetic dynamometer fatigued three muscle groups (knee extensors, hip abductors, and hip extensors) in 32 healthy participants aged 18-30. Each group was fatigued in three separate sessions one week apart after baseline testing. Muscle fatigue was reached when isokinetic force output was decreased by 50%. After fatigued SEBT reach distance was measured. A repeated measure ANOVA determined effects of fatigue on SEBT performance. The hypothesis was that SEBT performance would be altered following fatigued conditions.

1. Introduction

Dynamic balance is needed to maintain center of mass within the base of support with movements that require muscle control in response to some type of disturbance [1]. Numerous studies have used the SEBT to measure dynamic control during balance activities, which consists of integrated closed kinetic chain movements throughout the lower extremity (LE) [2]. It is unknown if muscle fatigue results in altered SEBT scores.

Previous studies show fatigue to be a major impairment that limits balance activities [1,3]. Quadriceps fatigue induced with isokinetic dynamometry results in adverse effects on a single leg stance balance tests [3]. In standing activities, the hip is the most proximal component of LE musculature involved, so it is important to note that fatigue may increase the likelihood of injuries above and below this joint [4]. Muscle fatigue of at least 50% may increase the risk of injury because of decreased balancing ability [1]. Although previous research has found the SEBT to be a good assessment of dynamic control, no studies have shown the relationship of fatigue in LE muscles and performance on the SEBT. Therefore, the purpose of our study was to determine the effects of knee and hip muscle fatigue on performance of the SEBT.

We hypothesize that LE muscle fatigue will negatively affect performance scores of SEBT.

2. Experiment, Results, Discussion, and Significance

A single-group, pretest-posttest repeated measures design was used. Lower-extremity muscle fatigue was the independent variable, with three levels: knee extensors, hip abductors, and hip extensors. The dependent variables were mean SEBT reach distance of three attempts in each of the 8 SEBT directions (anterior [A], anterior-medial [AM], medial [M], posterior-medial [PM], posterior [P], posterior-lateral [PL], lateral [L], and anterior-lateral [AL]).

Thirty-two healthy volunteers, nine male and 23 female, between the ages of 18 and 30 (avg. age 23.84 years) participated in this study.

After screening participants and receiving informed consent, leg dominance was determined using three tests [5]. The dominant leg was the stance leg for the entire study. Following a three minute warm-up and stretching of both lower extremities, participants performed six practice trials [6]. The participant stood on the ball of the dominant foot at the center of a grid with eight intersecting lines running in eight directions at 45° relative to one another. The participant reached the maximal distance possible with the non-dominant, "reach" leg. The participant then returned to center and repeated until all directions were complete. The participant was advised that if balance was lost or stance foot lifted, the trial would be discarded. Participants were not provided feedback during testing.

Each muscle group was tested in a separate session with a coin flip determining a random test direction (clockwise or counterclockwise). Sessions occurred one week apart, and participants were given the same warm-up/stretching protocol consistently. At the second session, baseline measurements were taken (the average of three SEBT trials). After 10

minutes of rest, the fatigue protocol was initiated for the knee extensors. On successive weeks the fatigue protocol was applied to hip abductors and extensors. After fatigue, participants immediately performed three SEBT trials before cooling down.

The means of the baseline and the three trials in each of the eight directions was calculated. Each direction was analyzed individually with the baseline average in the same direction. This was performed for each muscle group resulting in eight separate paired samples t tests calculated through the SPSS statistical software. The level of significance was previously set at 0.05 for all analyses.

Table 1: Baseline vs. Quad, Gluteus Medius and Gluteus Maximus

Direction		Mean	SD	P
A	Baseline	83.45	6.52	
	Knee Ext	81.96	7.73	0.127
	Hip Abd	78.73	5.90	0.000*
	Hip Ext	77.75	6.39	0.000*
AL	Baseline	78.93	7.64	
	Knee Ext	76.73	7.63	0.029*
	Hip Abd	74.56	7.46	0.000*
	Hip Ext	74.89	7.57	0.000*
L	Baseline	79.94	11.14	
	Knee Ext	79.26	10.96	0.648
	Hip Abd	80.46	8.74	0.671
	Hip Ext	80.05	9.34	0.936
PL	Baseline	97.27	10.16	
	Knee Ext	96.16	10.29	0.207
	Hip Abd	96.81	8.06	0.639
	Hip Ext	94.65	10.73	0.151
P	Baseline	110.14	9.84	
	Knee Ext	107.52	9.43	0.003*
	Hip Abd	106.35	8.34	0.000*
	Hip Ext	105.58	9.77	0.000*
PM	Baseline	105.72	9.08	
	Knee Ext	102.75	9.47	0.012*
	Hip Abd	102.63	8.47	0.000*
	Hip Ext	101.36	9.54	0.000*
M	Baseline	97.35	7.56	
	Knee Ext	95.43	8.31	0.003*
	Hip Abd	92.85	7.26	0.000*
	Hip Ext	91.32	8.79	0.000*
AM	Baseline	88.18	7.63	
	Knee Ext	87.06	7.76	0.265
	Hip Abd	85.29	6.63	0.009*
	Hip Ext	83.85	6.85	0.000*

Ext=extensor; Abd=Abductors

The paired samples t test comparing baseline to the fatigued knee extensors revealed significant differences in the directions of AL, P, PM, and M ($P < 0.005$). Comparing baseline to the hip abductors and baseline to hip extensors revealed significant differences in all reaching directions except L and

PL ($P < 0.005$). Mean reach distances were found to be less than the baseline value in all of the eight directions except Lateral for the hip abductors and hip extensors, but this was not found significant. In Table 1, the mean and standard deviation (SD) of each of the fatigued muscle groups are compared to the baseline means for each of the SEBT reaching directions. An asterisk (*) represents a significant difference in reaching distance when compared to baseline.

Knowledge of the relationship between proximal LE muscle fatigue and balance may be just as clinically important as that of muscle fatigue or distal instability. As expected, significant decreases in SEBT scores were found in all muscle groups tested, but unexpectedly, not in all directions. Possible reasons certain directions were unaffected could be (1) muscle performance is increased due to biomechanical factors, or (2) other hip musculature compensates for the fatigued muscle group. The clinical significance and generalizations regarding our results must be confined to young (college-aged) healthy individuals. Our results should be considered when implementing the SEBT clinically. Scores may be negatively affected if the SEBT is done following therapeutic exercise.

3. Conclusions

Fatigue of the knee extensors, hip abductors and extensors by at least 50% significantly affected performance negatively on the SEBT as a whole. In a young, healthy population, exercises that may lead to fatigue of these muscle groups should be done after the SEBT (as a measure of balance) is performed, to minimize the effect on test scores.

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Preliminary Investigation of the Speech Productions of Children with Hearing Loss

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Abstract. Children with severe hearing loss (HL) generally experience considerable difficulty developing intelligible speech. Most investigators have analyzed individual sound productions (e.g., /f/ as being totally correct or incorrect) without consideration of types of errors or patterns. This study was designed to evaluate phonological deviation patterns (e.g., final consonant deletion, cluster reduction) of children with HL. Fifty object-naming word productions of 12 children between the ages of 4 and 10 years were audio recorded and also transcribed phonetically at the time of utterance. Deviations were analyzed phonologically. This poster will compare the phonological deviation patterns of children by age, assistive listening device (e.g., cochlear implants, hearing aids), and age of speech intervention onset.

1. Introduction

Speech of children with hearing loss (HL) has been researched for the past century. The majority of the early investigators concluded that the speech of children with HL was different from their peers with normal hearing. Many researchers calculated the percentages of the children's words and sentences that were intelligible/unintelligible to an unfamiliar listener. Brannon [1] found that even for practiced words, children with a hearing loss of 75 decibels (dB) or greater spoke with 20-25% intelligibility. Other researchers searched for specific characteristics of deaf speech. Hudgins and Numbers [2] investigated speech sound productions of children with HL. They found that children with more severe HL demonstrated errors related to voicing, initial consonants, and nasality. For children with less severe HL, the investigators found errors related to substitutions and also omissions of consonants in blends and in word-final position. In the 1980s, some researchers shifted toward investigating phonology (i.e., the sound system of language) rather than individual speech sounds. Bernthal and Bankson [3] hypothesized that phonological analysis was a more precise approach than traditional methods because it is more specific in identifying deviations. Norms for typically developing children (without HL) were obtained, indicating that children demonstrate "adult-like speech" by age four years [4]. In addition, Meline [5] studied phonological skills of 19 children with HL and found the following seven predominant deviations: final consonant deletion, cluster reduction, deletion of initial consonants, gliding of liquids, backing to velars, stopping, and glottal replacement.

Technological advances in recent years (hearing aids, cochlear implants) have made it possible to restore children's hearing to some extent. A cochlear implant is an "electromagnetic device, surgically implanted into the ear, designed to stimulate sensory components remaining in the cochlea of persons with severe or profound hearing impairment who cannot use hearing aids effectively" [6, p. 71-72]. In the United States, the FDA approved implantation for infants as young as 12 months [7]. Research has evolved from examining the patterns of speech deviations of children with HL to studying the effects that various assistive listening devices have on their speech. Flipsen and Colvard [8], who studied overall speech intelligibility of children with HL, found that all six of their participants with cochlear implants were at least 65% intelligible; however, none of the children in their study achieved errorless "adult-like" speech even after four years of implant use. Due to the disbanded nature of current research examining the speech of children with hearing losses (HL), Speech-Language Pathologists (SLPs) still lack optimally effective treatment procedures for improving speech for this population. Consequently, these children fail to reach their maximal verbal potential. It is our goal that results from this study will provide critical information that will enable SLPs to develop more effective treatment methods for this unique population of children.

2. Methodology and Results

Twelve children between the ages of 4:0 and 10:11 (years:months) participated in this study. Children were included if they exhibited an unaided pure tone threshold hearing loss of at least 15 decibels (dB). Children with comorbid conditions (e.g., cerebral palsy) that might affect speech and/or language were excluded. The children were each tested once on a single day. Testing, which was arranged through the child's primary SLP or Teacher of the Deaf,

was conducted at the child's school or at the Wichita State University Speech-Language-Hearing Clinic. The *Hodson Assessment of Phonological Patterns (Happ-3)* [9] was utilized to identify phonological deviations and to tally specific types of individual deviations. The test was administered to the child in a quiet, non-disruptive environment. Each child named 50 common objects (e.g., *star, horse, crayons*) in the order of their preference. The children's productions were transcribed phonetically by the graduate student and the research advisor during the testing. In addition, the responses were recorded on an Olympus® VN-100 digital voice recorder using a Sony® ECMMS907 stereo-type microphone (set at the 90° setting for close-range recording). The recordings were uploaded to Audacity® (audio-editor & recorder) software on a Dell Inspiron E1705 laptop and were replayed to verify the transcriptions of speech productions. Whenever there was a discrepancy for a transcription, the graduate student and research advisor replayed recordings until consensus was reached. Deviations were then entered into the *Hodson Computerized Analysis of Phonological Patterns* [10] to obtain scores for Omissions, Consonant Category Deficiencies, and an overall score, Total Occurrences of Major Phonological Deviations (TOMPD). In addition, Substitutions and Other Strategies (HAPP-3) Analysis Forms were scored to identify additional deviations (e.g., gliding, stopping) for each child. Children with HL were compared to each other based on the following characteristics: age, assistive listening device (cochlear implants, hearing aids), implantation/fitting age, and speech intervention onset. The dependent variable was the child's Total Occurrences of Major Phonological Deviations (TOMPD) score on the HAPP-3. In addition, the children's Substitutions and Other Strategies (e.g., gliding, stopping) were analyzed. Analysis of the data as a whole indicated that gliding was the most common deviation (\bar{x} =9.67 occurrences within 50 words), followed by Stopping (\bar{x} =6.42), Vowel Deviations (\bar{x} =6.00), Vowelization (\bar{x} =5.92), and Fronting (\bar{x} =4.75). Overall, the younger children (4:0-7:5) had more phonological deviations (\bar{x} =122 TOMPD) than the older children (\bar{x} =79). The children wearing cochlear implants had fewer errors (\bar{x} =85) than the children who relied on hearing aids alone (\bar{x} =97). Children with bilateral cochlear implants outperformed (\bar{x} =28) children with unilateral implants (\bar{x} =127). Children who received their assistive listening device at an older age ($\geq 3:1$) had more phonological deviations (\bar{x} =101) than children who received their device at an earlier age ($\leq 3:0$, \bar{x} =68). Children introduced to speech intervention at a young age ($\leq 1:6$) had fewer errors (\bar{x} =57) than children with a later speech intervention onset ($\geq 1:7$, \bar{x} =114).

3. Conclusions

There was considerable variability among the speech productions of children in this study. All of the children demonstrated some deviations, including the oldest children. On the whole, however, the younger participants had more phonological deviations than the older children. Another finding was that children with cochlear implants had fewer deviations than children wearing only hearing aids. In addition, children with bilateral cochlear implants outperformed children with unilateral implants. The results of this study may assist practicing SLPs in designing more effective analysis and intervention procedures that will expedite intelligibility gains in children with HL.

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Kansas Physician Assistants' Attitudes and Beliefs Regarding Spirituality and Religiosity in Patient Care

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Abstract. The objective of this study was to explore Physician Assistants' (PAs) attitudes and beliefs regarding the role of spirituality and religiosity (S/R) in patient care. Surveys were mailed to PAs who were members of the Kansas Academy of Physician Assistants. The majority of PAs, both self-reporting being and not being religious or spiritual also believe that they should be aware of patients' S/R beliefs. However, less PAs, especially those who report not being religious or spiritual also believe that patients' S/R should be discussed in the patient encounter.

1. Introduction

Spirituality and religiosity (S/R) are an important part of many people's lives. According to a 2008 Gallup poll, 93% of people believe in God or a universal spirit [1]. These beliefs may become even more central in health crises. The relationship between spirituality and religiosity and health outcomes is well established [1]. Balboni et al [2] found 88% of advanced cancer patients found religion somewhat or very important. They also found higher overall spiritual support was positively associated with enhanced quality of life. However, they found 72% of patients felt their spiritual needs were met only to a small extent or not at all by the medical system and 42% found little or no spiritual support from a religious community or the medical system [2]. This indicates patients desire to discuss S/R beliefs with their healthcare provider.

Patients want their spiritual beliefs to be known for a variety of reasons. Making their beliefs known may help patients feel that their physician understands them better as a person, how they make decisions, and how their beliefs influence how they deal with sickness [3]. Research indicates a variety of health care professionals believe discussing spirituality and religiosity is an important part of patient care. Medical students, residents, nurses, and physicians from fields including primary care, pediatrics, and psychiatry have been studied [4].

PAs have become a vital part of the health care system, providing services to an increasing number of patients each year. According to the American Academy of Physician Assistants, PAs provided greater than 250 million patient visits in 2007 and data indicates an increasing number of visits each year. Researchers have looked at the attitudes and beliefs of a variety of health care professionals concerning incorporation of spiritual and religious discussions in patient care. There is a gap in the literature pertaining to the attitudes and beliefs of PAs. .

2. Experiment, Results, Discussion, and Significance

This was a cross-sectional study exploring the attitudes and beliefs of Kansas physician assistants regarding spirituality and religiosity in patient care. Surveys were sent to PAs who were active members of the Kansas Academy of Physician Assistants. The survey included questions about general demographics, scope of practice, personal S/R beliefs, attitudes about S/R in patient care, frequency of S/R encounters with patients, and S/R education received. Results are descriptive and presented in means, frequencies, and percentages where appropriate. Three hundred and thirty four PAs responded to the survey, resulting in an overall response rate of 42%. The average age of survey respondents was 40.7 years old and the majority were female 68% and white 94%. About half 52% of respondents had a Bachelors degree and about half 47 had a Masters degree. Family medicine was the most commonly reported primary specialty 38%. Practice setting was most commonly a single specialty 25%, followed by emergency medicine 17%, and solo practice 15%. Other specialties included and surgical specialties 20%, and emergency medicine 17%. The average number of years in practice was 10.5 years and the majority 91%

did not receive S/R training in their PA education. The majority of respondents reported being religious 81% and/or spiritual 95% and having a religious affiliation 93%.

The first research question examines if PAs should be aware of patients' S/R beliefs based on their own religious and spiritual values. Respondents who reported having personal religious or spiritual beliefs were more likely to believe they should be aware of patient S/R than respondents who reported not having personal spiritual or religious beliefs. Of respondents who reported having personal religious beliefs, a majority 92% agreed they should be aware of patient S/R. Of those who reported they are not religious, 82% still believed they should be aware of patient S/R. A majority 91% of respondents who reported spiritual beliefs believed they should be aware of patient S/R. Of respondents who report not being spiritual, 73% believed they should be aware of patient S/R.

The second research question examines if PAs should then address patients' S/R in the patient encounter based on their own religious and spiritual values. Respondents who reported having no personal religious or spiritual beliefs were significantly different from those who reported having beliefs in respect to addressing patient S/R. Of respondents who reported having personal religious beliefs, a majority 82% agreed they should address patient S/R. However, only 54% of those reporting no religious beliefs believed they should address patient S/R. A majority 79% of respondents who reported spiritual beliefs believed they should address patient S/R, while only 47% of those reporting no spiritual beliefs believed they should address patient S/R.

Significantly more PAs who report being religious agree that they should be aware of patients' S/R ($p = .01$) and it is their role to address patients' S/R needs ($p < .001$). Significantly more PAs who report spiritual beliefs in their life agree they should be aware of patients' S/R ($p = .02$) and it is their role to address patients' S/R needs ($p < .01$).

3. Conclusions

PAs continued growth as mid-level health care providers has necessitated the need for continued research, education, and application of S/R in patient care situations. This research indicates that a PAs own personal S/R beliefs influence their attitudes and beliefs towards the awareness of and discussion about S/R in direct patient care. The majority of PAs, both self-reporting being and not being religious or spiritual also believe that they should be aware of patients' S/R beliefs. However, less PAs, especially those report not being being religious or spiritual, also believe that patients' S/R should be discussed in the patient encounter. Research indicates S/R promotes enhanced health outcomes, and is desired by the majority of patients. Further PA education program or continuing medical education S/R training is needed to make PAs more aware, sensitive, comfortable, and educated to patients' S/R needs. Providing the best possible healthcare to patients essential, making the need for S/R education an important topic in the future.

4. Acknowledgements

Copying costs, postage expenses, and personnel to assist in the creation and distribution of this survey was generously funded by WesleyMedicalCenter.

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Factors Influencing Physician Assistant Practice Location in the United States

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Abstract. The purpose of this cross-sectional survey of 2,000 practicing PAs from the United States was to determine the number of PAs from rural areas who returned to a non-urban area after graduation and the factors that influenced their first practice location choice. Nearly one-half of respondents self-identified as graduating from a non-urban community high school, yet only one-third practiced in a similar community upon graduation. Many factors other than an individual's community size prior to PA training were related to first job selection. Chi-square analyses revealed six factors of significance ($p < .05$) in relationship with demographic variables in determining their first job, including: benefits and incentive programs offered by employer; hours of work required per week; significant other support of location; medically underserved designation of practice site; quality of surrounding schools; and quality of life for the entire family.

1. Introduction

As the population of the United States continues to grow, and trends in medical practice continue to change, healthcare providers must also adapt accordingly to meet the changes. Currently, rural underserved areas of the country suffer from inadequate health care and access to providers. Physician assistants have been an increasingly essential part of the healthcare system since the profession originated in 1965 as an effort to fulfill the shortage of medical-based healthcare providers. The PA profession is thus gaining interest as a vital contributor in keeping up with the nation's healthcare needs. According to the American Academy of Physician Assistants (AAPA), there was an estimated 85,345 PAs able to practice as of 2009, and the number is expected to continue to grow significantly over the next ten years. However, the distribution of future PAs should include increased deployment in areas of need contributing to health care access for U.S. citizens. Efforts have been made on a national level to increase the recruitment and retention of PAs for underserved areas. In order to promote such efforts among healthcare providers, specifically PAs, it is necessary to continue understanding the factors influencing where a PA is likely to practice.

2. Experiment, Results, Discussion, and Significance

This study was a cross-sectional, random sampling of 2,000 practicing PAs from the United States via query of the American Academy of Physician Assistants (AAPA) database. The purpose was to determine the number of PAs from rural areas (graduates of non-urban high schools) who returned to a non-urban area after graduation and the factors that influenced their first practice location choice. Respondents were asked a series of 21 Likert-based questions regarding their perception of factors influencing their decision towards their first employment as a PA. Additionally respondents were asked demographic information. Data were analyzed using standard statistical tests. Frequency statistics were used to illustrate the demographic and attitude data gathered from the survey. A chi square test was used to determine if there were relationships of importance between factor ratings and the demographic questions on the survey.

The response rate was 16% ($n=312$). Forty-seven percent reported graduating from a non-urban (<50,000 population) community high school, yet 32.1 percent reported their first job to be in a non-urban community setting. Among the demographic variables evaluated several repeatedly showed significance in their relationship with the factors influencing first employment location ($p < .05$). These included benefits and incentive programs offered by the employer (more important for younger PAs, minorities, and those not working in FQHCs), hours of work required per week (more important for females, younger PAs, and those with master degrees), significant others support of location (more important for males, older PAs, and those who are married), medically underserved designation of practice site (more important for minorities, and those working in primary care, and FQHCs), quality

of surrounding schools (i.e., for their children) (more important for males, older PAs, non-minorities, and those who are married), and quality of life for the entire family (more important for older, and married PAs and those not working in FQHCs).

3. Conclusions

Nearly one-half of respondents self-identified as graduating from a non-urban community high school, yet only one-third practiced in a similar community upon graduation. Married PAs had common needs when deciding on their location for employment. Those needs were based on the interests of their spouse and family. Significant factors including hours of work required per week, significant other's support of location, quality of surrounding schools, and quality of life for the entire family were all important to the majority of married PAs. Therefore, in order to successfully encourage these PA graduates to relocate to an underserved area, these significant factors must be catered to; otherwise, efforts made to advocate practice in an underserved area may be futile.

Another significant finding in this study was that there was no significant relationship between the community size in which PA graduates had grown up and the type of area in which they first practiced. In the past efforts have been made on a national level to recruit individuals from rural areas, who desire careers as health care providers, in the hopes that they will return upon graduation. This finding should be further investigated in order for PA programs to modify the recruitment of students in order to continue to meet the demand for access to health care in rural locations.

These significant factors provide evidence of motivating elements of PAs entering the profession. Studying this information may provide insight and possible reasoning for the increasing gap in healthcare and the shortage of PAs in rural areas. Using this information in the recruitment of PA students and in catering to the desires of PAs with families, may be beneficial in successfully encouraging PAs to work in underserved areas.

4. Acknowledgements

We would like to thank our friends and family for all of their support throughout our education. We would also like to thank the Wichita State University Physician Assistant program for continuing to assist us on this project. This project was funded in part by the Workforce Diversity Initiative Grant, funded by US/DHHS, grant number D57HP05123, 2008-2011, Richard Muma, PI.

Phylogeny of the tribe Cyclocephalini (Coleoptera: Scarabaeidae: Dynastinae): a combined analysis of morphology and molecular loci

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Abstract: Phylogenetics provides information about evolutionary relationships and is an essential tool in understanding broad patterns within groups. The scarab beetle tribe Cyclocephalini (Coleoptera: Scarabaeidae: Dynastinae) includes 15 genera and approximately 500 species that are distributed primarily in the New World. Species in the group are important pollinators of aroids, palms, and lilies; some are agricultural pests; and a few have become invasive when introduced to new areas. This group as a whole has only been examined alpha taxonomically. While individual species of economic importance have been studied, the monophyly of the tribe and relationships of genera have not been addressed. Using molecular and morphological methods, my research will be the first to examine the phylogeny for this tribe of beetles.

1. Introduction

The insect order Coleoptera, the beetles, is the largest and most diverse animal kingdom on earth with over 350,000 described species. The family Scarabaeidae contains more than 27,000 species [1, 2]. Some of the most impressive scarab beetles, in both size and form, are the rhinoceros beetles, subfamily Dynastinae. Scarab beetles in the tribe Cyclocephalini (Coleoptera: Scarabaeidae: Dynastinae), which contains 15 genera and approximately 500 species. All but two genera -- *Ruteloryctes* Arrow found only in Western Africa from Guinea to Angola [3] and *Peltonotus* Burmeister distributed in Southeastern Asia [4] -- are found in the New World. Most are distributed in Neotropical regions. Relocation of some cyclocephaline species to non-native areas, however, has occurred including the introduction of the invasive pest *Cyclocephala signaticollis* Burmeister from Argentina to Australia where it is established in lawns and turf [5], and the North American *Cyclocephala pasadenae* (Casey) which has been accidentally introduced to Hawaii [6].

While many of the members of the group are beneficial as important pollinators of palms, aroids [3], and lilies [7], others members are major pests of turf grass and agricultural crops [5]. Destructive pests are not limited to introduced species; many cause great damage in their native habitat. The immature stages (often referred to as white grubs) of many cyclocephalines are major pests (including such US species as *Cyclocephala borealis* Arrow, *C. lurida* Bland, *C. hirta* LeConte, and *C. parallela* Casey) [5].

Circumscription of the tribe is heavily debated and there have been several classification changes in recent years. The genus *Coscinocephalus* Prell was transferred to the tribe Pentodontini (Dynastinae) [8]. Two genera from the scarab subfamily Rutelinae were transferred into the Cyclocephalini: *Acrobolbia* Ohaus [9] and the genus *Peltonotus* Burmeister [4, 10]. These changes illustrate a lack of phylogenetic research.

The objectives of my research are to: 1) develop the first phylogenetic hypothesis for the tribe Cyclocephalini using both morphological and molecular characters; 2) to examine the monophyly of the tribe Cyclocephalini and genera within the tribe; 3) propose a classification of the 15 genera that reflects these relationships; 4) examine evolution of character traits within the tribe; 5) create a comprehensive key to all world genera. This research has broad implications in determining potential invasive species within the Cyclocephalini and understanding the historical biogeography of New World and Old World cyclocephalines.

2. Experiment, Results, Discussion, and Significance

Representatives of all 15 genera within the tribe Cyclocephalini will be used in combined morphological/molecular phylogenetic analyses. Monophyly of the tribe will be tested by including taxa that historically have been included in the group (e.g., *Coscinocephalus*). Adult beetles will be examined for morphological characters using a dissecting microscope (6.3–50.0 times magnification) and fiber-optic illumination. Morphological analyses will examine and score adult character suites (e.g., legs, mouthparts, flight wings) including those important in understanding pollination and herbivory. For taxon selection, I will use an exemplar approach

(with priority placed on type species of all genera) as well as broad representative species in order to provide an understanding of the breadth and depth of lineages. Distributional data will be examined using The Biofinity Project (<http://biofinity.unl.edu/>). Biogeographic inferences will be formulated based on phylogenetic analyses.

Molecular analyses will be based on the mitochondrial gene regions CO1 and 16S ribosomal RNA with adjacent regions *nad1* and tRNA leucine (*trnLeu*), and one nuclear gene region, the D3-D6 fragment of 28S nuclear rRNA. Molecular and morphological data will be analyzed separately and combined, and using parsimony and likelihood methods. Parsimony analyses will be conducted using PAUP*4.0β10 [11] and TNT 1.0 [12]. Representatives from the ruteline tribes Anomalini (specifically the genus *Anomala*) and Adoretini (specifically the genus *Adoretus*) will be used as external outgroups based on hypothesized sister group relationships [13].

To date, DNA has been extracted and amplified from X species and X genera using the CO1 gene sequence and primers *Pat* (5'TCCAATGCACTAATCTGCCATATTA) and *Jerry* (5'CAACATTTATTTTGATTTTTTGG) [14]. More samples await extraction and all samples await sequencing. I am in the process of conducting a preliminary morphological study examining and scoring characters. No results from either the molecular or the morphological analysis have been obtained yet.

3. Conclusions

The project is still in the early stages, so few results are currently available. However, accomplishing this project will help lead to a much greater understanding of the world's biodiversity. It will also help provide valuable information and tools to future evolutionary researchers.

4. Acknowledgements

This research is funded primarily by The Biofinity Project (<http://biofinity.unl.edu/>), and collaborators include Stephen Scott, Leen-Kiat Soh, Etsuko Moriyama, Steve Harris, Ian Cottingham, Shawn Baden, Adam Eck, Derrick Lam, Catherine Anderson, Yijo Mo, and Scott Henninger. Brett Ratcliffe (University of Nebraska) and Ron Cave (University of Florida) are thanked for funding for molecular research. This research is funded by Wichita State University; NSF DBI-0743783 to Scott, Henninger, Jameson, Moriyama, Soh, and Ocampo; and NSF-DEB 0716899 to Ratcliffe and Cave. Also, special thanks to Matt Paulsen (University of Nebraska) and the UNSM molecular lab for training and use of their facilities.

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Social Stories: A User-Friendly Intervention?

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Abstract. Social Stories are a popular intervention used to address the social impairments of children with Autism Spectrum Disorders (ASDs). Parents and teachers wrote two Social Stories, the first after reading a shortened version of widely available information about Social Stories and the second after instruction and guided practice. Results address how much training is needed in the composition prior to writing Social Stories.

1. Introduction (Describe your idea)

Social Stores wee developed by Carol Gray to teach social skills about a particular event and provided information about the expected or appropriate response within those conditions. They are a popular intervention used to address the social impairments of children with ASDs. The purpose of this study was to evaluate whether parents and educational professionals could, after reviewing shortened versions of Gray’s materials about social story rationale and composition, correctly author their own Social Stories according to Gray’s guidelines.

Social Stories should be understood easily by the child with an ASD and include vocabulary and presentation forms that are appropriate for the individual’s age, abilities, and comprehension level. The shortened versions of Gray’s materials included five sentence types and emphasized a specific ratio of various sentence types within the story in order that the social story describes the situation rather that only directs the expected behavior of the child.

The lives of family members can be substantially improved when the behaviors that disrupt regular routines are reduced. Social stories can be individualized to cater to the individual needs of the student and the individual situations. They are usually developed by those who know the child well (e.g., parents and teachers). Extant research in which parents have implemented social stories have employed stories authored by the researchers. There have not been studies, to date, in which parents have authored and implemented social stories with their children with ASDs.

There is a misconception that social stories are easily written. Depending on the needs of the individual with an ASD, the situation or event, and the individual authoring the story, the process may be time-consuming, requiring a lot of information gathering and rewriting. The Gray Center, which Carol Gray founded, offers materials about how to write Social Stories.

2. Experiment, Results, Discussion, and Significance (Describe how you developed your idea)

This study assisted in determining that social stories were not correctly written after the use of shortened versions of Gray’s materials and that more training is required. A convenience sample of 15 females comprised of parents who have children with ASDs and educators with current or recent experience with a child with an ASD, but without any formal training in Social Stories, participated in the study. Each individual completed the following activities solely or individually with a small group during a single 2-3 hours session.

Research participants read a condensed version of *Social Stories 10.0: The New Defining Criteria & Guidelines* (Gray, 2004) listing nine criteria for elements of correctly written Social Stories; read the profile of a fictional child with an ASD, “Zac”; and then wrote a Social Story to help Zac with his chore of feeding and watering the pets. This first phase was intended to simulate the experience of parents and educators who read about Social Stories and then write Social Stories for their children or students.

Next participants received additional instruction in writing social stories. The researcher gave a 30-minute power point presentation based on *Social Stories 10.0* that emphasized the basic Social Story writing elements and included more detail than the condensed version that participants read in the first phase of the research. This presentation provided opportunities for discussion and guided practice. Interactions between the researcher and participants were recorded with notes, audio tape, or both for later review.

Finally, participants read a second profile of a child with an ASD, “Jon”, and wrote a Social Story to help Jon complete his morning routine. The profiles of ac and Jon were of similar lengths and readability levels. This final phase represents the experience of individuals who have received more extensive and individualized instruction in writing Social Stories.

Both of each participant’s Social Stories, for Zac and for Jon, were scored on 23 criteria based on elements of correctly written Social Stories. Interrater reliability of the scoring protocol was established based on stories written by 27 subjects prior to this research.

The basic research question of how much instruction parents and educators need to attain competence in writing Social Stories was addressed by the statistical comparison of participants’ scores on the criteria for their stories for Zac and Jon. This research showed that training is required over independent reading and self-instruction based on interpreting the literature oneself.

3. Conclusions

Participant’s stories improved after training occurred; there were several areas of composition that showed significant improvements. Participants reported the second story was easier to write after training, compared to their first attempt. Participant’s stories showed significantly more difficulty with writing correct sentence types than other story components. The quality of sentences improved after training with the stories moving closer to the preferred sentence ratio.

4. Acknowledgements

The researcher would like to extend thanks to Jill Terhune who donated hours of her time to help score stories and establish interrater reliability.

A Preliminary Investigation of Eye-gaze Patterns on Fast-mapping Abilities of Children with ASD

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Abstract. Research has suggested that during storybook reading children's eye-gaze is primarily on the picture versus the text. Further research with written fast-mapping (FM) indicates that children acquire orthographic images during reading after minimal exposure. Limited research has been conducted on the FM or orthographic skills of children with autism spectrum disorder (ASD). The purpose was to investigate eye-gaze patterns of children with ASD to assess orthographic and written FM abilities. Twin 6-year-old boys with ASD and two 5-year-old typically developing children participated. Fast-mapping skills were assessed by presenting novel words and pictures on a computer. Eye-gaze patterns were analyzed using Tobii Studio 2.0.1 eye tracking software. Data was analyzed to determine eye-gaze patterns in relation to FM skills.

1. Introduction

There have been numerous studies conducted to examine the factors that influence the reading and writing skills of typically developing children. Children learn new words through a process termed fast-mapping, which involves the rapid, associative pairing of objects with labels to form words. Through fast-mapping, children create an initial mental representation of the phonological structure of a spoken word which is then refined following subsequent exposures of the spoken word. The fast-mapping of spoken words requires the ability to participate in joint attention, which includes the ability to follow and share information by following another's eye-gaze. Joint attention is a core deficit in children with autism spectrum disorder (ASD) and is a predictor of concurrent and future language ability.

The research on eye-gaze patterns with typically developing children has suggested that storybook reading is a picture-focused activity, implying that children's eye-gaze is focused primarily on the picture versus the text [1]. In addition, research with written fast-mapping skills has indicated that children acquire mental orthographic images of words within implicit storybook reading contexts after minimal exposures [2]. Mental orthographic representations are stored mental images of a written word or a prefix or suffix. These mental orthographic representations appear to be crucial for successful reading and writing skills.

Consequently, typically developing children with well-developed mental orthographic representations can recognize or recall the visual representations of the word and, therefore, free up memory and attentional resources for comprehending or composing text [3].

Previous research on the fast-mapping abilities of children with Autism Spectrum Disorder (ASD) has focused primarily on the verbal word learning process. The fast-mapping abilities of school-aged children with ASD have been found to be impaired because of using personal focus of attention as a strategy for forming word object associations instead of using the speaker's eye-gaze [4]. Therefore, the deficits of joint attention that often are seen in children with ASD may have a direct impact on the development of core vocabulary. Similarly, the attention-following skills of children with ASD have a significant predictive relationship with fast-mapping and vocabulary development. Furthermore, it appears that targeting attention-following tasks, such as, joint attention, may increase the vocabulary development in children with ASD.

Research related to the written fast-mapping or orthographic processing skills of children with (ASD) has been limited. Previous research has focused on the fast-mapping abilities of children with ASD in relation to verbal word learning. It is important, therefore, that studies be conducted to investigate the written fast-mapping skills of children with ASD, as well as explore the eye-gaze patterns of children on the autism spectrum when presented with both images and text. The purpose of this pilot study was to investigate the eye-gaze patterns of children with ASD when presented with novel words and pictures to assess their orthographic and written fast-mapping abilities.

2. Experiment, Results, Discussion, and Significance

Method

Participants Twin six-year-old boys with ASD and two 5-year-old typically developing children participated in this study. The participants were assessed to determine nonverbal intelligence (TONI-

3) [5], reading (WRMT-R) [6] and spelling abilities (spelling test), receptive vocabulary skills (PPVT-4) [7], and phonological processing ability (CTOPP) [8] prior to initiating the eye-gaze protocol.

Apparatus

A Pentium IV-based PC with 96 dpi 17" monitor with a resolution of 1280 by 1024 pixels integrated with the Tobii 1750 eye-tracking system running at 50Hz was used to capture eye-tracking measures. Tobii Studio™ software was used to record and provide fixation and Area of Interest (AOI) eye-tracking data of the participants.

Procedure

As each participant began the research study a visual work system, physical structure of the environment, reinforcement, and mental load were standardized across participants. The participants used a work system that included both picture icons and photographs that indicated what activities would occur and in what sequence. The physical structure of the room was adapted to clarify boundaries and minimize both distractions and stimulation for each participant. Each participant selected a preferred item from the vending machine prior to the initiation of the research study to help motivate participants to complete the research task.

Fast-mapping skills were assessed by presenting 12 stories containing a novel word paired with a picture of novel objects through a storybook context presented on a computer. Each slide of the story appeared for 10 seconds, while an image of the novel object was paired with a pre-recorded female voice reading the sentence that contained the target novel word. The sentence with the novel word was printed below each picture. Each target word was heard and seen four times within the context of the story. After each storybook presentation, participants were asked to generate the novel word through a written response and via receptive identification. The written answer required the child to spell the novel word. For the receptive identification task, the child was asked to point to the target novel word when given a set of four words.

Results

In this study, two measures were used to quantify eye-movements. Fixations are a stationary gaze that remains within a 35px radius for 2 consecutive samples. Fixation duration represents the mean period that a fixation lasts, which is expressed in milliseconds.

Due to the small sample size, data were examined descriptively. The ASD group fixated more on images ($M = 727.0$, $SD = 63.64$) than text ($M = 412.0$, $SD = 178.19$). In contrast, the typically developing group focused more on text ($M = 797.0$,

$SD = 530.33$) than images ($M = 582.0$, $SD = 117.38$). The typically developing group ($M = 8.5$, $SD = 3.54$) had greater written fast-mapping scores than the ASD group ($M = 7.5$, $SD = 3.54$). Receptive fast mapping scores ($M = 12.0$, $SD = NA$) were greater for the typically developing group than the ASD group ($M = 10.5$, $SD = .71$).

In summary, written fast-mapping scores had a positive relationship with mean fixation duration ($r = .873$, $p > .05$), and a negative relationship with fixation count ($r = -.298$, $p > .05$). Additionally, fast-mapping receptive scores had positive trends with fixation count ($r = .502$, $p > .05$) and fixation duration ($r = .373$, $p > .05$).

Discussion

The participants with ASD focused more on the images than the text, which may have impacted their ability to learn novel words. The results imply that children with ASD have difficulty focusing attention to relevant stimuli in order to develop new vocabulary. The data from this pilot study will be used for exploratory purposes to enhance the research design and protocol for further research. Future research will include a larger sample size to generalize results to the target population.

Significance

The data from this study could have an impact on the assessment, instruction, and intervention methods for literacy development among children with ASD. The outcomes from this study may encourage literacy curriculums for children with ASD that focus on both phonemic awareness and orthographic concepts to facilitate reading and spelling skills. In addition, the processes underlying fast-mapping abilities of children with ASD may be understood better with the investigation of eye-gaze patterns when presented with text and images.

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Physician Assistant Attitudes on the Risks to the Public Involved When Wearing Contaminated Work Attire Outside of the Medical Setting

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Abstract. It is relatively common to see healthcare employees in their uniforms outside of the workplace. Research has shown that microorganisms can be transmitted from patient to employee, resulting in concern that pathogens on the uniforms may then be spread to other individuals. The purpose of this study was to investigate the perceptions and practices of physician assistant (PA) students and practicing PAs in Kansas regarding the manner of wearing medical uniforms outside the clinical setting. A majority of respondents (82%) to an email survey admitted to wearing work attire in public after seeing a patient. Professional organizations should consider the development of educational programs to increase awareness of the possibility of disease transmission from clothing worn in the clinical setting.

1. Introduction

Spreading infectious diseases from patient to patient is an ongoing problem in health care. Measures have been implemented to try to prevent the spread of pathogens such as hand washing techniques, sterilization, personal protective equipment measures and information on how to properly launder scrubs at home. Despite these measures, there is still a growing concern as microorganisms are continuously being dispersed within the healthcare community. Monkhouse et al (2008) posted a survey at hospitalinfections.org to determine if the public was concerned about health care professionals wearing hospital clothing outside the hospital.¹ The majority of respondents answered “yes” to this question.

Many hospitals discourage their employees to wear their work attire outside the medical setting.² They recommend that employees change clothes prior to leaving the job. However, this is not strictly enforced, especially if the facility does not provide laundering services. Most individuals remain in their work attire because of convenience. Weinbroum et al (2007) surveyed physicians about their habits and found that 80% admitted to leaving the operating room while wearing their surgical uniform.³ This study also revealed that 86% of the physicians polled believed that a policy should be implemented to discourage this practice.³

Research has shown that microorganisms are transmitted to healthcare workers' clothing when caring for patients, resulting in concern that pathogens on the clothing could be spread to individuals of the public.^{4,5,6} There is insufficient evidence to either support or refute that this possibility exists. However, in the past several decades there has been an increased incidence of infections caused by methicillin-resistant *Staphylococcus aureus* (MRSA), vancomycin-resistant *Enterococcus* (VRE), *Clostridium difficile*, and numerous other pathogens.^{5,7} When individuals are in close contact with a patient who has MRSA, they are at risk, themselves, for developing the disease.⁸ MRSA has been found on the gowns of healthcare workers who were in close contact with those infected by the bacteria, possibly contributing to its transmission.⁵ Smith et al (2000) showed that MRSA was able to survive on the fabric used in scrubs and lab coats for a minimum of one to three days and longer on other fabrics commonly used in hospitals such as polyester and cotton.⁹

To prevent the possible spread of infection, hospitals in the United Kingdom have developed a “bare below the elbows” approach where healthcare providers must wear short-sleeved shirts to work.² In addition, they are not allowed to wear ties, white coats, watches, or jewelry.² Countries such as Denmark, Holland, and Belgium provide laundering of their hospital uniforms at the facility and employees are not allowed to wear these articles of clothing home or outside of the hospital.⁶ Denmark has kept their rates of MRSA near zero.⁷ In contrast, most healthcare facilities in the United States require employees to buy their own uniforms and launder these at home.⁶ As a result, employees in the United States may be less likely to change out of their work uniforms.

2. Experiment, Results, Discussion, and Significance

This cross-sectional study was designed to investigate the perceptions and practices of physician assistant (PA) students and practicing PAs in Kansas regarding wearing work uniforms outside the clinical setting. An online survey was created using Survey Monkey and sent to students in the physician assistant program at Wichita State University and PAs on the Kansas Academy of Physician Assistants (KAPA) registry. The identity of the respondents was kept private by assigning each a number in the order that they were received.

A total of 263 surveys were dispersed with 25 returned due to inaccurate contact information. There were 163 completed surveys sent back with a 69% response rate. Of the participants, 39% are current students and 48% have 15 years of work experience or less. A majority of respondents (82%) admitted to wearing work attire in public after seeing patients and 45% of this group agreed that they were at moderate risk for carrying pathogens on their clothing. Many of the participants (74%) declared that their workplace did not have guidelines regarding changing out of work attire prior to leaving the facility. Respondents were about equally split with 45% believing guidelines should be implemented. Of those in favor, 39% are practicing PAs. In addition, 88% of PAs and PA students agree that there is a potential risk of spreading pathogens from their clothing when worn out of the workplace. A majority (79%) also believe that an educational program needs to be offered regarding this topic.

Most respondents agree that there is a possibility of transferring pathogens to members of the community by wearing work attire outside the clinical setting. The majority also responded that they wear their work attire in public places. Current research does not provide adequate evidence as to whether clothing is a vector in the spread of disease. It does suggest that pathogens such as MRSA are able to survive on fabrics commonly worn in the healthcare setting for several days, which increases the risk of infecting others if such clothing is not laundered appropriately and timely. It might be beneficial to patients and society if guidelines were organized and enforced requiring healthcare providers to change clothing prior to leaving the medical setting.

3. Conclusions

PA students and practicing PAs may have concerns that are different from the general public because they are educated about pathogens and the spread of the disease. Based on the results of this survey, additional research may be needed to determine if pathogens can be spread from infected hospital attire to individuals in society.

There is concern about wearing contaminated work attire into the community, but no research to prove this practice is unacceptable. In the hospitals where guidelines are in place, they are not strictly enforced. A division in opinions was noted among respondents about implementing guidelines regarding changing uniforms before leaving the facility. This would more than likely decrease rates of infections but increase costs for the employer due to laundering expenses. Since there is a concern among these healthcare professionals about spreading pathogens to the public, further research should be conducted. In addition, the majority of PAs and PA students agree that an informational program should be offered to help educate and reduce the transmission of infectious diseases.

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Separation of Metallic and Semiconducting SWNTs by Density Gradient Ultracentrifugation and Formation of Donor-Acceptor Hybrids using Porphyrins

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Abstract: Occurrence of photo induced electron transfer in donor-acceptor self-assembled Zinc porphyrin (ZnP) and CoMoCAT single walled carbon nanotube (SWNT) nanohybrid has been demonstrated. CoMoCAT (6,5) and CoMoCAT(7,6) SWNT nanohybrid were constructed by solubilizing SWNT by π - π stacking of pyrene-NH₃⁺ and pyrenebutyric acid. SWNT (6,5)/SWNT(7,6).Pyr.COO⁻(TMPyP)M;M=H₂,Zn and SWNT(6,5)/(7,6).Pyr-NH₃⁺ (TPPS)M; M=H₂,Zn so formed were then studied using various techniques such UV/Vis-NIR,PL, TEM and nanosecond Transient Absorption techniques. The rates of charge separation, κ_{CS} and κ_{CR} were than studied for both the two nanotube samples.

1. Introduction

In the last decade of 20th century scientists around the world got busy in understanding the physic-chemical properties of fullerene (C₆₀) compounds. Major contribution to this field was of Sumio Iijima who developed Multi Walled Carbon Nanotube in 1991 and then Single Walled Carbon Nanotube (SWNT) in 1993. Single walled Carbon Nanotube or SWNT caught attention of one and all because of its unique physico-chemical and mechanical properties.

SWNT can be studied in terms of their chirality (n, m) and henceforth can be divided as metallic and semiconducting SWNT's. This gives rise to the unique electronic properties of SWNT. Density Gradient Centrifugation or DGU is a technique that has been used to separate raw SWNT using sucrose as gradient. The unique structure and the presence of π -delocalization have made SWNTs extremely attractive towards the development of photovoltaic materials. Till now, due to the lack of separated SWNT it was hard to establish structure – reactivity relationships.

In the present work we have selected two nanotube types namely SWNT (6,5) and (7,6) both of which are semiconducting in nature. Nanohybrids were then made with Pyr-NH₃⁺ and Pyrenebutyric acid by solubilizing in DMF.

2. Experiment, Results, Discussion, and Significance

Fig 1.a.CoMoCAT(7,6)

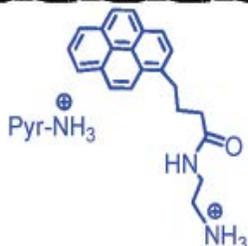
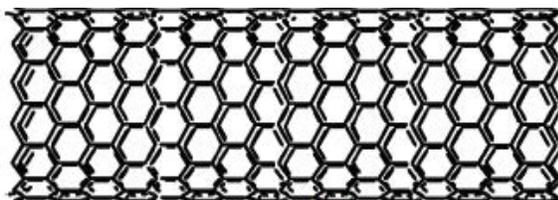
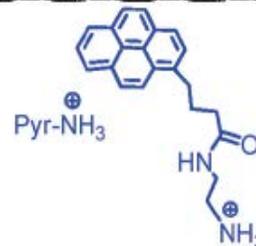
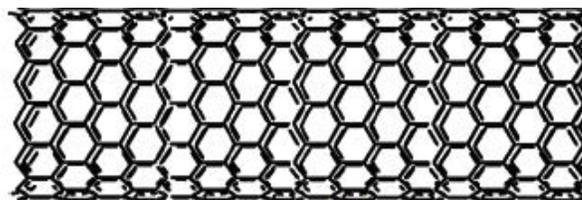


Fig1.b.CoMoCAT(6,5)



(TPPS)

Fig2.a.(TPPS)M;M=H₂,Zn



Fig2.b (TMPyP)M; M=H₂,Zn

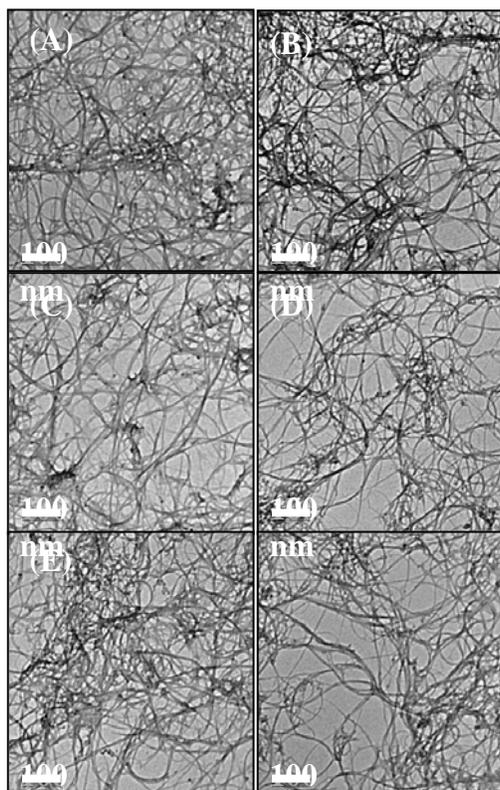
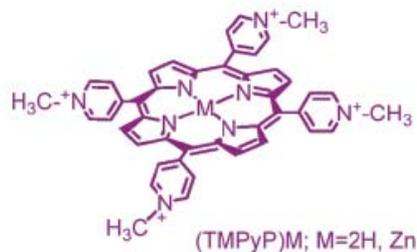


Figure3.TEM images of (A) SWNT, (B) SWNT(6,5)pyNH₃(TPPS)2H (D) SWNT(6,5)pyNH₃(TPPS)Zn and (F)

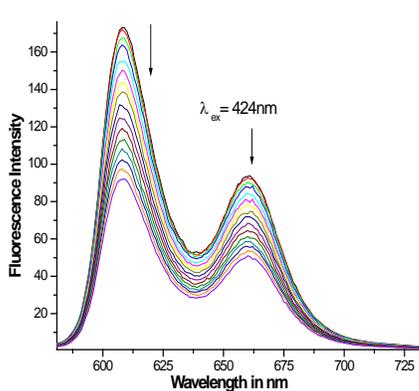


Fig4.a.Steady state emission spectra of ZnTPPS titrated with SWNT(6,5)-pyreneammoniumcation in DMF

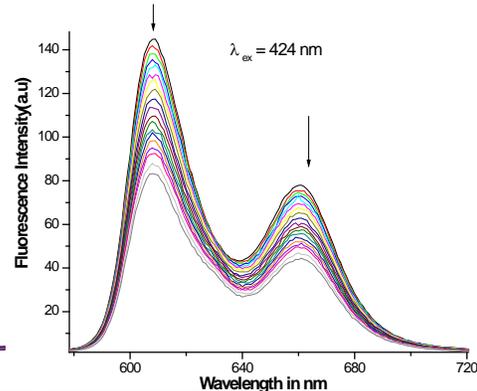


Fig4.b. Steady state emission spectra of ZnTPPS titrated with SWNT(7,6)-pyreneammoniumcation in DMF

Nanosecond transient absorption studies were also done for the above nanohybrids. Similar set of data were collected for SWNT(6,5) and (7,6)-Pyrbutyric acid with (TMPyP)M(M=H₂,Zn in water.

3. Conclusions:

Photoinduced electron transfer in self-assembled Zinc porphyrin –SWNT hybrids are demonstrated. Steady state studies revealed efficient quenching of the Zn porphyrin. Nanosecond transient absorption studies revealed electron transfer to the quenching mechanism.

4. Acknowledgement;

We are thankful to Dr Atula S. D. Sandanayaka, Japan. Authors are thankful to the National Science Foundation, NSF-EPSCOR

Effects of Body Position and Vision on Speech Understanding

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Abstract. Twenty-four young adults with normal hearing, vision and balance completed the BKN-SIN Test under four conditions: Sitting versus standing with eyes open versus blindfolded. Subjects' SNR-50 scores did not differ significantly among conditions; however, subjects rated listening as significantly easier when sitting with eyes closed than standing with eyes open. This normative research is the first of several inter-modality studies at our laboratory addressing effects of body position and balance on speech understanding.

Introduction

The most common hearing tests used by audiologists are pure-tone threshold testing (which measures how softly a person hears a tone) and speech recognition testing (which measures how accurately a person understands speech at a soft or loud level in quiet or noise.) Most hearing tests are done with a client sitting in a sound booth while listening through earphones or loudspeakers. Sitting is mainly for the client's comfort, so the client does not fatigue and can devote more attention to listening. Likewise, some clients close their eyes during hearing testing, presumably to concentrate better by blocking visual distractions in the sound booth. In other words, sitting in a quiet room is supposed to improve the reliability and accuracy of hearing test results. Sitting (with eyes open or closed) during hearing tests, however, does not reflect the range of positions people assume in during everyday listening. People often stand, for example, while they listen and converse. Listening to speech while standing up, however, often may require people to focus on maintaining balance which may cause them to become tired quicker and, thereby, decrease their understanding of what they hear. Moreover, because vision can improve balance, people rarely converse when standing with their eyes closed. No researchers, to our knowledge, however, have systematically compared how well people understand speech when they are sitting versus standing, with their eyes opened or closed. Therefore, the purpose

of this study is to determine combined effects of body position (sitting versus standing) and vision (eyes opened versus eyes covered) on understanding speech.

Method

Participants were 24 adults between the ages of 18 to 35. They spoke English as their first language; were not an audiologist or in an audiology program; had normal hearing, vision, and balance; were not taking medication that could influence hearing, vision, or balance; and had not consumed alcohol in the last eight hours.

Participants completed a brief questionnaire followed by a basic screening of hearing, vision, and balance. During *objective* measurements, participants meeting selection criteria then repeated back simple sentences from the BKN test which were heard in a background of noise. These lists were presented under four conditions: with participants sitting with their eyes open or eyes blindfolded or standing with their eyes open or eyes blindfolded. After completing all conditions, *subjective* measurements of how participants ranked the difficulty of listening under the four conditions relative to one another.

Results

Friedman's Test indicated no significant differences ($p > 0.05$) in *objective* rankings of speech understanding in noise scores among the four conditions (see Figure 1). Conversely, another Friedman's Test indicated that participants subjectively ranked listening while standing with eyes open as significantly more difficult ($p < 0.05$) than listening while sitting with eyes closed (see Figure 2).

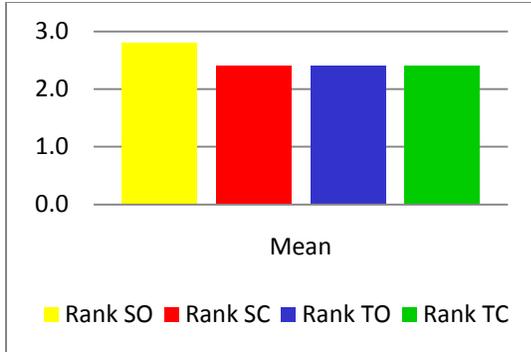


Fig. 1 Objective rankings of speech understanding in noise scores among the four conditions

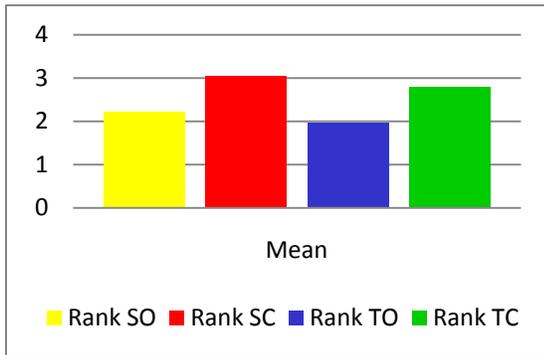


Fig. 2 Subjective rankings of ease of listening to speech

in noise scores among the four conditions

Conclusions

Results suggest that when a person takes a routine hearing test, there may be no objective difference in speech understanding in noise when sitting or standing with eyes opened or eyes closed. However, a person may prefer to sit with eyes closed during the test, presumably, because listening is more comfortable. One reason there may not have been objective differences in speech understanding between conditions is because the tasks might not have been difficult enough. Accordingly, we are now conducting a follow-up study with participants standing with eyes opened or eyes closed doing a more difficult balance task.

Acknowledgements

This study will be presented at the annual convention of the American Academy of Audiology with partial funding from 269500 Communication Sciences and Disorders (CSD) Foundation Account.

Scholarship of Teaching: What Do PhD Students Know?

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Abstract. The development of the Scholarship of Teaching and Learning (SoTL) is essential to foster learning for all students and to enhance the practice and profession of teaching. Little is known about the knowledge PhD students have about the SoTL or the value they place on it. The purpose of this study was to assess the understanding and intended use of the SoTL by PhD students. An online survey was sent to 61 CSD programs in the United States and Canada. The results indicated that PhD students may have heard of the term SoTL but over a third of the participants did not have a working model. Also, many participants did not distinguish between the different levels of scholarly teaching.

1. Introduction

The development of the scholarship of teaching and learning (SoTL) is essential to foster significant, long lasting learning for all students and it enhances the practice and profession of teaching [1, 2]. There have been several initiatives by the American Speech-Language Hearing Association and the Council of Academic Programs in Communication Sciences and Disorders to document the current shortage of PhD students in our professions. With fewer students graduating and moving into university positions created by retiring faculty, not only is the shortage made worse, but mentoring of new faculty members is compromised. We need to provide knowledge about the scholarship of teaching so that new faculty in CSD can continue the positive cycle of quality teaching. Little is known regarding the value that current PhD students place on the scholarship of teaching. As a result, the art of the SoTL may be declining at our universities as professors retire. We need to identify if significant numbers of our future faculty members have this knowledge and whether they plan to incorporate these skills into their teaching.

2. Experiment, Results, Discussion, and Significance

Method: An online survey was sent to 61 CSD programs in the United States and Canada. Program Directors distributed the survey link to PhD students in their programs. The survey was designed to elicit information regarding students' teaching experiences, their knowledge of SoTL, and the value of SoTL. Participants were 108 students who responded to the survey and of those, 95 participants who completed it (M = 18, F = 86).

Results: The doctoral students in this study are unfamiliar with the SoTL but believe that it will be important to their success as teachers, to their future students' success, and that it has a place within their profession. They report that they reflect on their teaching, draw on literature to design their lectures, and attempt to engage in innovative teaching practices. They also reported that they would like to learn more about SoTL and would like to complete research in this area. (See means and standard deviations in Table 1.)

PhD students were also asked to respond narratively to the question, When I hear "Scholarship of Teaching and Learning" I think of...? Many participants could not distinguish good teaching from scholarly teaching from the scholarship of teaching and learning. 35 students responded that they didn't know, 40 students described good teaching, 9 students described scholarly teaching, and only 9 students had appropriate descriptions for the SoTL.

Table:1
 Doctoral students' knowledge and value of the scholarship of teaching and learning

Knowledge of SoTL (n = 100)	Mean ± SD	Strongly Agree/ Agree	Strongly Disagree/ Disagree
<small>Data from 5-point likert scale ranging from (1) "strongly agree" to (5) "strongly disagree"</small>			
1. I am familiar with the phrase "the scholarship of teaching" (SoTL)	3.7±1.41	28%	63%
2. The body of literature regarding teaching and learning will/be is important to my success as a teacher.	1.9±.79	77%	2%
3. The body of literature regarding teaching and learning will/be is important to my students' success.	2.0±.82	74%	4%
4. Research regarding teaching and learning does not have a place within our discipline.	4.4±.83	2%	88%
Knowledge Based on Teaching as a Doctoral Student (n=72)			
5. I routinely reflect on my teaching.	1.5±.67	93%	1%
6. I draw on teaching and learning literature in designing my lectures.	2.7±1.09	49%	28%
7. I attempt to engage in innovative teaching practices.	2.0±.94	76%	7%
Value of SoTL (n = 98)			
8. My academic department places value on research about teaching and learning for the purposes of tenure and promotion	2.9±1.12	33%	27%
9. I would like to engage in research regarding teaching and learning	2.8±1.07	42%	29%
10. I would like to learn more about literature on effective teaching	1.9±.73	84%	3%

Discussion: Although PhD students may have heard of the term SoTL, over a third of the participants in this study did not have a working model of it. The majority of PhD students were not familiar with the SoTL however, most indicated they would like to learn more. Additionally, many of the participants did not distinguish good teaching from scholarly teaching from the scholarship of teaching and learning. Although there are connections in the different stages of teaching, it is important to distinguish among them [3].

Significance: With fewer students graduating and moving into university positions created by retiring faculty, not only is the shortage made worse, but mentoring of new faculty members is compromised. Information about the scholarship of teaching is essential to new faculty in CSD to ensure the positive cycle of quality teaching. The results of this survey indicate that the majority of PhD students are not familiar with the term SoTL, therefore, potentially comprising the future positive cycle of quality teaching.

3. Conclusions

Most PhD students were not familiar with SoTL, however, they appeared to recognize the value of evidence-based education principles. The development of the SoTL is essential to fostering significant, long lasting learning for students and enhances the practice and profession of teaching. It will therefore, be critical to continue to provide PhD students with the necessary information pertaining to SoTL.

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Environmental Sustainability: Metrics and Definitions

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Abstract. Corporate sustainability as a newly defined concept is based on five main pillars of environment, business excellence, innovation, governance and human contributions. Among these pillars, environment is an important one since it has a wide common area with other pillars. In this paper, environmental sustainability as an important challenge to achieve a sustainability program in any corporation is discussed. This paper develops some important metrics to assess the environmental sustainability program of any given corporation. Moreover, as there are some overlaps among environment and other pillars of sustainability, these similarities and overlaps will be discussed. Finally, the application of introduced metrics in top five Fortune companies will be illustrated to accredit the practicality of the introduced metrics.

1. Introduction

Sustainability as a rather newly defined concept refers to the capability of an organization to continue its activity without exposing any risks to its surroundings. This concept first started with an increasing attention about pollution and seems to gain attention more by the developments of industrial activities. Sustainability as a broad concept is based on five important pillars of environment, business excellence, innovation, governance and human contributions (social pillar). In this research, environmental pillar addresses environmental impact which is considered to be the possible [adverse effects](#) caused by an [industrial](#) project or by the [release](#) of a substance in the environment. By increasing the global attention toward some environmental crises during the last two decades such as the ozone hole, global warming and some drastic chemical pollution in air, water sources and soil, a great need was recognized for corporations to consider some specific programs to assess the ecological effects of their activities on the environment. With the help of these assessing programs, corporations can document their environmental goals along with improving their environmental management systems. [1] In other words, environmental sustainability measurements investigate the firms to illustrate how green they are, how the activities of a firm can change the environment and how the environmental risks and opportunities are managed within the firm.

According to [2] environmental sustainability, encompassing a wide range of issues from pollution to natural resource management challenges and institutional capacity refer to the long-term maintenance of valued environmental resources in an evolving human context. According to [Brundtland Commission](#) of the [United Nations](#) environmental sustainability can be defined as the capability to meet the needs of the present without compromising the ability of future generations to meet their needs. [3] Improving the efficiency of processes and cycles with respect to the throughput of energy and materials is the most important operational challenge of clean production corresponding to the concept of reducing or minimizing waste.

2. Experiment, Results, Discussion, and Significance

Emerging new concepts like sustainability have broadened the environmental assessment metrics tremendously in comparison with traditional visions which consider some metrics just as gauges to assess the toxic emissions of a company. Defining efficient metrics for environmental assessment is challenging since the environment is complicated and usually cannot be assessed based on mathematical relations easily. In this paper, some applicable metrics for assessing environmental sustainability programs are introduced as below:

Long term plan of corporations, traditional metrics for measuring toxic emissions, innovation rate, investment rate on new technologies, number of employed researchers in the area of environment, executed process improvement programs, planned preventive costs, design revision rates, number of memberships in voluntary environmental-based programs and commitment to some global regulatory standards.

Among these metrics, long term plan, toxic emission measurement and innovation are assumed to be more important since they are more comprehensive. Long term plan of a corporation reflects the defined strategies related to environmental objectives such as budgeting on environmental issues. It means that as predefined metrics are directly related to the main objectives of corporations, long term planning can be regarded as the most comprehensive metric. Toxic emission assessing methods, measuring the amount of chemicals emitted to the environment are fundamental for environmental problems. Also, innovation which addresses new products rate and innovating production methods in order to achieve more efficiency is of great importance such that it is accounted as one the main pillars of sustainability.

Case studies approve that in top Fortune companies (such as Exxonmobile, Walmart, Royal Dutch Shell plc..) these metrics are extensively used for related environmental sustainability programs. Moreover, more precise studies show that there are some overlapping areas between environment and other pillars of sustainability which sound to be independent at first glance. This relation is illustrated in Figure 1. For instance, some metrics of environmental assessment are exactly related to innovation such as innovation rate, or number of employed researchers in the area of environment. Regulations set by government are key leading factors while enacting environmental programs for a firm. Also, if a corporation holds the requirements of an environmental sustainable program, it can achieve to a competitive advantage resulting in higher profits. This argument verifies the relation between environment and business excellence pillar. By means of environmental sustainable program a company will be able to reduce emissions and provide healthier environment, providing more degree of acceptance for the corporation in the society. This argument can support the relation between environment and social pillar.

3. Conclusions

In this paper some definitions of corporate sustainability and environmental sustainability are introduced. Then 10 important metrics for measuring environmental issues of any corporation are presented. Moreover, the overlaps between environment and other pillars of sustainability are discussed. Also the practicality of the proposed metrics are discussed in top Fortune companies to illustrate how they apply efficiency programs to make their processes and energy consumption under control while reducing their harmful environmental impacts. In this way, they can recreate their required amount of energy by managing their wastes.

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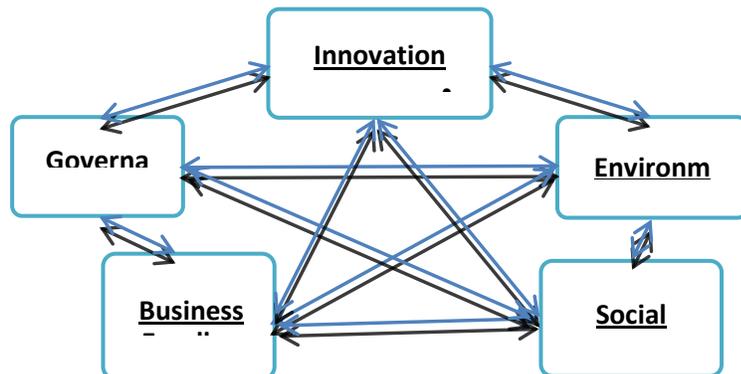


Fig. 1. The relation among pillars of sustainability

Cfd Modelling Of Rectangular Microchannel With Increase In Heat Flux And Effect On Nusselt Number

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Faculty: Ikram Ahmed

Department of Mechanical Engineering

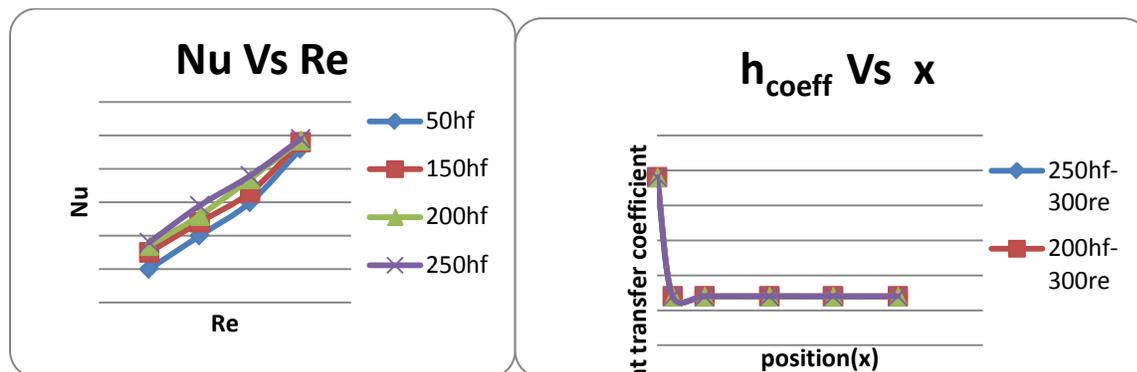
Abstract: A laminar convective heat transfer coefficient of a rectangular microchannel is investigated under constant heat flux value throughout the wall. Two dimensional numerical simulations were performed using the FLUENT and GAMBIT software packages for a rectangular microchannel with a breadth of L and a length of $200L$. Based on the temperature distributions obtained from simulations, both the local and average Nusselt numbers for different Reynolds numbers ranging from 100 to 400 for different heat flux values are determined.

1. Introduction

Recently, much research has been conducted on microchannels due to their high heat transfer performance, and these experimental studies proved to be successful. Lee determined Nusselt numbers as a function of aspect ratio [2]. Experimental data was collected to find the Nusselt numbers and a linear relationship was observed between the Nusselt number and Reynolds number. Three-dimensional numerical simulations for trapezoidal and triangular channels of the laminar flow and heat transfer of water in microchannel flow were performed. The studies showed that fully developed Nusselt number for the microchannels simulated increases with the increasing Reynolds number, rather than a constant.

2. Experiment, Results, Discussion, and Significance

A microchannel was modeled in GAMBIT with the required dimensions and the mesh density of the microchannel taken 10×400 (Fig.2). The boundary conditions were applied in GAMBIT design, and then exported to FLUENT. The inlet is taken as velocity inlet and outlet is taken as pressure outlet. The case file was read from the GAMBIT file followed by a grid check and scaling process. The properties were obtained to select fluid for further calculations which lead to the next step of applying the boundary conditions. The solution converged at 250 iterations and the surface temperature and bulk temperature values were used in calculating. Using these temperatures, the heat transfer coefficient and Nusselt number were calculated. The results are shown in Figure.1 below. At a particular position, for different Reynolds numbers and heat flux values the Nusselt numbers were calculated and graphs were drawn to illustrate the variations. At different positions, the average Nusselt number was calculated and compared with a single position values. Grid independence was done to verify the accuracy of the results.



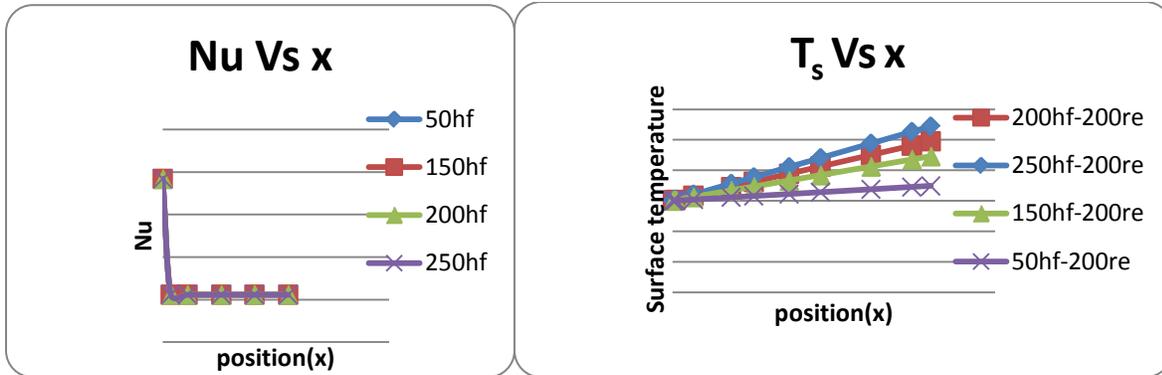


Fig. 1 Graph for Nusselt number, Heat transfer coefficient and temperature

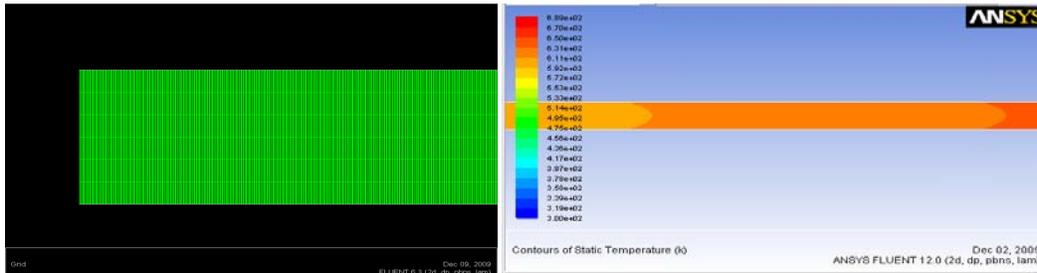


Fig.2 Gambit mesh model and fluent model

3. Conclusions

Theoretically in a conventional duct, the Nusselt number in the fully developed laminar heat transfer is constant, but in the microchannel the Nusselt number increases with an increase in Reynolds number. This is because the constant value (8.23) is for an ordinary conventional channel but in the case of microchannel heat transfer process is more efficient, perhaps due to thin boundary layer. The hydraulic diameter is very small and hence the Nusselt number is very small. In case of heat transfer coefficients and Nusselt numbers, there is a major decrease for the first positions and as it goes on the values are becoming constant and hence using the FLUENT, it can be stated that in a thermally developing flow of fluid with constant properties, heat transfer coefficient and the Nusselt numbers are constant, independent of position. The heat transfer intensity is very high while entering the channel but it decreases gradually while flowing through the downstream. This also indicates that after the fluid flowing through a long channel is fully developed. Thus such a microchannel can be used in heat exchangers, heat sinks, MEMS, microelectronics, biomedical, fuel processing and aerospace.

Acknowledgements

Dr. Ikram Ahmed and Dr. T.S. Ravigururajan from the Mechanical Engineering Department is thanked for his guidance and support throughout this project.

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PI Controller Design for Robust Stability of a Steam Generator Unit in the Presence of Additive Uncertainty

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Abstract. A graphical design method for finding all achievable Proportional Integral (PI) controllers that stabilize a non-reheat steam generator unit for a range of plant parameters has been introduced. Additive Uncertainty is used to describe the uncertain perturbed system for simplification of design. A key advantage of this procedure is that it depends only on the frequency response of the system and does not require the plant transfer function coefficients.

1. Introduction

The primary goal of an Automatic Generation Control (AGC) is to match consumer load demand with the generator electrical output. AGC effects the optimization of generator output, tie-line power interchange, customer billing, reducing Area Control Error (ACE), and stability of a power operation system [1].

Our graphical design method is useful in finding the entire set of PI controller gains that robustly stabilize a single area non-reheat power generator unit. This method guarantees closed loop stability in the presence of uncertain plant parameters. As this method is based on the previous developments [2], it does not require the plant transfer function coefficients but only the frequency response of the system.

2. Experiment, Results, Discussion, and Significance

An equivalent representation of the nominal model of the non-reheat power generation unit is shown in Fig.

$$1. G_1(s) = \frac{1}{1+T_{g1}}, G_2 = \frac{1}{1+sT_{t1}}, \text{ and}$$

$G_3 = \frac{1}{D_1 + M_1 s}$ represents the transfer function

models of the speed governor, non reheat steam turbine and rotating mass and load, respectively [1].

Here, T_{g1} is the governor

time coefficient, T_{t1} is the non-reheat steam turbine

time coefficient and D_1 and M_1 are the load damping

and the generator inertia coefficient, respectively. In this figure, B_i , R_i , and T_i are the frequency bias factor, speed-droop characteristics, and the tie-line power interchange for area i , respectively. G_p is the nominal plant model, V is the Area Control Error signal of the system, and U is the control input to the system.

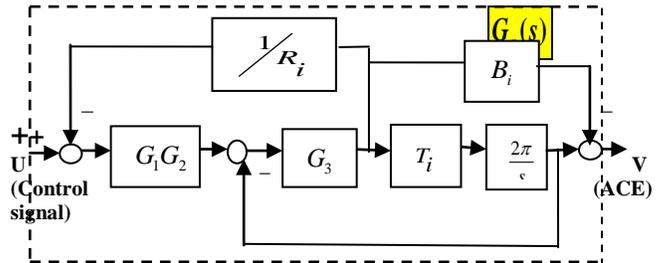


Fig 1. Nominal SISO model for a non-reheat steam generator unit.

The closed loop system transfer function of the nominal plant is given as,

$$G_p(s) = \left[\left\{ \frac{2\pi}{s} T_i + B_i \right\} G_3 G_2 G_1 \left\{ \left(1 + \frac{2\pi}{s} G_3 T_i \right)^{-1} + \left(I + \frac{1}{R_i} G_3 G_2 G_1 \right)^{-1} \right\} \right] \quad (1)$$

Consider the Single Input Single Output (SISO) system shown in Fig. 2, where $G_p(s)$ is the

nominal model of the non-reheat power generation unit as represented in eq. (1). $K(s)$ is

the PI controller defined as, $K(s) = K_p + \frac{K_i}{s}$

where K_p and K_i are the Proportional and

Integral gains of the controller. $W_A(s)$ is our

designed additive weight and $\Delta_A(s)$ is the norm-bounded additive uncertainty. The

reference input signal and the output signal are $R(s)$ and $Y(s)$, respectively.

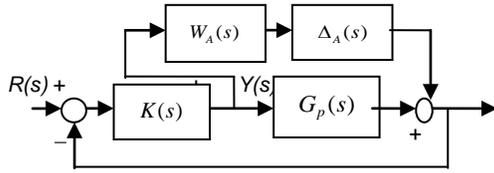


Fig 2. Additive Uncertainty Modeling

In this paper, the problem is to find all PI controllers that stabilize the non-reheat steam generator unit for all $|\Delta_A(j\omega)| < 1$. The system is robustly stable if the nominal system is stable and if for an entire range of frequency (ω),

$$|W_A(j\omega)K(j\omega)S(j\omega)|e^{j\theta_A} \leq \gamma \quad (2)$$

To accomplish this, for each value of $\theta_A \in [0, 2\pi]$ we will find all PI controllers on the boundary of Eq. (2).

The characteristic polynomial can be obtained from Eq (2). Its frequency response is evaluated and thereafter expanding it in terms of its real and imaginary parts for $\theta_A \neq 0$, and $\theta_A \in [0, 2\pi]$, yields:

$$K_p(\omega, \theta_A, \gamma) = \frac{-\left[R_p(\omega) + \left(\frac{1}{\gamma} (A_A(\omega) \cos \theta_A - B_A(\omega) \sin \theta_A) \right) \right]}{Q(\omega)}$$

$$K_i(\omega, \theta_A, \gamma) = \frac{(-\omega) \left[I_p(\omega) + \left(\frac{1}{\gamma} (A_A(\omega) \cos \theta_A - B_A(\omega) \sin \theta_A) \right) \right]}{Q(\omega)}$$

Where,
 (3)

$$G_p(j\omega) = R_p(\omega) + jI_p(\omega)$$

$$W_A(j\omega) = A_A(\omega) + jB_A(\omega)$$

$$Q(\omega) = \left\{ \begin{array}{l} |G_p(j\omega)|^2 + \frac{1}{\gamma^2} |W_A(j\omega)|^2 \\ + \frac{2}{\gamma} \left[\begin{array}{l} R_p(\omega) (A_A(\omega) \cos \theta_A - B_A(\omega) \sin \theta_A) \\ I_p(\omega) (A_A(\omega) \sin \theta_A + B_A(\omega) \cos \theta_A) \end{array} \right] \end{array} \right\}$$

The range of uncertain parameters in the generator units is given in Table 1. The frequency response of the additive errors for different parametric uncertainties present in the plant and the additive weight is shown in Fig. 3.

The PI stability boundary of the nominal system can be found by setting $\gamma \rightarrow \infty$. All PI controllers that satisfy the robust stability constraint given in Eq. (2) are found by setting $\gamma \rightarrow 1$ and finding the intersection of all regions.

The intersection of all regions inside the nominal stability boundary is the robust stability region (Fig. 4).

The results shows that for our designed controller $K(s)$, the H-inf norm is less than one, which implies all our design goals are met.

Table: 1 Uncertainty range in the governor-load-rotating mass model.

Plant parameters	Uncertainty Range	Unit
Governor-Time coefficient, T_{g1}	[0.072, 0.088]	sec
Load- damping coefficient, D_1	[0.0135, 0.0165]	pu/Hz
Rotor Inertia coefficient, M_1	[0.15, 0.18337]	pu s

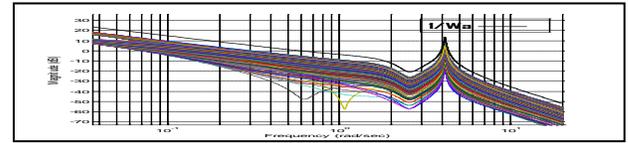


Fig 3. Additive errors and additive weight bound

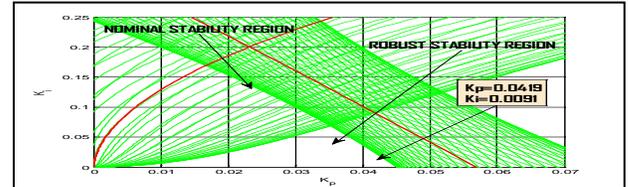


Fig 4. Nominal stability boundary and robust stability area

3. Conclusion

In this paper a graphical design method for finding all achievable PI controller that satisfy a robust stability constraint and stabilize a single area non-reheat steam generator unit is presented.

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Characterization of Drug-Carrying Nanocomposite Spheres for Targeted Drug Delivery

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Abstract. Active targeted drug delivery occurs when a drug is associated with a biodegradable polymer and a bio-targeting compound and administered to the site of interest. In this study, these nanocomposite spheres are characterized using various techniques. In-vitro characterization of the nano-spheres containing therapeutic agent and fluorescence molecules are accomplished by culturing live cells in microscopic cells, and introducing the nano-spheres. In-vivo studies are conducted using immune-deficient mice. Other characteristics such as release rates, percent entrapment efficiency and size are studied with UV-Vis spectroscopy, TGA, and TEM.

1. Introduction

Targeted drug delivery, delivering therapeutic agents in a manner where the affected or injured part of the body has increased concentration of the medication, has increased the efficiency of treatments for various diseases by many folds. One of the most important uses of targeted drug delivery is for treating cancerous tumors. In this research, skin cancer is targeted to be treated using magnetic nanoparticles, therapeutic agents, and bio-targeting compound enveloped in a biodegradable polymer sphere measuring in micron scale. The nano-composite spheres are characterized for their rates of release, cytotoxicity, size and percent entrapment efficiency using UV-Vis spectroscopy, TGA, and cytotoxicity tests.

2. Materials and Methods

The nano-composite spheres are synthesized by oil-emulsification process. The bio-targeting compound functions to target specific cancerous cells in need of extra nourishment[1]. The magnetic nano-particle, in the presence of exterior magnetic field, helps in the propagation of the spheres towards the target site. Therapeutic agents functions to treat cancerous tumor cells. The polymer helps in holding all the above described ingredients together.

The Transmission Electron Microscope (TEM) is used to measure the size of the magnetic nano- particles, as shown in Figures 1 and 2. The TEM uses a focused beam of electron to measure the size. The average size is measured to be 18 nm in size.

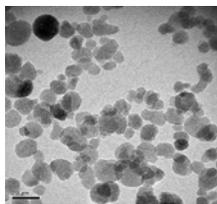


Fig. 1. TEM pictures of the magnetic nanoparticles

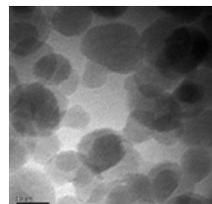
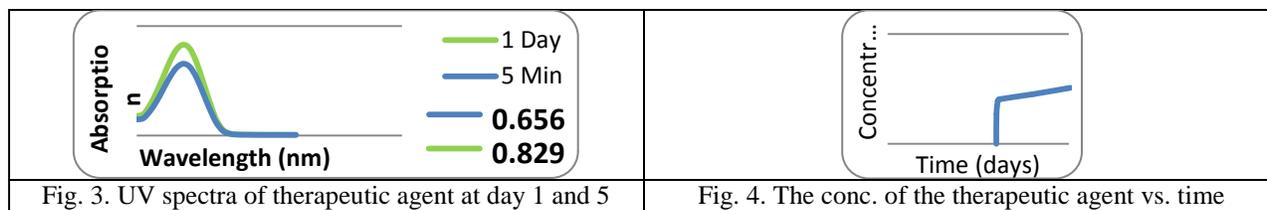


Fig. 2. Closer TEM pictures of the nanoparticles

The UV-Vis spectroscopy is used to analyze the amount of different compounds present in a solution. Thus the release rates of the nano-composite spheres are calculated. The UV spectra shown in Fig. 3 shows that as the days progress the absorption at 264 nm increases which relates back to the concentration. Figure 4 shows the individual concentration of various elements in the sphere.



Knowing the percent entrapment efficiency will allow medical treatments to be developed with the known amount of therapeutic agent retained in the drug carrier system. Thermal gravimetric analysis (TGA) can be used to find the percent entrapment efficiency. Fig. 55 shows the loss of one constituent between 35 and 23 percent. The total amount of that constituent was 20%, thus an entrapment efficiency of 60% is calculated.

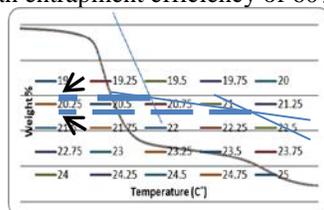


Fig. 5. TGA results used to find the entrapment efficiency

To better understand the passage of the nano-composite spheres in the in-vitro and in-vivo tests, they are added with fluorescent material. This enables the nano-composite spheres to be fluorescent in certain wavelength of light. Thus the path of the spheres and the location of the spheres can be easily observed.

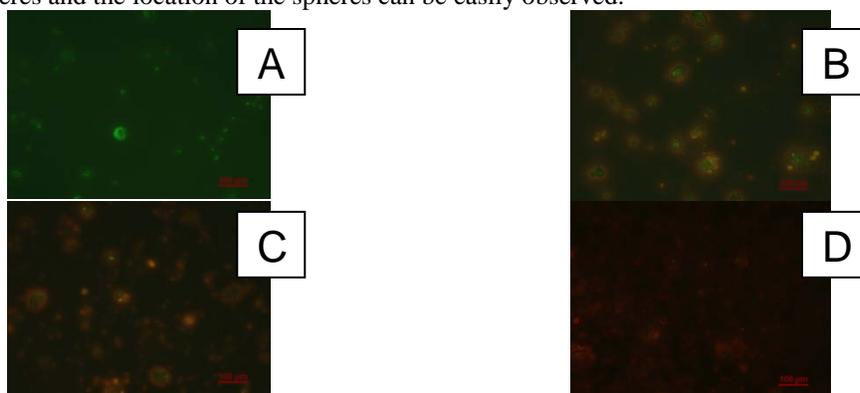


Fig. 6. In-Vitro cytotoxicity test, cells fluoresce at the green wavelength while the drug carrier system fluoresces at red. The yellow is the result of both overlaid on top of each other

In-Vivo Tests: To better mimic real conditions of a human body, in-vivo tests are carried out in immune-deficient mice, as shown in Figure 6. These mice by genetic engineering are devoid of Thymus cells thus lacking an immune system and unable to reject foreign bodies [2]. Human skin cancer cells grown in certain spots on the mice are administered the nano-composite spheres and monitored at constant intervals.

3. Conclusion

The magnetic nano-composite spheres are characterized for important parameters using various techniques[3]. These characterizations will help understand the efficiency of the drug carrying spheres.

4. Acknowledgements

We would like to thank Dr. Ramazan Asmatulu, Dr. Paul Wooley, and Dr. Shang you for the continuous support in giving us a direction to proceed in, in this project and the well equipped labs we work in.

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Car Talk: Gender-specific Observer Communication at the Kansas State Fair Nostalgic Car Show

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Abstract. The Kansas State Fair (KSF) Nostalgic Car Show provides an environment where both male and female observers can showcase their communication style. The focus of this research was designed to address the research question: “What are the gender differences or similarities in communication among observers at the Nostalgic Car Show?” Grounded theory [2] and Boyatzis’ method of thematic analysis [3] were used to yield insights into the similarities or differences in communication among male and female observers at the car show. Findings indicated that male initiated communication is more technical and female initiated communication is more aesthetically based. The data implies that context is not an important factor in influencing gender and communication style. However, females and males at the KSF Nostalgic Car Show communicated in stereotypical manners consistent with research on general biological sex differences in communication.

Introduction. Distinctions between the sexes, in the significant areas of role, temperament and status have cultural rather than biological bases. [4] Gender plays a role in developing communication style and female and male communication styles are more acute based on context. [1] On Sunday, September 20, 2009 the Communication 802 graduate class in qualitative research methods observed events at the Kansas State Fair. This research focused on the communication within the KSF Nostalgic Car Show.

Experiment, Results, Discussion and Significance.

The KSF Nostalgic Car Show ran from 10:00 a.m. to 5 p.m. The length of time allowed for optimal observation and data collection. There was a total of five hours of observation.

The first observation took place from 10:00 a.m. until 1:30 p.m. During this time, I sat on a bench south of “car row”, two rows of 11 cars and observed the communication between car owners and car observers. The naturalistic, unobtrusive observation reduced corruption in the data. After several hours, I began to walk through “car row” where I further observed interactions.

The second observation took place from 2:30 p.m. to 4:30 p.m. During this time, I walked through “car row” and observed communication among car observers. The observer’s gender, estimated age and rough communication content were documented in a binder.

After conducting research, an hour was dedicated to expanding the field notes. Any observations or implications

that were not documented earlier were written down in the field notes.

Gender-specific patterns in communication emerged from the grounded research; two main themes included male initiated communication and female initiated communication.

Using Boyatzis’ method of clustering and code development, raw data was reduced into understandable and manageable pieces for comparison and analysis. For example, data was reduced to the most relevant material, i.e. observer to observer communication. Common patterns emerged from the data, the most obvious theme being observer group size. Furthermore, three clusters emerged: group communication, which was three or more people, couple communication and single communication. Initially these were the emergent clusters, or groups containing items with similar qualities. The initial clusters were further explored and two main themes emerged: male initiated communication and female initiated communication. Under the main themes, subthemes were also identified. For example, a subtheme under male initiated communication was male to male communication. A code was then created based on these emergent themes. A list of the themes I identified became a tool to test the validity of the themes against the data. The code was used to direct the rest of my data.

Using the determined themes and cluster code, all observations were typed, cut into slips of paper and sorted into theme piles. It became clear that gender was more relevant as a cluster than group size. The main clusters then became male initiated and female initiated communication. Many subthemes were appropriate under the umbrella of gender. In further analysis, what emerged as important for males was with whom they were speaking. Under the male initiated cluster there was, male to female, male to male, and male to child communication dynamics. On the other hand, the conversation partner didn’t change female communication style and regardless of their conversation partner they communicated in three distinct ways. The female initiated cluster consisted of different themes, such as: questions, emotional ties and aesthetics.

The first main theme is male initiated communication. Most of the observers were males and they were mostly alone while walking through “car row”. However, when they were walking with other people there was a wide range of communication content. During the study, males discussed the mechanical specification of a car, the car

mechanics of car mechanics, taught people in their group about a car, and/or would talk about the aesthetics of a car.

The first subtheme is male to female communication. During the observations men asserted a dominant role in communicating with women. Males conversed in a teaching manner. Also, male observers would tell a story about their connection to a car or discuss their desire for a car. An example of a teaching moment in my data was a conversation between a male and female around the age of 50. The male said to the woman, "Look at that boiler." Based on the latent content, the male was showing that he knew it was a boiler and he wanted his wife to know that he knew it was a boiler. Another example, was between a male and a female, the male said to the female, "That's a Firebird right there." In this example, the male observer conveyed a "lesson" to the female observer.

The second subtheme is male to male communication. After examining how males communicate their knowledge of cars to their female counterparts, the second subtheme emerged focusing on how males would communicate that knowledge to one another. The data illustrated that male to male communication was more egalitarian and conversation topics consisted of discussing car mechanics, car history or car aesthetics. The most talked about was car mechanics. An example of car mechanics is when a group of about 3 men, around the age of 45, stood around a car and talked about the specific car's engine. The second style of communication is car history. An example of the style is when a clump of three men, ages ranging from 45-70, discuss the history of the Firebird and how the car changed over time. The third style of communication is car aesthetics. An example of male to male communication about car aesthetics is when two males, both around age 35, talked about a black car. One male said, "Looks like they forgot to put a clear coat on that one...I don't like it." The one male made a statement indicating he knew about the different types of car finishes.

The third subtheme is male to child communication. From the data, father figures appear to feel they have a duty to pass on their knowledge of cars to their children. Male to child communication involved "teaching moments" about the history or car mechanics of a car. They would also engage in storytelling about their connection to a car. An example of the connection between male, child and car is when a grandson, age 12, asked his grandfather about the Model T, in the nostalgic car show. The grandson asked, "Do you remember this one, grandpa?" and the grandfather responded by telling him the history of the car.

The second main theme was female initiated communication. With the perception that males hold the most knowledge of cars, it was interesting to see there were emergent patterns in the female communication. In fact, females initiated conversation with questions in which the communication was emotional and females generally talked about aesthetics rather than the mechanics of a car. The

first subtheme observed was that many female initiated conversations began with a question, such as, "What do you think of that car?" or "What type of car is that?" To show how often questions were used, out of the 28 conversations I placed in the female initiated theme, questions were used in 11 conversations.

The second subtheme consists of emotional communication women use when they initiate conversations. "Emotional communication" occurred when women initiated conversation by using words like "like" or "love" or related the car to a personal memory rather than talking about the car and its mechanics. For example, a woman, age 50, was discussing her memories of the car with a man, age 50. She said, "My parents had this car when I was 13." She also said, "I sure loved that car." This shows that she has an emotional tie to the car that males didn't express in the research. The females in my study were more connected to the cars emotionally. They were less interested in how a car worked and more in how a car made them feel.

The third subtheme centers on female discussion of aesthetics. Study results indicated that females communicated more about how the car looked than about emotional connections or asking questions. Women made statements about the aesthetics of the car rather than the mechanics which men emphasized. For example, one woman, age 35, told her family, "Oh that one looks nice." In another example, a female, age 25, told her male companion, age 25, about the color of a certain car. In this research, the statements or questions women made were more superficial and the statements men made tended to be more complex including explanation and justification.

Conclusion. Based on these findings, context was not an important factor in influencing gender and communication style. In the KSF Nostalgic Car Show, males communicated more about the mechanical or technical aspect of cars while the communication of females was more aesthetically based. Based on the findings of this research, females and males at the KSF Nostalgic Car Show communicated in stereotypical manners consistent with research on general biological sex differences in communication.

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Sources of Upper Permian Sedimentary Rocks in the BogdaMountains, NW China

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Abstract. Both distant Tianshan suture zone and proximal local horsts are possible sources of Upper Permian sedimentary rocks exposed in the BogdaMountains. The Abundance of volcanic grains indicates the former was the main source. Paleocurrent direction further suggests the sole main source located to the south, which is consistent with that the Tianshan suture zone is the main source. Sandstone petrographic data show two petrofacies, A and B (QFL = 5:7:88 and 32:8:60). The change from A to B suggests that the Tianshan suture zone evolved from an undissected to a transitional arc during unroofing; upsection increase of phaneritic clasts (from 3 to 14%) in conglomerates supports the interpretation.

1. Introduction

The composition and texture of sediments filling a half-graben can be used to infer the lithology, location, and unroofing history of sediment source(s). The Tarlong-Taodonggou half-graben was developed in a shear-related rifting zone, and was filled with fluvial-lacustrine sediments during Permian [1, 2]. Both distant Tianshan suture zones and local horsts were possible sources. Petrographic, paleocurrent, and stratigraphic data are used to evaluate the relative contributions from the two sources, and to reconstruct the unroofing history of the main source.

2. Methodology and Data

A 424-m-thick stratigraphic section was measured at a cm-dm scale. On the basis of lithology, sedimentary texture and structure, stratal contact and vertical stacking pattern, depositional environments are interpreted; and 214 high-order cycles (HCs) are defined by systematic environmental changes and classified into three categories – meandering stream, lacustrine delta, and lake margin-littoral. Lithology and tectonic setting of sources are inferred through sandstone and conglomerate petrography. 1500 point-counts from five lithic arenites show two petrofacies, A and B, with QFL ratios of 5:7:88 and 32:8:60, respectively (Fig. 1). Petrofacies A occurs in four deltaic/littoral lithic-arenites in the lower ~320 m; petrofacies B in one deltaic lithic-arenite in the uppermost part of the section. Lithic grains are dominantly felsic, intermediate, and mafic volcanic grains. 2060 point-counts from four conglomerates are dominantly igneous clasts (96%), among which phaneritic clast increases upsection from 3 to 14%. 134 paleocurrent data were collected from tabular and trough cross-beddings, groove marks, parting lineations, asymmetric ripple marks, oriented petrified wood, and imbricated clasts (Fig. 2). The mean paleocurrent direction is 350°; and the mode is in the range of 320-340°. The mean paleocurrent directions from sandstones containing petrofacies A and B are 355° and 303°, respectively; and those from fluvial and deltaic deposits are 345° and 353°, respectively.

3. Implications

The abundance of volcanic grains in sandstones and conglomerates suggests the Tianshan suture zone as the main source. The rarity of quartz and siliciclastic grains suggests the local horsts as a minor source. The presence of metamorphic and chert grains derived from metamorphic and marine carbonate rocks in the Tianshan suture zone supports the interpretation. Moreover, the overall northward paleocurrent direction suggests a single source to the south, where the Tianshan suture zone was located.

Petrofacies A indicates the Northern Tianshan as an undissected arc in the suture zone, whereas petrofacies B indicates a transitional arc [3]. The change from A to B suggests the removal of volcanic cap and gradual exposure of the underlying batholithic basement, as indicated by the increase in phaneritic clasts, during the process of unroofing of the Tianshan suture zone. The difference in paleocurrent direction between petrofacies A and B suggests that they may have had different areas within the suture zone. The more diverse paleocurrent directions of deltaic deposits in comparison to fluvial deposits may have been caused by distributary flows on delta plains.

4. Conclusions

Sediments in the Tarlong-Taodonggou half-graben were mainly derived from the distant Tianshan suture zone. The contribution from local horsts is negligible. The unroofing of North Tianshan arc occurred first by removal of the volcanic cap, followed by gradual exposure of the batholithic basement during Late Permian.

5. Acknowledgements

We thank J. Li, Y. Yang, X. Cheng, H. Tian, W. Chen, D. Fu, W. Li for field assistance in the summers of 2008 and 2009. The project was partially supported by AAPG Grants-in-Aid, Dora Wallace Hodgson Summer Graduate Research Grants from WichitaStateUniversity, and Kansas Geological Foundation. We are grateful to Dr. Wan Yang's mentoring and encouragement.

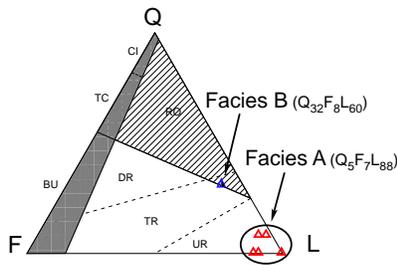


Figure 1. Ternary diagram showing QFL composition of sandstone framework grains. Two petrofacies are recognized on the basis of their distribution on the ternary diagram. Petrofacies A falls within undissected arc region, suggesting a source area of volcanic arc during its initial unroofing stage; petrofacies B within transitional arc region, suggesting underlying intrusive rocks were partially exposed [3]. CI: craton interior; TC: transitional continental; BU: basement uplift; RO: recycled orogen; DR: dissected arc; TR: transitional arc; UR: undissected arc

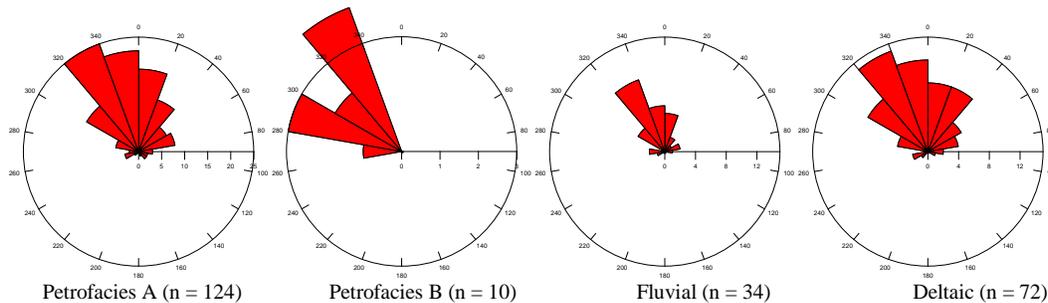


Figure 2. Rose diagrams showing paleocurrent directions from petrofacies A and B, and fluvial and deltaic deposits.

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Ankle Range of Motion and Vertical Jump Height are not Affected by Six Weeks of Static Gastrocnemius Stretching

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Abstract. The purpose of our research study was to examine the effects of a 6 week chronic static stretching program on gastrocnemius flexibility and vertical jump height. Twenty-five students participated in this study. Subjects were tested for bilateral ankle ROM and vertical jump height at 0, 3, and 6 weeks. The protocol consisted of four stretches, for five repetitions, done once a day, 5 days a week, for 6 weeks. The results showed that there was no significant difference ($p \leq 0.05$) in ROM and vertical jump heights between the beginning and end of the 6 week stretching program. No significant correlations were found between change in ankle ROM and change in vertical jump height.

1. Introduction

Stretching is often utilized in rehabilitation and conditioning programs as a means to improve performance; however, the research to support this practice is very limited. Our study was intended to provide evidence either in support of, or against this common practice, so that physical therapists and other health professionals can provide meaningful, effective, and efficient services to their patients and/or clients.

Previous research on this topic indicates that acute stretching is detrimental to performance [1]. The research on the effects of a chronic stretching program is more limited [1,2]. Studies have been conducted on how hamstring stretching or general lower extremity stretching affects various aspects of performance [2]; however, published literature revealed no studies that looked specifically at the effect of static gastrocnemius stretching on vertical jump performance.

2. Experiment, Results, Discussion, and Significance

Methods

Each subject began warming up by riding a stationary bike at a comfortable speed for 3 minutes. Subjects were measured for passive ankle dorsiflexion. The subjects performed a stationary vertical jump, and the subject was instructed to “slap” the highest possible vane on the Vertec Vertical Leap. The highest of the three jumps was recorded.

A stretching program was then given to each subject to stretch the gastrocnemius for 6 weeks. The subjects were instructed to perform each of the 4 stretches for 5 repetitions, once a day, 5 days a week, for 6 weeks. Each repetition was to be held for 30 seconds, with a 30 second rest period between repetitions. Each subject returned and performed the jump testing again at 3 weeks and at 6 weeks following the initial testing session, along with another measurement of ankle dorsiflexion.

Subjects

Twenty-five healthy college aged subjects (mean age \pm SD, 22.6 \pm 1.80 y; 16 female, 9 male) voluntarily participated in this study and provided written consent. Subjects were not allowed to participate if they were affected by a hip, knee, or ankle pathology or surgery from which they were still recovering. The assignment of each subject was the same.

Results

The variables measured were right and left ankle ROM, maximum vertical jump height, and self-reported compliance. The subjects showed no significant increase or decrease in ankle ROM or vertical jump height over the 6-week period. Self-reported compliance was measured as the number of days out of 30 that subjects performed the prescribed stretching program. Only 19 subjects provided compliance information (mean \pm SD, 20.47 \pm 4.43).

No significant correlation was found between change in right ankle ROM and change in vertical jump height (-0.079). There was also no significant correlation between change in left ankle ROM and change in vertical jump height (-0.261). There was a significant correlation between change in right ankle ROM and change in left ankle ROM (0.843). Inclusion or exclusion of compliance data as a covariate did not change the significance of any data.

Discussion

The results of our study show that chronic static stretching of the gastrocnemius has no effect on ankle ROM and vertical jump height. However, the 6 week stretching protocol did cause a small non-significant increase in both right and left ankle ROM.

We originally hypothesized that the 6 week stretching program would result in increased ankle ROM of both the right and left ankles. The unexpected result, of no significant change in ankle ROM, could be due to many factors: compliance, clarity of protocol, ceiling effect, dropouts, and facilities available.

3. Conclusion

The results showed that there was no significant difference ($p \leq 0.05$) in ROM and vertical jump heights between the beginning and end of the 6 week stretching program. No significant correlations were found between change in ankle ROM and change in vertical jump height. Based on the results from our study and conflicting evidence within the literature, further research is needed to determine if a relationship does exist between chronic static stretching, flexibility, and vertical jump height.

4. Acknowledgements

The authors would like to thank Dr. Jeremy Patterson for the use of his performance laboratory in which we performed our research. We would also like to thank Dr. Barb Smith for her assistance with data analysis. Finally, we would like to thank Nicholas Walton for allowing us to recruit students from his classes for our research study.

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The Development of Ottoman Ceramics

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Abstract. Many of the world's ceramic objects can trace their aesthetic lineage to one source, Ming Dynasty export porcelain. Turkish or Ottoman ceramics is a tradition that drew inspiration from luxury goods acquired through trade along the Silk Road. Centrally located between Asia and Europe, Istanbul, the former capital of the Ottoman Empire became a trading center for these wares. An entire genre of ceramic work was produced in reference to these vessels. My research shows the influence of Chinese imports as the spring board for the development of Ottoman ceramics, by examining the advances in material experimentation and the interdisciplinary collaboration between artisans and design guilds, that in turn made these Iznik ceramic vessels and tiles so distinguishably Turkish.

1. Introduction

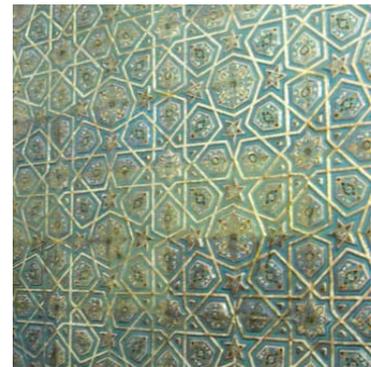
My personal and academic interest in Islamic ceramics developed through looking at different ceramic traditions in search for my own artistic voice and direction. During the summer of 2009 a month long trip to Turkey solidified that interest and admiration. Upon further scholarly investigation, and a return trip to Istanbul this Fall I discovered that I was taught to research and use historical influences in my work, much like the artisans of the Ottoman tradition did. The openness to sharing information between educational and artistic institutions in Ottoman Turkey closely resembles the current attitude in the ceramic community of academia. By examining early Ottoman ceramic wares that are literally replicas of Ming Dynasty porcelain and following the changes over the 15th and 16th century, we see the dramatic advances in new colors, and the complexity of motifs and meanings as the full development of an original Ottoman style

2. Experiment, Results, Discussion, and Significance

While traveling in Turkey with students and professors from Western Kentucky University I saw many examples of Ottoman and Islamic ceramic art. Visiting the infamous Topkapi Palace, Hagia Sophia and the Blue Mosque, to lesser known medieval Ottoman Mosques and the Museum of Islamic Art, I observed and documented much of the historical ceramic art that Istanbul had to offer. Traveling south of Istanbul to Bursa, I observed examples of the beginnings of that ceramic tradition. Safavid style monochrome relief tiles cover the interior walls of the Imperial Mosque of Mehmed 1. In the elevated sultan's prayer quarters the tiles were cut and arranged into complex patterns that represented the eternal and expansive oneness of God. These tiles were turquoise in color with gold inlay; the theological content is a reoccurring theme in nearly all Islamic art. (Figure 1. Below)



After the capture of Constantinople, (Istanbul) in 1521 the bridge between East and West was complete; the Ottoman Empire controlled the center point of the Silk Road. As a result of this strategic economic location, an admiration of Chinese blue and white porcelain. (Figure 2. Left) as a luxury item began to influence the development of an Ottoman Islamic style. Many replicas of these Ming Dynasty wares were being produced by workers in Istanbul to



meet the demand in the Imperial court. Through requests by the Sultan to the Royal Design Workshop, or "Nakkashane", new designs based on Chinese ceramics were drawn by calligraphers to help create revenue from within the Empire. The typical "Hatayi" motifs of Ming Dynasty porcelain were lotus blossoms, palmettes, dragons and flames. These designs were replaced by continuous patterns of local garden vegetation, and plants associated with the Islamic ideology of a heavenly Garden of Paradise. Motifs of this type began to appear on table wares and

wall tiles produced in the established pottery town of Iznik, which would soon become the center of all Ottoman ceramic production during the 15th and 16th centuries. Responsible in part for this change was the Ottomans well established systematic approach to education. Earned experience through the guild, coupled with collaboration between artisans, and advancement by merit and achievement created a standard of technical excellence unsurpassed by other artisans of the day. The development began by encouraging scholarly research on existing Imperial ceramic collections of Ming Dynasty porcelain by the artisans themselves. Do to an interdisciplinary collaboration between artisan's guilds, many examples of ceramic, glass, wood, metal and stone artifacts of Ottoman origin are heavily embellished with Arabic calligraphy. The rise of Islam as the official religion of the Empire made the art prolific. The Holy Qur'an forbids the use of the figure in religious art, in response the decorative arts flourished in the place of sculpture and painting. Inscriptions from the Qur'an are seen in all mediums but especially in ceramic tiles. Thuluth is the style associated with Ottoman ceramics and is characterized by tall and graceful vertical letters. (Figure 3. Below Left) the admiration of Chinese blue and white porcelain had direct influence in the emergence of this style. Nearly all ceramic examples of this script are blue on a white ground or white on a blue ground. From innovations made by court designers in Istanbul and tile makers in Iznik the new style of floral patterns and religious script would gain fame around the world as the decorative element chosen to cover the interiors of the Islamic world's most sacred shrines and Mosques. Lacking the materials and high temperature kiln technology to produce true porcelain, the Iznik potters and tile makers developed white clays that resembled Ming porcelain and was fully



matured at a lower temperature. Because of this lower temperature, and firing method a whole array of color options developed that would eventually define Ottoman ceramics.

The decorative elements that made Iznik Ceramics popular in the blue and white phase could now be produced in vivid new colors including tomato red, emerald green, olive green, pale purple, and amber. This expanded color sensibility pushed the context of the floral patterns to a new level. Most of the interior walls in Mosques and public buildings built in Istanbul during the 15th and 16th centuries are embellished with a variety

of Iznik tiles.

Conclusion.

While traveling with WSU to Istanbul this Fall I gained a greater awareness of University and academic philosophy in its most general terms. I started to see the world of academia as a figurative "Silk Road" or a place that fosters the many varieties of disciplines that all come together to form a community. Just as Istanbul was a center of trade for blue and white porcelain, bringing an awareness of Asian culture to Europe, a research University is an institution where knowledge is shared openly and freely between disciplines. Cultivating ideas to be shared with our students and professors alike not only enriches our perspective fields of study but the University as a whole. I am comparing the Nakkashane (Royal Design Workshop) and artisan guilds to a contemporary research University. Had I not been part of this University I might never have researched Turkish ceramics to this extent. Finding the similarities between cultures and artistic disciplines is for me the next step towards planting seeds for the future. Through my shared experience in Turkish ceramics I hope to contribute to the sense of community at Wichita state University. The relation to our current artistic educational philosophy to that of the Ottomans is one that cannot be denied. Had the Nakkashane (Royal Design Workshop) never formed, the history of Ottoman ceramics would have been much different in comparison. The rich and advanced display of shared knowledge that the Ottomans cultivated so long ago is what a research school such as WichitaStateUniversity does for the academic community.



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Benefits of the Wii Fit as an Exercise Program for Older Adults

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Purpose: To determine if Wii Fit is an effective older adult exercise program compared to a traditional exercise program (TRAD) with respect to functional fitness (FF) and balance. Wii Fit women (n=4) were matched on multiple variables to TRAD subjects (Ss)(n=4) and a control group (CON)(n=4). Interventions were 8 weeks and consisted of flexibility, strength, and balance training. Wii group followed the Wii program and TRAD participated in traditional classes. Pre and post measures included FF and balance. Results were evaluated using qualitative comparison. No baseline difference existed. With respect to FF, TRAD exhibited largest changes. With respect to balance, Wii exhibited similar large changes. Using Wii Fit appears to be as effective as TRAD for balance.

Introduction: There have been increasing concerns in recent years about falls in the older adult population. Blake, A.J, et al [1], found that 53% of falls by older adults resulted from tripping as a consequence of decreased muscle strength and balance. Therefore, exercise to increase balance and muscle-strength is warranted in prevention of falls in this population group.² The Wii Fit is an interactive gaming system that offers programs to increase strength, endurance, balance, and flexibility. The goal of this paper is to determine if the Wii Fit can improve functional fitness (muscle strength, cardio-respiratory endurance, flexibility) and balance in the older adult when compared to a traditional exercise class and control group. If successful, Wii Fit could benefit homebound populations, or individuals with no access to exercise facilities. Research is warranted to determine and quantify the physiological benefits of video game technology for the older adult, as there are currently no published studies. Results of the project could be useful in development of physical activity programs for older adults. It is hypothesized that the Wii Fit will improve functional fitness and balance in the older adult population as much as or more than the traditional exercise group.

Subjects: Four Females 65 years of age or older, who were community dwelling, active and able to get to a community center were recruited. Excluded from the study were those with pacemakers or seizure conditions, as these were contraindications of the Wii Fit. Also excluded were individuals whose physical or mental health would prevent them from performing the experimental protocols as determined by the EASY (Exercise And Screening for You).

Instruments: The instrument used for pre - and post- balance assessment was the Basic Balance Master by Neurocom. The Limits of Stability assessment was used to determine the maximum distance a person can lean in 4 directions without falling or reaching for assistance. Data collected included: End Point Excursion (EPE), Maximum Excursion (MXE), Movement Velocity (MVL), Directional Control (DCL) and Reaction Time (RTO). Functional fitness measures included the 30 second chair stand, 30 second arm curl, timed 8-foot up and go, and a 12 minute walk. General measures of height, weight, and body mass index (BMI) were also assessed.

Procedures: This was an 8-week intervention study, utilizing the Wii Fit gaming system and corresponding balance board. The Wii Fit was offered at a local senior center twice per week for 40 minutes and included flexibility (yoga), strength training and balance training with balance games, and cardio-respiratory training. All participants completed a Wii Fit familiarization session prior to starting interventions. Program progression involved increasing repetitions and sets of exercises and adding new or more difficult fitness components. Three sets of workouts (easy, moderate, difficult) were designed with the Wii Fit exercises. Participants progressed to more difficult exercises every two weeks based on ability and safety. Wii Fit uses an animated on-screen Wii Fit trainer, to provide one-on-one instructions to guide participants. Researchers also supervised to ensure safety and correct performance.

Data Analysis & Results: Four females (71 ± 8 years) participating in the Wii Fit group and were compared to 4 females (71 ± 8 years) participating in a traditional physical activity program, and 4 females serving as a control group (75 ± 1 year). Participants in the traditional and control group were drawn from larger programs allowing Wii Fit participants to be matched on the pre-measures of age, BMI, arm curl and chair stand. General physical

measures, functional fitness, balance, and a one-week daily activity assessment (steps) were completed prior to intervention and after eight weeks. Due to small sample size, quantitative analysis would yield little meaningful information and results were evaluated using qualitative comparison. Percent change was calculated and group change was compared (Table 1). With respect to functional fitness, Wii exhibited little change whereas, the traditional group exhibited large changes, especially on measures of strength. With respect to balance, Wii exhibited similar large changes compared to the traditional group and on some measures exceed the traditional group. The Wii group exhibited greatest balance improvement while leaning backward, showing superior improvements over the traditional group on endpoint excursion, maximum excursion and directional control.

Discussion: Results supported the hypothesis that the Wii group would improve on balance compared to traditional and control groups. In fact, the Wii group showed larger improvement on many balance measures compared to the traditional and control groups. Wii participants also improved similarly on the functional fitness measures of Up & Go and 12-min walk. However, the Wii group did not improve strength as measured by the arm curl and chair stand. This finding is not surprising as the Wii gaming system focuses more on balance and cardio activities. It should also be noted that many of the Wii strength exercises required using the body for resistance and were generally too difficult for the older adults to perform.

Limitations: This study did not include enough participants to allow for quantitative analysis. Due to participants being community dwelling, participation in every session was not guaranteed. Transportation and convenience for participants could have been a factor due to location. Following the progression schedule was difficult because of restrictions of games and activities on the Wii console. The study had 2 males originally, but one did not attend the posttest and the data of the other male was thrown out due to inability to match him to males in the traditional and control groups. Two subjects were in the same room at a time during Wii interventions, therefore, distractions and volume could have limited their performance. The generalization of this study is limited due to the small sample size and female sample.

Conclusion: This research study did not yield a significant difference between groups due to small sample size. The results do indicate that future research is warranted and that with a larger sample size significant differences may be expected. Results of this pilot study suggest the Wii Fit could be used as an effective tool for improving balance in healthy, older adults.

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Table 1: Percent Changes for Balance Measures

	Reaction Time %Δ			Mean Velocity %Δ			End Point Excursion %Δ			Max Excursion %Δ			Directional Control %Δ		
	Wii	TRAD	CON	Wii	TRAD	CON	Wii	TRAD	CON	Wii	TRAD	CON	Wii	TRAD	CON
Front	-24	-17	7	18	5	4	26	23	-7	25	14	3	9	8	4
Back	-16	-16	-4	32	36	2	17	17	-10	22	24	9	39	2	4
Right	-20	-23	9	58	24	4	3	-6	-19	2	0	-11	4	1	1
Left	-37	-20	-9	43	24	12	9	4	-10	7	12	-9	7	4	-1

Table 2: Percent Changes for Functional Fitness

	Wii %Δ	TRAD %Δ	CON %Δ
Arm Curl	5	48	6
Chair Stand	11	59	0
Up & Go	-11	-14	3
12 Min Walk	10	9	0

Kansas Pharmacists' Attitudes/Beliefs and Current Practices Regarding Implementation of Fall Prevention Strategies In Older Adults

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Abstract. Falls among older adults are a significant economic and social health care issue. Evidence-based fall prevention guidelines exist but are not routinely implemented. *Purpose:* Evaluate Kansas pharmacists' attitudes/beliefs, current practices, and barriers/facilitators regarding implementation of fall assessment and prevention strategies in older adults. *Methods:* A 67-item, non-validated survey was mailed to all 2,601 registered Kansas pharmacists in 2010. *Results:* 97% of pharmacists believe falls are a significant public health problem and >90% believe falls are preventable. Although 89% believe they have a professional responsibility to perform medication reviews, only 33% routinely do. *Conclusions:* Most pharmacists believe falls are a significant preventable health problem; however, few currently implement fall prevention strategies in daily practice.

1. Introduction

Falls are the leading cause of injury related death and nursing home placement in older adults (age 65 years).[1] An estimated one in three older adults falls each year and of those, 20% - 30% will have impaired mobility and independence. Hip fractures are especially devastating; 25% will die within one year of the fracture and 40% will be unable to live independently.[2] Older adults in rural communities face additional challenges of physical and social isolation, increased poverty rates, reduced availability of health care and medical resources, and transportation issues making maintenance of physical independence even more necessary to independent living.[4]

Evidence-based fall prevention guidelines exist; however, implementation is less than optimal.[5,6] CDC and National Council on Aging (NCOA) identify four key fall prevention strategies: 1) evaluating and resolving medication issues, 2) increasing regular exercise, 3) home safety evaluation and modification, and 4) screening for vision problems.[2,3]

Although the effectiveness of fall prevention strategies have been studied in isolated, researcher-driven situations, little is known about the translation of this evidence into clinical practice.[5] Health care providers' attitude/beliefs, barriers to implementation and other possible reasons for underutilization has not

been well studied. Pharmacists' can play a vital role as a health care provider, particularly as their experience and input to the health care team translates to safe and optimal medication use in older adults.

Study Purpose

The study purpose is to evaluate the attitudes/beliefs and current practices of Kansas pharmacists regarding fall assessment and prevention strategies in older adults as well as barriers/facilitators to integrating these strategies into daily clinical practice.

2. Methods, Results, Significance

Methods

Study Design, Setting, and Population: This cross-sectional study surveyed 2,601 registered Kansas pharmacists; addresses obtained from the Kansas State Board of Pharmacy. Surveys were mailed in January, 2009. Survey collection is still underway.

Survey Description: Survey content was based upon fall prevention consensus guidelines and data regarding perceived barriers/facilitators to implementation. The non-validated, 67-item survey asked about respondent characteristics, attitudes/beliefs, current practices, and barriers/facilitators. Attitudes/beliefs were assessed using a 4-point Likert scale ranging from "strongly agree" to "strongly disagree." A 4-point Likert scale, "never," "sometimes," "frequently," and "always" was used to assess current practices.

Data Analysis: Survey analysis is still underway; to date n=265; a 10% response rate. Data were analyzed using SPSS and *t* test, chi-square, and ANOVA as appropriate; statistical significance was set at $p \leq 0.05$.

Results

Respondent Characteristics: The mean age was 51 ± 15 years old with 45% being female. Mean number of years in practice was 26 ± 15 years. The pharmacists represent a variety of settings including chain retail (36%), independent retail (24%), hospital (24%) and

community sizes: 30% work in a community of \geq 300,000 and 38% in a community of $<$ 50,000.

Table 1: Attitudes and Beliefs	
As a pharmacist, I believe...	Agree
Most falls in older adults are preventable	86%
Most older adults do not report falls out of a fear of losing independence	87%
Fall prevention programs, like other programs in the community should be funded by the state	43%
Screening for fall risk should be as routine as screening for other medical problems	93%
I believe it is difficult to provide fall-related preventive care to...	
patients with a different cultural background	56%
patients who seem healthy	75%
patients with a low socio-economic status	47%
patients rarely visiting the practice	87%
Regarding fall prevention in older adults, I would be willing to routinely...	
engage in further educational opportunities	90%
educate my patients regarding fall prevention	85%
evaluate meds with a focus on fall prevention	94%
check vision or refer to an ophthalmologist	66%
ask about exercise habits	55%
recommend strength / balance exercise programs	66%
refer patients for a home safety evaluation	69%

Attitudes and Beliefs: Overall, 97% of pharmacists felt that falls in older adults are a significant health concern. Pharmacists felt most falls could be reduced by routine review of medications (94%), vision screening (92%), balance/strength exercise programs (97%), and home safety evaluation and modification (97%). The majority felt it was their professional responsibility to routinely review medications with a focus on fall prevention (89%) but only 55% felt it was their professional responsibility to ask about recent and past falls. Regarding expected patient compliance, pharmacists felt older adults would be compliant with medication changes (85%), vision screening (75%), exercise (40%), and home safety (66%). See Table 1 for additional responses to attitudes/beliefs questions.

Table 2: Current Practices

Currently, I address fall prevention in my older patients by...	Always or Frequently
asking about recent and past falls	9%
reviewing meds with a focus on fall prevention	33%
decreasing/eliminating meds that increase fall risk	23%
assuring vision evaluations	5%
asking about exercise habits	9%
recommending strength/balance exercise programs	8%
referring for home safety evaluations	6%
refer to fall prevention education/programs	2%

Current Practices: Pharmacists are most likely to engage in medication-related fall prevention strategies. See Table 2.

Perceived Barriers: When asked to indicate the reasons why fall prevention strategies were not currently implemented in patient encounters, the following were checked: unprepared to conduct fall screening (48%); lack of time (43%); lack of support staff (33%); unprepared to conduct fall focused medication reviews (17%); and not my responsibility (11%).

Significance

This study demonstrates that although most Kansas pharmacists believe that fall prevention in older adults is possible and important, especially by identifying and resolving medication-related issues, most do not implement fall prevention strategies into their daily practice. The majority are willing to engage in further educational opportunities and are willing to routinely implement fall prevention strategies including and beyond medication review, however there is a lack of time, support staff, and knowledge.

Further education is necessary to increase the use of fall prevention strategies by Kansas pharmacists. To be successful, this education should attempt to address the barriers identified in this study. The education should discuss strategies that are efficient, systematic, scientifically based, and realistic for implementation across a variety of practice settings where medical and support resources are often limited.

3. Conclusions

Most Kansas pharmacists believe falls are a significant preventable public health problem in older adults; however, few currently implement fall prevention strategies in their daily practice.

4. Acknowledgements

Other research team members included: Kayla Keuter, Gina Berg, Sue Nyberg, Ken Bethel, and Shelton Fraser. This project was fully funded through a WSU Regional Institute on Aging Gridley-Hoover Award.

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Bone Mineral Density and Body Composition Assessment In Individuals with Severe Mental Illness

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Abstract. Bone Density among the average population has been researched however little has been reported on the effects of Severe Mental Illness (SMI) on bone density (BMD). BMD of the forearm, femoral neck and body % was measured by a DXA unit (Hologic QDR 4500). 30 individuals (17 male; 13 female) with SMI (bipolar (N=14), schizophrenia (N=5), schizoaffective (N=4), major depression/depression (N=2), and other (N=5)) volunteered for the study. Total group (N=30) body fat % (37.3 ± 8.4) and BMI (32.4 ± 6.06) is significantly greater than national and state averages. Bipolar (N=14) showed the highest body fat % (39.1 ± 8.1 vs. 30.7 ± 9.4 %, $p < 0.05$).

Introduction

Bone is a living, dynamic tissue that is the single most important supportive tissue in the human body [1]. Bone strength is determined by bone mineral density (BMD) which accounts for up to 70% of total bone strength [2]. Psychiatric disorders are associated with an increased rate of premature death [3]. While a number of recent reports have investigated the risk of obesity and metabolic syndrome in patients with Severe Mental Illness, few studies have investigated other potential serious long-term side-effects such as osteopenia or osteoporosis [4,5,6]. This study was to determine the bone mineral density (BMD) and body composition (Body Fat %) of individuals with severe mental illness.

2. Experiment, Results, Discussion, and Significance

Methods: Thirty individuals (aged 21-66) with severe mental illness 30 individuals (17 male; 13 female) with SMI (bipolar (N=14), schizophrenia (N=5), schizoaffective (N=4), major depression/depression (N=2), and other (N=5)) volunteered for the study. The participants were recruited from Breakthrough (Wichita, Kansas) and all conditions were stable (no change in medication regime for three weeks prior to enrollment). The study was approved by the Institutional Review Board. Written informed consent was obtained from each subject prior to testing. Height and weight were obtained in the Human Performance Laboratory (Wichita State University), prior to the BMD scan. Bone mineral Density and Body composition were measured by a dual energy x-ray absorptiometry (DXA) unit (Hologic QDR 4500). Standard protocol set forth by the manufacturer, for the non-dominant forearm, femoral neck, and whole body scans were followed.

Results: This study was designed to measure the bone mineral density and body composition of individuals with severe mental illness, using the DEXA. Total group (N=30) body fat % (37.3 ± 8.4) and BMI (32.4 ± 6.06) is significantly greater than national and state averages. By groups, bipolar (N=14) showed the highest body fat % (39.1 ± 8.1 vs. 30.7 ± 9.4 %, $p < 0.05$), forearm and femoral neck t-scores were normal. Schizophrenia group (N=5), schizoaffective (N=4), major depression/depression (N=2), and other (N=5), body fat %, forearm t-score, femoral neck t-score were within normal range (results found in Table 1). Of the individuals with bipolar disorder 57% are currently taking one of the four drugs (Zyprexa, Abilify, Risperdol, Seroquel) found to cause excess weight gain in children and adolescents [7]. Those individuals with the diagnosis of schizophrenia were found to have the lowest t-scores in both their femoral necks and forearms.

Discussion: These participants have several risk factors other than medications to cause lower BMD and high BF%. Many of the individuals that were tested live lifestyles that can cause lower BMD and higher BF%. These can include but aren't limited to smoking, excessive carbonated soft drink consumption, consumption of alcohol, and

poor diets. . This study has found the same outcome of other studies [8,9], that antipsychotic drug treatment may cause long-term consequences that include bone loss.

Table 1: Results

	Whole Body t-score	Body Fat %	Forearm t-score	Femoral Neck t-score
Bipolar Disorder (N= 14)		39.1±8.1	-0.1±1.0	-0.1±0.8
Schizophrenia (N=5)		26.38±8.0	-0.6±1.43	-1.0±1.08
Schizoaffective (N=4)		27.33±3.8	-0.4±1.56	0.4±0.51
Major Depression (N=2)		32.8±8.13	0.8±0.42	-0.4±0.42
Other (N=5)		34.7±8.33	-0.7±0.91	-0.9±0.70
Total Group	32.4±6.06	37.3±8.4	-0.3±1.1	-0.4±0.8

Significance: The information gained in this study will be particularly beneficial to exercise professionals, medical professionals, and the participants. This is an original study that has an outcome that would be both beneficial to the general public and have a significant contribution to the scientific field. The data collected provided information that is relevant to the understanding of mental illness, the medication to control the illness, and the changes in bone density.

3. Conclusions

This pilot study adds to the limited evidence about the underserved population of severe mental illness, with results showing a decreased bone mineral density and increased body fat %. Many studies that are present are on psychiatric inpatients or on hospitalized patients. This study shows results for individuals who are living within the community with their illness. Additional research is needed to support these finding.

4. Acknowledgements

I would like to thank Breakthrough for allowing me to help their members through this study. Thank you, Ashley Fryman for the many hours that you helped me with the DXA. It made the scans go much faster and the time more manageable. I would like to thank Dr. Jeremy Patterson for allowing me to work on this project. I enjoyed it and learned so much, even though it didn't always seem that way. And finally, thank you WSU for awarding us the ULINK grant last year, which allowed this project to happen.

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Kinetic studies of protein-carbohydrate interactions at the bilayer interface of cationic vesicles

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Abstract. In this paper, we describe our work on surface functionalization and modification of cationic vesicles with an aim toward increasing their range of applications. Conventional vesicles are formed from double-tailed phospholipids and have important roles in biology. Unlike conventional phospholipids vesicles, aqueous mixtures of cationic and anionic single-tailed surfactants can spontaneously form unilamellar vesicles without sonication or extrusion. These vesicles dubbed “catanionic vesicles” in the literature are extremely stable with respect to salt and pH and are composed of inexpensive components. They are promising candidates for a variety of biotechnological applications including drug delivery and vaccine development. Our studies report that the ability to control the distribution of glycoconjugates in the vesicle bilayer surface provides a method to study protein-carbohydrate multivalent binding kinetics in a biomimetic environment. In this work, the exterior of cationic vesicles was controllably functionalized by insertion of the hydrocarbon chain of the glycoconjugate n-dodecyl- β -D-glucopyranoside (C₁₂-glucose) at varying concentrations. We demonstrate how this platform consisting of a carbohydrate functionalized bilayer can be used to evaluate binding inhibitors for the lectin ConA.

1. Introduction

Protein-Carbohydrate interactions are prevalent throughout biology and play important roles in cell-cell recognition including the infectivity of pathogens, immune response and reproduction [1]. Interactions between carbohydrates and proteins are typically weak. To provide interaction strength and specificity, it is possible for proteins to interact with carbohydrates in a multivalent fashion where more than one binding event occurs simultaneously. In biological systems, multivalent binding is facilitated by imbedded a protein or carbohydrate in cell membrane and the affinity depends on both ligand density and spatial arrangements. Double-tailed phospholipids vesicles have been extensively used as model membrane systems to study interactions at the bilayer interface. In this paper we use a novel type of vesicle developed in our lab which consists of inexpensive single-tailed surfactants and has the

advantages of superior stability and easier preparation compared to conventional carbohydrate functionalized vesicles or bilayers. We use a mixture of cationic and anionic single-tailed surfactants that can form unilamellar vesicle and add varying amounts of a glucose-based glycol-lipid. These new vesicles and our ability to vary carbohydrate concentrations over a wide range should increase their potential in biotechnological applications including targeted drug delivery and as new tools in the area of glycomics.

2. Experiment, Results, Discussion, and Significance

SDBS-rich cationic vesicles were prepared simply by dissolving 3 to 1 mole ratio mixture of surfactants sodium dodecylbenzenesulfonate (SDBS) and cetyltrimethylammonium tosylate (CTAT) in water maintaining total surfactant concentration 1 wt%. Vesicle surface were decorated by hydrophobic insertion of the 12 carbons alkyl chain of the glycoconjugate n-dodecyl- β -D-glucopyranoside (C₁₂-glucose). Various C₁₂-glucose mole fractions in the bilayer vesicle surface were obtained in the range of 0.0 to 0.05 in a controllable fashion.

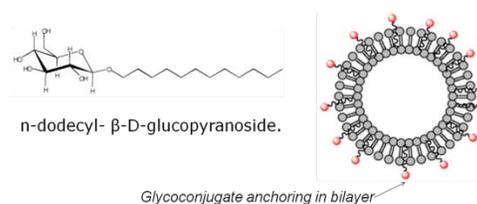


Fig 1: Glycoconjugate structure and cartoon depiction of functionalized vesicle surface.

Aggregation of this C₁₂-glucose modified SDBS-rich vesicle was observed upon addition of the lectin Concanavalin A (ConA). ConA is a tetrameric protein and has four binding sites. Strong binding between ConA and glucose occurs in a multivalent fashion when more than one simultaneous binding

event is possible. Our ability to control C12-glucose densities in the bilayer enables us to find the C-12 glucose densities where multivalent binding is enabled. This method provides us a way to determine the effective binding site separation distance of ConA and glucose [3].

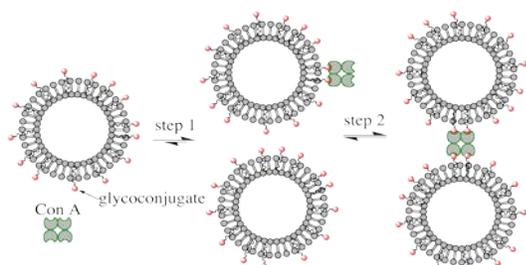


Fig 2: Cartoon depiction of ConA induced aggregation of functionalized vesicle.

ConA induced aggregation was monitored by turbidity change in a stopped-flow instrument after rapid mixing with functionalized vesicles. Kinetic assay of aggregation was obtained from turbidity at 450nm as a function of time. Binding kinetics were monitored by evaluating the initial binding rate from the first half second of a kinetic plot. A linear regression was applied to acquire the initial rate of ConA-glucose multivalent binding.

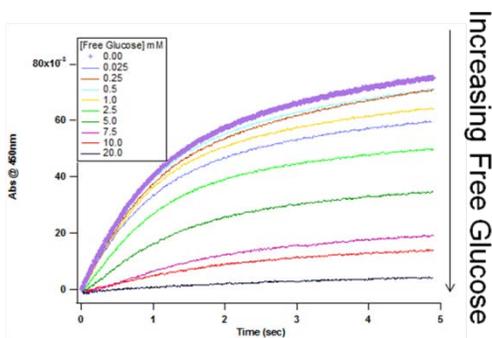


Fig 3. Inhibition binding assay of ConA and C12-glucose imbedded in catanionic vesicle bilayer by addition of free water soluble glucose in buffer.

To evaluate the role that the bilayer plays in facilitating multivalent binding, competitive inhibition experiments were conducted using free glucose in solutions. In this experiment, free glucose was added in the vesicle sample prior to rapid mixing with ConA in the stop flow instrument and inhibition binding assay was obtained. Figure 3 shows that binding rate decreases uniformly with the increasing concentration of free glucose inhibitor. Results shows that 100% inhibition occurs at free glucose concentration 20.0 mM when concentration of bilayer c12-glucose is about 0.035 mM. The result shows that roughly 600 times more inhibitor free glucose is required to completely inhibit multivalent binding of ConA and glucose illustrating how important the bilayer is in facilitating multivalent binding.

3. Conclusions

Catanionic vesicle of CTAT-SDBS system has been functionalized in a controlled fashion for kinetic studies of ConA-glucose multivalent binding. This method can be a model platform for investigating multivalent binding. Also this system can be a useful tool in evaluating competitive inhibitors of multivalent binding.

4. Acknowledgements

This work was supported in part by a grant from the NSF (CTS-0608906) and by the Wichita State University Foundation.

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Academic Performance in Middle School: Friendship Influences

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Abstract. The results of this study build on previous research findings demonstrating relational significance of peer influences to academic performance during adolescence. Whereas family, teachers, and peers play a significant role in a student's academic career, extant literature about the relational dynamics between peers and academic achievement remains scarce. This study evaluated the constructs of social support and negative interchanges in relation to academic performance. Additionally, students' gender, race, and perception of a friend's level of school interest were measured. The sample consisted of 321 participants in the 6th, 7th, and 8th grade from three public middle schools in the Midwest. Results supported the hypothesis that adolescents' relationships with peers influence academic performance.

Keywords: academic performance, peer relationships, early adolescence, social support, negative interchanges

The Role of Peers to Academic Performance

Upon entry to middle school, young adolescents experience contextual, physiological, relational, and cognitive changes associated with early puberty (Eccles, Wigfield, Midgley, Reuman, MacIver, & Feldlaufer, 1993). Research demonstrates that students who have a reciprocated friendship in middle school show increased levels of prosocial behavior and academic achievement (Wentzel, McNamara, & Caldwell, 2004). Hence, friendships may serve as a protective factor for academic performance. Other studies indicate that students who associate with friends who reject school are more likely to perform poorly academically (Veronneau, Vitaro, Pederson & Tremblay, 2008; Nelson & DeBacker, 2008). These students may be at increased risk for substance use, violence, pregnancy, and general school failure (Fergusson, Woodward, & Horwood, 1999).

The Current Study

The literature on relational dynamics between peers and academic achievement remains scarce. Existing preventive intervention programs that exclusively focus on building healthy peer relationships do not exist. The Peer/Performance Relationship Study (P/PRS) enhances understanding of the nature of the relationship between peers and academic performance. The current study operationalizes the term "peers" as friends who are of the same and opposite gender.

Method

Participants were recruited from the 6th, 7th, and 8th grade from three medium-sized suburban, public middle schools in the Midwest. The sample consisted of 321 participants of which 49% were male and 51% were female. Caucasians comprised 82.6% of the total sample population. The overall response rate was 19.7%. Only students who submitted signed parental consent forms were allowed to complete the questionnaire. The P/PRS consisted of 52 questions. Social support and negative interchanges were measured by sub-scales of the Network of Relationships Inventory (Furman & Buhrmester, 1985). Academic performance was measured as a grade point average of the scores for four academic disciplines.

Results

Assumptions of normality, linearity, and homoscedasticity were met.

Are Social Support and Negative Interchanges Related to Students' Academic Performance?

Correlations Among Variables. Table 1 shows the means and standard deviations for the constructs under social support, negative interchanges, and academic performance. Table 2 describes zero-order correlations for these factors along with level of school interest. The factor of social support was significantly and positively related to academic performance, $r = 0.23$ and $r^2 = 0.05$. This is a moderate effect size and indicates that 5% of the variance of academic performance is accounted for by its linear relationship with social support. All social support constructs were significantly and positively related to academic performance. The factor of negative interchanges was not significantly related to academic performance. The level of school interest was significantly related to social support, $r = 0.16$.

Table 1

Means and Standard Deviations for Social Support, Negative Interchanges, and Academic Performance

Factor	<i>M</i>	<i>SD</i>
Social support		
1. Companionship	2.99	0.86

2. Instrumental aid	2.78	0.89
3. Intimacy	2.79	0.97
4. Affection	3.13	1.02
5. Admiration	3.39	0.96
6. Reliable alliance	3.63	0.96
7. Support	3.18	1.01
8. Satisfaction	3.99	0.91
Negative interchanges		
9. Conflict	1.62	0.61
10. Antagonism	1.75	0.75
11. Criticism	1.48	0.63
12. Dominance	1.87	0.70
13. Punishment	1.47	0.63
Academic performance		
14. GPA Reading	3.50	0.66
15. GPA Mathematics	3.45	0.69
16. GPA Social Studies	3.43	0.70
17. GPA Science	3.55	0.60

Table 2

Zero-Order Correlations for Interest in School, Social Support, Negative Interchanges, and Academic Performance Variables

Variable	Interest in School	Social Support	Negative Interchanges	Academic Performance
Interest in School	-			
Social Support	0.16**	-		
Negative Interchanges	-0.07	-0.01	-	
Academic Performance	0.10	0.23**	-0.05	-

** $p < .01$ * $p < .05$

Student Demographic Differences. Gender was statistically significant in its relationship to social support, negative interchanges, and academic performance with $r = 0.35$, $r = -0.14$ and $r = 0.17$ respectively. Further examination of the data revealed that gender and race were statistically significant for males, but not for females. Social support for Caucasian males was significantly related to academic performance, $r = 0.25$, and level of school interest, $r = 0.31$. Negative interchanges for Non-Caucasian males was significantly and negatively related to academic performance, $r = -0.44$ and $r^2 = -0.19$. This shows that nearly 20% of the variance of academic performance for Non-Caucasian males was accounted for by its linear relationship with negative interchanges.

Discussion

The outcome of the P/PRS is consistent with previous research findings. Results support the hypothesis that adolescents' relationships with peers are related to

academic performance. Specifically, this study shows that social support is positively related to academic performance. Overall, negative interchanges did not relate significantly to academic performance; however, it did adversely affect academic performance for Non-Caucasian males. Additionally, it was discovered that friends' level of interest in school affects the level of social support one receives, or vice versa. Furthermore, gender was significantly related to social support, negative interchanges, and academic performance. Its greatest influence was on social support. Overall, girls scored higher on social support ($M = 3.50$, $SD = 0.70$) than boys did ($M = 2.95$, $SD = 0.77$). These findings may be interpreted in light of girls being more relationship oriented than boys who tend to focus on fewer defining requirements for a satisfying relationship. Also, boys scored slightly higher on negative interchanges ($M = 1.72$, $SD = 0.59$) than girls did ($M = 1.56$, $SD = 0.45$) indicating that boys and girls experience few differences within their relationships.

Conclusion

These findings provide evidence for the importance of adolescent friendships with peers and their effect on academic performance. Due to the lack of empirical evidence in causation between academic failure and high-risk behaviors, we must continue to consider other alternatives that lead to poor academic performance. The P/PRS provides one alternative: the relational dynamics of peers and academic performance. This study enhances our understanding in this area so that prevention programs may use this information in their relationship building training modules.

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Nature and Origins of a Stratigraphic Boundary in a Continental Setting, Southern Bogda Mountains, NW China

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Abstract

A nonmarine stratigraphic boundary where major facies shifts occur indicates drastic changes in environmental conditions, but may have highly variable magnitude of facies shifts to rapid lateral facies changes, common autogenic processes, and irregular topography. This hypothesis is tested for the boundary separating fluvial-lacustrine Lower-Permian Lucaogou and Hongyanchi formations, deposited in a continental rift setting. The boundary is identified on 5 stratigraphic sections 0.2-5 km apart over ~80 km² area, NW China.

Regionally, the boundary indicates a drastic shift from a widespread, NE-deepening lake during uppermost Lucaogou time to lake contraction, fluvial incision and regression in the north, and transgressive beach and deltaic systems in the south in early Hongyanchi time. Lake contraction may be caused by climatic change, tectonic processes including volcanism, and/or sediment infilling of the lake basin.

Introduction

A stratigraphic boundary where major shifts in depositional environments occur indicates drastic changes in environmental conditions, and is critical to time-stratigraphic analysis. The boundary in nonmarine strata may have highly variable magnitude of facies shifts in different parts of a continental rift basin due to rapid lateral facies changes, common local processes, and irregular topography intrinsic to nonmarine environments (Talbot and Allen, 1996; Carroll and Bohacs, 1999; Yang et al., 2009). This hypothesis is tested using a boundary separating Lower-Permian Lucaogou and Hongyanchi formations, deposited in the Tarlong-Taodonggou half graben, exposed in the southern Bogda Mountains, NW China. The graben fill covers ~80 km². An accurate time-stratigraphic framework will allow a more accurate reconstruction of stratigraphic architecture, paleogeography, and basin-filling history.

Results

The boundary is identified by major shifts of depositional environments on 5 sections 0.2-5 km apart. In Taodonggou, braided stream deposits downcut older shallow-water deposits. In NE Tarlong, braided and coarse meandering stream deposits downcut deep-water deposits, suggesting a fluvial valley at the boundary. Fluvial overbank deposits overlie deep-water deposits 0.2 km to the west, and .5 km further to the west the boundary becomes conformable, separating deep-water deposits from overlying transgressive beach and deltaic deposits. In SE Tarlong, a transgressive surface separates deep-water deposits from overlying thick beach pebbles and deltaic deposits, suggesting a deltaic depocenter at the boundary. In SW Tarlong, deltaic deposits are overlain by transgressive beach and shallow- to deep-water deposits.

The fact that strata thicken to the NE suggests asymmetric sediment infilling of a half graben (Fig. 1). The uppermost Lucaogou trend of deepening to the NE may indicate that NE Tarlong is along the steep margin, and SW Tarlong is along the ramp margin of the half graben (Fig. 1). Regionally, the boundary indicates a drastic shift from a widespread, NE-deepening lake during uppermost Lucaogou time (Fig. 2a) to major lake contraction, fluvial incision in Taodonggou and NE Tarlong, and deltaic progradation in SE Tarlong during early Hongyanchi time (Fig. 2b). Source uplift to the north is indicated by regression and significant erosion at the boundary in Taodonggou and NE Tarlong and transgression in SE and SW Tarlong. Southward tilting of the lake basin would cause northern regression and southern transgression, as seen in the modern Yellowstone Lake, which has been tilted due to volcanic dome uplift.

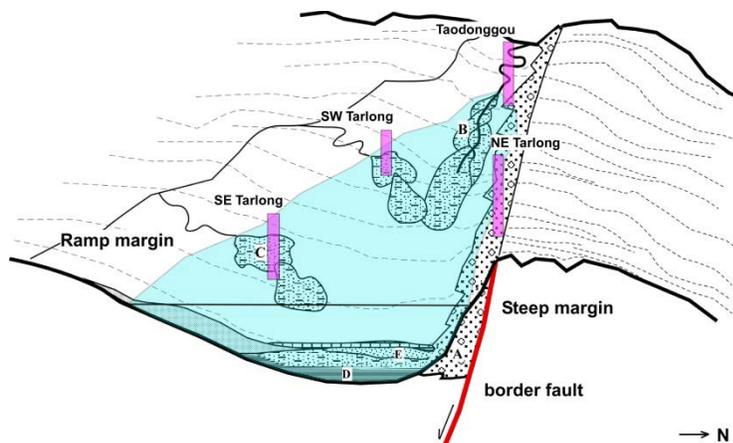
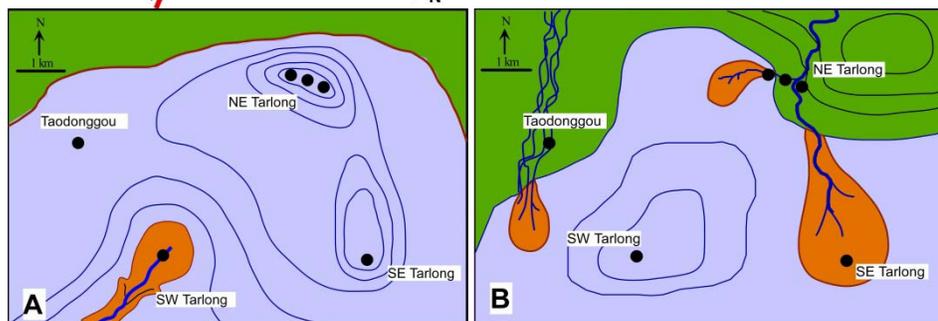


Figure 1. Schematic model of asymmetric half graben during Lower Permian time. Purple bars indicate locations and relative thickness of Lucaogou and Hongyanchi. Fluvial-lacustrine depositional systems include (A)–coarse deposits along steep margin, (B) - delta progradation along rift axis, (C) - delta progradation along ramp margin, (D) - deep lake deposits, (E) - sediment gravity flows.

Figure 2. Paleogeographic reconstruction of (a) uppermost Lucaogou, and (b) basal Hongyanchi.



Conclusions

The uppermost Lucaogou lake deposits record a widespread, balance- to overfilled lake in a subhumid to humid climate, and a rapidly subsiding basin floor. Lake expansion may have been caused by increased precipitation and runoff to the basin, lake-margin subsidence, uplift of the spill point, and/or damming of the spillway by volcanic or glacial deposits. Causes for major lake contraction across the Lucaogou-Hongyanchi boundary include increased aridity, sediment infilling, a catastrophic spill-point lowering event such as a dam break, and/or uplift of the lake margin by means of rift tectonics. The lack of arid climate indicators, and abundance of coarse clastics in basal Hongyanchi deposits indicate large perennial river inflow in a humid, seasonal climate. Tectonic movement may be a likely cause for lake contraction, such as volcanic doming, as indicated by tuff and rhyolitic deposits a short interval above the boundary. Volcanic doming may have tilted the lake to the south, causing regression in the northern margin and transgression in the southern margin. Major lake contraction at the boundary is followed by gradual lake expansion, forming a widespread Hongyanchi lake. A thorough understanding of local and regional sedimentary, climatic, and tectonic processes and basin topography is critical to identifying and correlating major nonmarine stratigraphic boundaries.

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Acknowledgements

I would like to thank Wei Guan for his support in the field, laboratory, and international travel to the remote field area. We thank Wei Li, Qianyao Wang, J. Li, X. Cheng, H. Tian, W. Chen, D. Fu, W. Li, Neil Tabor, for field assistance. The project was partially supported by the Kansas Geological Foundation.

Does Individualizing Vocabulary Instruction Combined with Fluency Instruction Increase Reading Comprehension to Students Scoring Below the First Quartile

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After pre assessing students in a third grade classroom, the researcher noted four students, scoring below the 25th Percentile on the reading portion of the Northwest Evaluation Association (NWEA) in fall, 2008. As the researcher further assessed the students, it was noted that these students lacked proficient fluency and vocabulary skills. Research revealed that "Providing vocabulary instruction is one of the most significant ways in which teachers can improve students' reading and listening comprehension" (Curtis & Longo, 2008). "Reading fluency is the bridge from decoding skills to comprehension" (Penner-Wilger, 2008). The researcher used a combination of the Power Pak Reading program and coupled it with individual, vocabulary strategies to assist readers with fluency and comprehension. As their reading progressed, students were challenged to next levels. Data was analyzed using the NWEA assessment, Houghton Mifflin Leveled Reading Assessment and Kansas State Reading Assessments during the course of the school year to mark progress. The research examined the question "Does individualized reading vocabulary combined with fluency instruction increase reading comprehension in below quartile, third grade readers?"

1. Introduction (Describe your idea)

In the previous year when pre-assessing students at the start of the third grade year, the researcher noted several who struggled with reading comprehension and more specifically with reading fluency. These students scored in the bottom quartile of the NWEA, or Northwest Evaluation Assessment. As the year progressed, the researcher noted that decoding new vocabulary words was a constant struggle. These students' vocabulary was limited. Research shows that fluency is a probable indicator of student success in reading comprehension if it is focused on with other skills as well and used, ultimately to help students learn to think while they read. Since "Underachieving readers need to develop their own personal mental dictionaries for unknown words" (Juel&Deffres, 2004), the researcher examined the question "Does individualized vocabulary instruction combined with fluency instruction increase comprehension results with below quartile readers?" Torgesen, Shaywitz and Chhabra, (2004) state "...small group interventions can substantially reduce the proportion of students who struggle to read". So the researcher added explicit, *individualized* vocabulary and fluency instruction to the bottom quartile learners during this school year and the results were significant on all post assessments that were administered in the spring semester (2009). Students working with the teacher using these practices rose above the bottom quartile in May with the NWEA. These students also increased their leveled reading comprehension level by 1.5 to at least 3.0 grade levels. Finally, all students using the individualized vocabulary and fluency instruction scored within the top twelfth percentile on the Kansas State Assessments

During this school year (2009-1010) after pre-assessing students at the start of the third grade year, the researcher again noted students in particular who struggled with reading comprehension and more specifically with reading fluency and vocabulary. The past year's experience found the most gains were made after the teacher added individual, vocabulary instruction WITH fluency practice. Individualized vocabulary built mental dictionaries for students. Combining vocabulary with fluency aided students in better interpreting text as they read. Because the needs of the bottom quartile readers in the current year's class (2009-10), were similar to the needs of the bottom quartile readers of the past year, the researcher opted to examine whether or not the research in the past year would be effective during a *second* year with *twice* as many candidates. The researcher chose to examine the same question once again, forming a replicated study examining - "Does vocabulary instruction combined with fluency instruction increase comprehension results with below quartile readers, third grade readers?"

2. Experiment, Results, Discussion, and Significance

During the 2008-2009 year, the researcher developed an individualized reading program to stress individualized vocabulary combined with fluency to examine its effects with reading comprehension. The students qualifying scored below 25% on the NWEA. Students were given reading passages and met with a trained paraprofessional. During each of the students' first meeting time, the students' reading was timed and mispronounced words were highlighted. The teacher recorded the first reading time. The teacher and the student together developed a list words mispronounced and together formed sentences, pictures, symbols, etc. to aid the student in retaining the meaning of each word. The following four days the student met with the paraprofessional and together they discussed the mispronounced words and then the student read the passage aloud. On day five the student and paraprofessional, discussed mispronounced words, read aloud the passage while being timed and then completed a five point comprehension quiz. The teacher recorded the time it took the student to read the passage as well as the comprehension score. This process was completed with each participating student for a total of three months, using different passages. A variety of assessment scores were recorded at the beginning of the year and the end of the year to mark progress. Due to significant results, this research is being conducted currently with eight different students. The following tables show data from the 2008-2009 year.

Table 1:

Comprehension Results with Fluency Only Compared to Fluency Combined with Vocab. Instruction

Student	Fluency Only	Fluency Combined with Vocab. Instruction
A	80%	100%
B	60%	100%
C	80%	100%
D	40%	100%

Table 2:

Mispronounced Vocabulary in Reading Passages Before and After Instruction

Student	First Read	Second Read
A	8	0
B	10	1
C	6	0
D	8	0

Table 3:

Local, State and National Reading Scores/Percentiles

Student	Birth	NWEA (Sept. & May %)		Reading Level (Sept. & May)		Kansas Assessment
A	June '99	15%	69%	Early 2 nd 5 th Grade		93%
B	Mar. '00	19%	48%	Early 2 nd	Late 3 rd	88%
C	Apr., '00	9%	39%	Early 2 nd 5 th Grade		89%
D	Dec., '00	4%	20%	Early 1 st	Late 2 nd	93% (KAMM)

3. Conclusions

The results of combining vocabulary with explicit, fluency instruction were significant. As seen in Table 1, 2 and 3, students' comprehension of passages increased significantly with fluency and vocabulary instruction combined. The amount of mispronounced vocabulary words decreased significantly when students were given vocabulary instruction and repeated reading opportunities. With months of instruction, this aided students with their overall comprehension results.

Component-wise Energy Breakdown of Laptop

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Abstract-In the modern age, there is an exponential growth in the usage of laptops for computing and communication. However, the battery life of laptops is only a few hours at best. Further, studies indicate that laptops have a stake of approximately one percent in the overall global energy consumption. Thus, there are significant incentives to minimize energy consumed by laptops. To achieve this goal, it is important to understand the energy consumed by each component of a laptop. In this work, we systematically studied the power consumed by each component of a modern laptop. Our results indicate that wireless communication is a significant consumer of power along with obvious power hogs like the Display, Graphics card and the Processor.

I. INTRODUCTION

Importance of energy efficiency lies in the fact that it ensures provision of same level of energy using fewer amounts of fossil fuels. Owing to the increasing demand and limited availability of fossil fuels, the importance of efficient use of energy has been realized all over the world. The measures of energy efficiency are useful in multiple ways. Reduced use of fossil fuels is essential in lowering the emission of greenhouse gases contributing to global warming. The policies for energy efficiency aim to minimize the use of fossil fuels; thereby prevent the occurrence of adverse climatic change resulting from it. Energy efficiency reduces electricity consumption and helps in saving money and nature [1].

The concepts of renewable energy and energy efficiency go hand in hand. These two concepts are considered to be the “twin pillars” of the policies regarding sustainable energy. To make the most of the sustainable energy policy there needs to be simultaneous application of strategies regarding renewable energy and efficient use of energy [1].

In this project we have focused more on the latter part of the energy saving schema discussed above. We have been hearing from the past years that desktop sales have been taken over by laptops worldwide. We tried to calculate an approximate amount of energy consumed only by laptops. Some interesting facts have been revealed that the stake taken by it is approximately one percent of overall global energy consumption. Also we wanted to explore further by seeing which component is the major contributor of energy in the laptop.

The rest of the project is organized as follows. We first introduce the hardware and software setup used in the project. Then, the explanation about the procedure and graphs obtained is discussed and finally limitations and breakdown of components are explained.

II. HARDWARE & SOFTWARE

Our laptop used in the project is IBM Lenovo SL400 [2] with a 14 inch display. The operating system loaded on it is Ubuntu 9.04 [3]. We used an Intel Core 2 Duo Processor, 2GB RAM, 14.1” display and a 6-cell Li-Ion battery. The setup used for conducting the experiments is multimeter, for obtaining the direct readings and rest is using the ‘state’ of the battery at different stages of the experiment. The stress to any system is the graphics; this could be achieved using the 3D games. Direct measurements were done for the hard drive and the I/O ports.

III. PROCEDURE

The various components exploited in the work are as follows

A. Hard Disk Drive:

The hard disk drive connected to the laptop under examination was a 7200 rpm drive with 160 GB capacity. In its original configuration, the hard disk drive is connected to the laptop through a 22 pin SATA connector. In order to take the current and voltage measurements across the hard drive terminals, a 22 pin SATA extension cable is used facilitating the use of a Multimeter for measuring the current. At first the power consumption of hard drive is studied by running the standard read, write and copy operations on the disk and checking the power drained from the battery to estimate the effect of hard disk utilization on the battery. A 697.9 MB Ubuntu ISO image file is used for performing the tests. The results obtained are highest for copy which is 3.37W and lowest is 2.13W for idle operation.

B. LCD Display

We measured the energy used by laptop using an inbuilt procedure taken from ACPI of Ubuntu operating system. Our measurement was done using a different approach. The display was isolated by removing the hard drive, optical drive and turning off network and Bluetooth devices. We booted the laptop using an USB drive. Once the laptop was up and running we even removed the USB. Now the laptop was only left with LCD, CPU and Memory (RAM). Here CPU and Memory (RAM) takes very minimal amount of energy since nothing is being processed.

Brightness was kept at maximum level and appropriate readings were taken from ACPI procedure for every minute for over an hour. The experiment was repeated for Brightness with minimum level, White and Black background. The power consumption is highest for

black background which is 0.210W and lowest for default background at low brightness which is 0.180W per minute interval. We can observe that power consumed is 15% more when the brightness level is at maximum when compared to minimum.

C. Graphics Card

NVIDIA graphics card is used in the experiment. The 3D games are played using the Wi-Fi and later with Wi-Fi off. The 3D game used was *Warezone 2100* without Wi-Fi and with Wi-Fi was *Evony*. Additionally 2D game like *Solitaire* was used for comparison of the three stages of stress on graphics. 3D Game with Wi-Fi consumed more energy than any other methods used.

D. Wireless Card

The Wireless LAN standard that was considered for the testing the laptop was IEEE 802.11g [4], for which standard transmission rate is 54 Mbps. The applications that were tested were FTP, Voice and Video streaming. To check the power consumption of FTP application 690 MB file was downloaded. The voice application was tested using Skype. The highest is 20.629W for VOIP application and lowest is 18.732W for FTP.

E. Optical drive

The component under test is a DVD-RW Drive. The Drive is capable of writing and reading from both 8x as well as 16x Disks. This component is a part of Lenovo SL400 laptop. It uses SATA cable for transmitting data and also embedded is the power chords.

The test was performed for two kinds of operations on this device, one is the read operation and the other is write operation. During the first part of our experiment we tested with small amount of data (600Mb) on different brightness levels of LCD Display. One of the key things we observed here is that not only did low brightness consume less energy but also it consumed less time to perform the operation.

F. I/O ports

In our first experiment we measured the energy consumption of the usb port by playing a movie continuously for an hour using flash drive in intervals of 5 mins. Some USB devices can shorten battery life dramatically when used for a longer time. To experiment this we tested a set of standard USB devices which are used in our daily life. An USB extension cable was used to connect and measure the power consumption. This cable enables us to measure current drawn for USB devices while they're in use with help of an ammeter. The highest and the lowest being iphone charging 2.475W and flash drive in idle state that is 0.297W respectively.

G. Bluetooth

For the measurement of energy consumed by the Bluetooth we have taken a *BlueSoleil Dongle of version 2.0 and transfer files to and from laptop to mobile devices. We have used mobile devices like Sony Ericsson W580i (Bluetooth v2.0), MotoV3 (Bluetooth*

v1.1) for our experiments. Due to Bluetooth v1.1's transmission rate is less time taken to transfer data was more, so it consumed more energy. But with respect to version 2.0, energy consumed was comparatively less due to faster transmission rate. The readings were taken with full brightness and Wi-Fi off.

It is evident from the results that receiving data consumes more energy than transferring data. And with v1.1 Bluetooth the reception is very high compared to v2.0.

IV. RESULTS DISCUSSION & LIMITATIONS

Wireless NIC card has been tested with different types of applications like FTP, VoIP and video streaming. The results over a period of time show that VoIP consumes more energy out of the tested applications. The chart obtained for it is shown in figure 1.

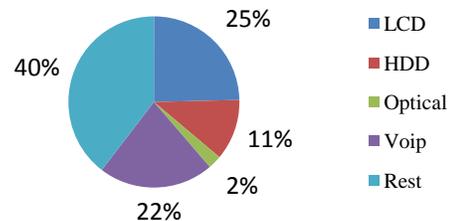


Fig1. Operation: Wireless card (VoIP); System power: 19W

Limitations

The accuracy of the experiments conducted is limited by various factors. When we were measuring via the multimeter there could be a marginal error of +/- 3mA. Another factor would be some results were obtained by the subtractive approach so the results obtained could vary with an error rate of less than one percent [5]. Finally we were able to obtain the results for some components and other components integration are termed as 'Rest' in the pie charts which means rest of the system.

V. CONCLUSION AND FUTURE WORK

The main purpose of this project was to obtain the component wise energy breakdown of a laptop. We were able to obtain the energy for the following components: Hard disk, display, graphics card, wireless card, optical drive, I/O ports and Bluetooth. The results obtained suggest that Display, Graphics card and Processor consume a significant amount of energy in a system. And surprisingly, a very active wireless card consumes energy second only to the LCD. This calls for future research on developing energy-efficient algorithms and protocols for wireless communication.

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Impact of Crane Availability During the Construction Phase of the Wind Farm

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Abstract. The availability of the high capacity crawler cranes at the project site during the construction phase of the wind farm may help the turbine assembly rate, which may significantly vary due to the terrain at the project site. Increasing the crane availability at the project site by optimizing the crane utilization rate will reduce the project duration. As a result, the number of turbines that generate electricity early in the construction phase will increase and the payback time will be reduced, although increasing the number of cranes will result in higher investment costs.

1. Introduction

Wind is a clean source of energy, from which electricity can be generated by using wind turbines, without polluting the atmosphere [1]. In order to increase electricity generation by means of wind power, United states is marching towards the goal of 20% wind power by 2030 [2]. As the capacity of wind turbines increase, the size of the components such as blades, nacelle, and the tower sections increase, which complicates the logistic activities and results in the increase in transportation costs, as well as the overall investment costs [3, 4]. As the size of the wind turbines increase, the need for high capacity crawler cranes increases. The rental costs of the high capacity crawler cranes are quite substantial compared to other costs. The crane rental costs are governed by the availability of the crawler cranes at the project site, which highly impacts the turbine assembly rate. When the terrain at the project site is good, the turbine assembly rate is good and when the terrain is bad, the turbine assembly rate is worse [5].

Once the wind turbine is constructed and the grid connectivity is made, the turbine starts the power generation process. The increase in the project duration to construct all the wind turbines in a wind farm is longer when the terrain is worse [5]. In order to decrease the project duration, one option is to increase the number of high capacity crawler cranes. Having one extra high capacity crawler crane will induce additional rental costs for one high capacity crawler crane and two small capacity crawler cranes, additional crane crew, crane supervisor and assembly crew. Along with the crane rental costs, the labor charges for the additional crew members and as well

as the food and lodging expenses and the fuel costs contribute to the overall investment costs [6]. On the other hand, when more high capacity crawler cranes are used, the number of turbines that generate electricity will increase (e.g. with two cranes, the installation rate will double, with three cranes, it will triple) linearly. The efforts to reduce the project duration will result in an increase in the overall investment costs by less than 2%.

In this paper, we compare different wind turbine installation scenarios based on the initial investment costs, monthly investment costs, and the monthly revenue generated by utilizing annual worth analysis. Also, the benefits attained by reducing the project duration are compared by using the payback analysis [7].

2. Experiment, Results, Discussion, and Significance

A wind farm location, which has the potential to install 50 3MW wind turbines, is considered for the case study. The wind turbines are placed in a layout of 2D by 10D where D is the length of the wind turbine blade. The material costs for the 50 3MW wind turbines and transportation costs, assembly costs, crane rental costs, and the labor costs will contribute to the overall investment costs [5]. The overall investment costs will vary for individual projects, depending on the location of the project site [2]. The terrain effects at the project site are one of the most influencing factors on the overall investment costs as well as on the project duration. For the same project site, when the terrain effects are good, it may take 13 months to assemble all of the 50 3MW wind turbines, while this duration increases to 40 months, when the terrain effects are worse [5]. When the project duration increases, the overall investment costs will increase due to the interest applied on the initial investments made and the payback period will increase.



Fig. 1 Monthly Investment Costs (in millions): 50 3.5 MW Turbines at bad Terrain. No of Turbines assembled per setup is equal to 2.



Fig. 2. Breakeven Duration: 50 3.5 MW Turbines at bad Terrain. No of Turbines assembled per setup is equal to 2.



Fig. 3. Savings in Project Duration for a 3.5MW wind farm (in years).

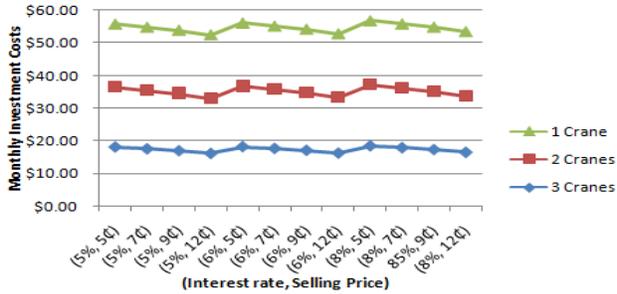


Fig. 4. Monthly Investment Costs (in Millions): 50 3.5 MW Turbines at good Terrain. No of Turbines assembled per setup is equal to 50.



Fig. 5. Breakeven Duration: 50 3.5 MW Turbines at good Terrain. No of Turbines assembled per setup is equal to 50.

Different scenarios are compared by using the annual worth analysis, considering the initial investment costs, monthly investment costs, monthly revenue generated (based on the selling price), as well as the interest rate applied. The overall results vary mainly due to the number of crawler cranes that are used during the construction phase of the wind turbines.

Fig. 1 shows that, when three high capacity crawler cranes are used to reduce the project duration, when the terrain effects are worse, the monthly investment costs are less when compared to using one crane, irrespective of the electricity selling price and the interest applied. Also, the payback period is reduced while using three cranes, instead of one, which is shown in Fig. 2. The savings in project duration for different scenarios are shown in Fig.3. Even when the terrain is good, the monthly investment costs are less, when three cranes are used, as shown in Fig. 4. Also, the Payback period is less when compared with the results of using one crane, as shown in Fig. 5.

3. Conclusions

When the terrain effects are worse and the project duration to construct the wind farm is high, it is better to use two or three cranes, in order to reduce the project duration and as well as to increase the turbine assembly rate. Also the benefits are high in terms of the payback period. The same results apply to the case, where the terrain effects are good and with reasonable turbine assembly rate.

4. Acknowledgements

This grant has been supported by DOE award DE-FG36-08GO88149 Sustainable Energy Solutions: Wind Energy.

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Determination of All Stabilizing Fractional-Order PID Controllers

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Abstract. A novel method for finding all fractional-order (FO) proportional-integral-derivative (PID) controllers that stabilize a given system of integer or non-integer order is proposed. The stability bounds of such FO PID controllers are calculated in the frequency domain and are given in terms of the proportional gain K_p , integral gain K_i and derivative gain K_d . In this paper, they will be plotted on the (K_p, K_i) plane. A key advantage of this approach is that it provides the stability boundaries even when the transfer function of a system is not available, as long as the frequency response of the system can be obtained. An example is presented to illustrate the effectiveness of this method.

1. Introduction

Though PID controllers are clearly in the mainstream of the controls area, their non-integer order counterparts, so called $PI^\lambda D^\mu$ controllers (where λ and μ are arbitrary real numbers) are receiving considerable attention. While integer-order (IO) mathematical models are easier to work with, real physical systems are often described more accurately through non-integer order modeling. In [1], a torsional system consisting of a rigid disk and a flexible shaft attached thereto is modeled using an FO transfer function. The resulting frequency response shows that the mechanical resonance effect is represented more naturally with an FO model than an IO model.

As in the case of IO PID controllers, the stability boundary of an FO PID controller is an important research topic and has received significant attention. In [2], the D-partition method, which has been used for the IO controller case, is used to find stability bounds of FO PI or PI^λ controllers for four cases. These cases include all the combinations of an IO/FO plant and an IO/FO controller. However, only a first order IO plant or an FO plant with the order α (where $0 < \alpha < 1$) is used in [2]. In addition, Matignon's stability theorem is used to find the stability of an FO system [3].

Nonetheless, there still exists a need for more efficient and less complicated ways of finding all controllers that stabilize a given system with an IO or FO transfer function. In [4], the frequency response is used to find all stabilizing IO controllers for a given

plant transfer function of an arbitrary IO. The stabilizing controllers that lie within the stability regions are plotted in three different planes: (K_p, K_i) , (K_p, K_d) and (K_d, K_i) .

In this paper, a new method, similar to the one described in [4], is used to find all the stabilizing $PI^\alpha D^\beta$ controllers for a given plant transfer function using the frequency response. Because of limited space, results presented in this paper are limited to the (K_p, K_i) plane for a fixed K_p value. The results and an example will be described in section 2.

2. Determination of Stabilizing Controllers.

Consider the following unity feedback control system shown in Fig. 1.

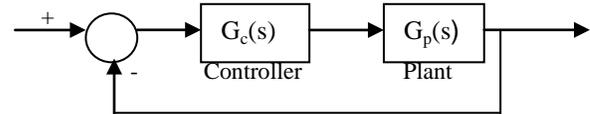


Fig. 1. Control system with negative unity feedback

The plant transfer function is $G_p(s)$. The $PI^\alpha D^\beta$ controller $G_c(s)$ is given by

$$G_c(s) = K_p + \frac{K_i}{s^\alpha} + K_d s^\beta \quad (1-1)$$

where K_p , K_i and K_d denote the proportional, integral and derivative gains, respectively, and α and β are arbitrary positive real numbers.

2.1 General Solution in (K_p, K_i) Plane

To determine the K_p and K_i values that stabilize the given transfer function, the characteristic equation in frequency domain is found by replacing s with $j\omega$ in the closed-loop transfer function of Fig. 1, which is given by

$$\Delta(j\omega) = 1 + G_p(j\omega)G_c(j\omega) \quad (1-2)$$

The plant transfer function can be decomposed into real and imaginary parts as follows:

$$G_p(j\omega) = R_p(j\omega) + jI_p(j\omega) \quad (1-3)$$

Setting (1-2) to zero and expanding it into real and imaginary parts gives us two equations and three unknowns: K_p , K_i and K_d . We will fix the value of K_d and find the stability region in the (K_p, K_i) plane.

Solving these two equations for $\omega \neq 0$ and $\alpha \neq 2n$ where n is an interger, K_p and K_i are given by

$$K_p = -K_d \omega^\beta \frac{\sin\left(\frac{\pi}{2}(\alpha + \beta)\right)}{\sin\left(\frac{\pi}{2}\alpha\right)} - \frac{R_p(\omega) - \cot\left(\frac{\pi}{2}\alpha\right)I_p(\omega)}{|G_p(j\omega)|^2} \quad (1-4)$$

$$K_i = K_d \omega^{\alpha+\beta} \frac{\sin\left(\frac{\pi}{2}\beta\right)}{\sin\left(\frac{\pi}{2}\alpha\right)} - \frac{\omega^\alpha I_p(\omega)}{\sin\left(\frac{\pi}{2}\alpha\right) \cdot |G_p(j\omega)|^2} \quad (1-5)$$

where

$$|G_p(j\omega)|^2 = R_p^2(\omega) + I_p^2(\omega) \quad (1-6)$$

2.2 Example

Consider the following plant with a second order transfer function having a time delay of 0.6 seconds

$$G_p(s) = \frac{4-2s}{s^2 + s + 9} e^{-0.6s} \quad (1-7)$$

which is described in [5] without the time delay. The objective here is to compare the stability region of an FO PID controller with that of an IO PID controller, along with their step responses. In this example, an FO PID controller with $\alpha=0.85$ and $\beta=0.7$ is used for the controller transfer function in (1-1).

In Fig. 2, the stability regions of the IO and FO PID controllers are plotted in the (K_p, K_i) plane for $K_d=0.4$. As can be seen, the FO PID controller provides a much wider stability region than the conventional IO PID controller. Two arbitrary controllers are chosen from the stability regions in Fig. 2, as marked on the plot. For the IO PID, $K_p=0.2137$ and $K_i=3.0548$, and for the FO PID, $K_p=-0.8508$ and $K_i=1.6221$.

Fig. 3 shows the corresponding closed-loop step responses with the above IO and FO PID controllers. In the example, the closed-loop system with the IO PID controller has the percent overshoot of P.O=92.7% and the 2% settling time of $t_s=31.3$ seconds, while the closed-loop system with the FO PID has the P.O=32.9% and $t_s=14.1$ seconds.

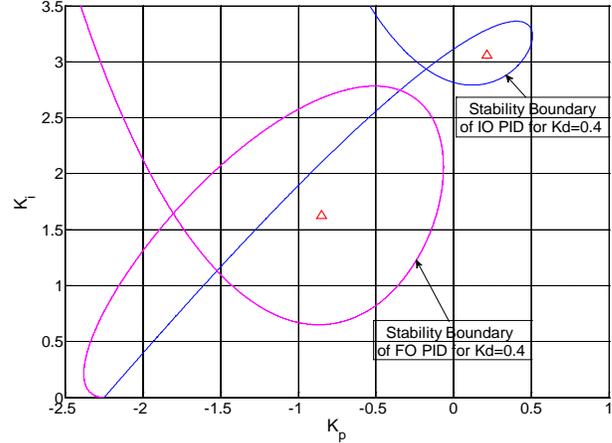


Fig. 2. Stability regions in (K_p, K_i) plane for $K_d=0.4$

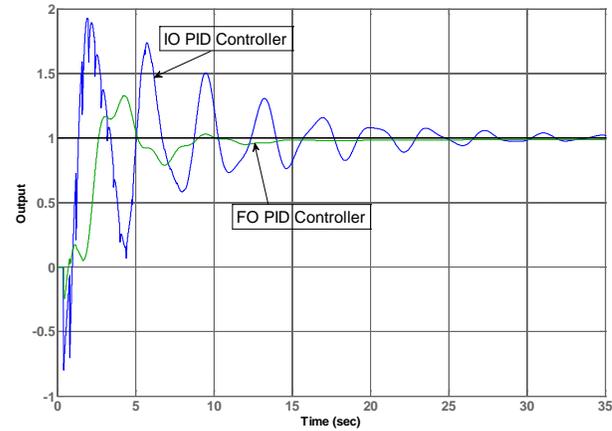


Fig. 3. Closed-loop step responses with the IO and FO PID controllers for $K_d=0.4$

3. Conclusions

As described in Section 2, a general solution for finding all FO stabilizing controllers for a given system transfer function of an arbitrary order is given in the (K_p, K_i) plane for a fixed K_d value.

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Questioning the Construction of Reality

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How do we arrive at ourselves, is it the question of nature vs. nurture, or is there a greater sense of manipulation? People are locked into an uncontrollable controlled system, which they both develop and absorb. I think we are created by a society that we ourselves have adopted and manipulate during our lives.

As a ceramic artist, objects which occupy both external and internal space are a constant source of investigation. These forms are used as surrogates or metaphors in investigating how people engage and understand objects, and places. My work is designed in a manner to not exclude the manipulated environments of man, but to be a conduit of understanding between society and the individual.

1. Introduction

I have long been curious about how it is that we arrive at a system of language and social structure. A social structure is produced through a layered relationship of cultural norms that result from traditions, ideologies, belief systems, and these are articulated through language that is understood throughout the culture. Ferdinand De Saussure⁴ investigated, and posited that word images create a recognizable language and these symbols are a result of an object and an agreed upon value, being the written letter/ words. I strongly feel that our understanding of ourselves within a culture is a direct result of the objects that we produce and possess.

2. Methodology

Within my current body of work various hand building processes are utilized to construct pieces that reference both the altered landscape and architecture. This juncture of the naturally occurring and the produced is most intriguing to me because of its direct relation to humans and their “natural” inclination to manipulate their direct environment to suit a personal need. This could be interpreted as encompassing that on a global scale, with consideration to national conquests, corporations branching out to meet market demand, or to the individual “nesting” within their domain- in order to create a personal space-and yet again to include the assumable impersonal space of office or school, and how the individual can create a more intimate area with orientation of personal possessions within a centralized area of occupation. The collaboration on social construction in the “Communist Manifesto” by Karl Marx and Frederick Engels⁵ posited some well regarded thoughts about how “it is not the consciousness of man that determines their existence, but their social existence that determines their consciousness.” A related concept to both the work of an artist and by that of the fathers of modern Communism was that society is merely a product of man’s reciprocal actions. Well how do we attempt to understand what every individual interprets and understands the fabric of their social existence beyond their own mental borders? That is why within my work I focus on how it is that an individual entity will procure and surround themselves with commodities, objects of desire and communication in order to connect and project their own personal understanding of society and self.

The purpose of the utilization of multiple hand-building techniques- slab construction, coiled and pinched portions, combined with thrown and altered forms- is to discuss repetition and routine that we as humans form and participate in. These techniques require repetitively visiting and laboring over areas of construction, and each process brings its own information, and form of habit. It is through these habits, the routinely performed act that we create the impetus for the understanding of self. The daily chore, a meal, the interaction with another human, most any regularly occurring activity is acted out with or centered on an object. It is through our relationships with objects

⁴de Saussure, Ferdinand “Course in General Linguistics” Part One: General Principles, pgs. 65-80

⁵Adorno, Theodore W/ Horkheimer, Max “Dialectic of Enlightenment: Philosophical Fragments”
Culture Industry: Enlightenment as Mass Deception

that create connections and begin an understanding with other individuals and ourselves. The forms I construct reference the natural landscape alongside the manipulated environment, the personal domain with characteristics of the large scale commercial building. The broad parameters of my investigation are intentionally chosen to discuss the disparate areas that people inhabit.

The “finishing” of each piece will appear raw, and rough, leading to an appearance of either the unfinished location, or one that is degrading. Surfaces of pieces appear like oxidized building materials to discuss the presence or loss of potential within a space. It is this allusion to potential that I think is most important to the discussion of the construction of an identity through object. GirmaNegash⁶ stated in “International Political Science Review, Vol. 25” the “art is the fountain head from which all political discourse, beliefs about politics, and consequent actions ultimately spring.”

3. Conclusion

Within our consumerist existence, we strive to obtain possessions in order to identify both ourselves and our culture through the collection of various possessions. These occupiers of space and idea are a collection of mediators between our internal consciousness and our external environment. So within a distilled perspective of how we construct our social structures, it is the object that could be said to be core. We cannot understand nor expand our choices without that which is tangible as reference.

4. Acknowledgements

I would like to thank Wichita State University for providing an environment which is conducive to exploration and investigation of scholarly work. I would also like to thank Ted Adler for his guidance, and as a constant source of encouragement and the provider of intellectual challenges.

[1]de Saussure, Ferdinand “Course in General Linguistics” Part One: General Principles, pgs. 65-80

[2] Adorno, Theodore W/ Horkheimer, Max “Dialectic of Enlightenment: Philosophical Fragments”
Culture Industry: Enlightenment as Mass Deception

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⁶Negash, Girma “International Political Science Review”-Vol. 25, No.2 April 2004 pg185-201

Critical Thinking Dispositions in Physician Assistant Students and the Relationship with Board Scores and Graduate GPA

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ABSTRACT

This study examined correlations between two standardized critical thinking tests, the Health Science Reasoning Test (HSRT) and the California Critical Thinking Disposition Inventory (CCTDI), graduate GPA, and performance on the Physician Assistant National Certifying Exam (PANCE) in a convenience sample of 42 physician assistant students.

Positive correlations were found between GPA and PANCE scores ($r = 0.668$, $p < 0.01$) and GPA and pre-program HSRT scores ($r = 0.423$, $p < 0.01$). No other correlations were found.

GPA was strongly associated with PANCE success and may be a useful way to identify students requiring remediation for certification preparation. HSRT was modestly associated with program success as measured by GPA; therefore, the HSRT may be a valuable tool in the program's admission selection process.

1. Introduction

Critical thinking is the process of solving a problem that involves multiple variables, options, and outcomes. In order to provide the highest quality of patient care and to be the best advocate for the patient, health care providers must consistently apply appropriate critical thinking skills and effective clinical judgment. Students admitted into the Masters of Physician Assistant (MPA) program have demonstrated the academic ability to retain and apply information when prompted. However, these skills must also be transferred to the clinical setting in order to be successful. In the clinical setting, students often exhibit a high level of stress and uneasiness when faced with a clinical issue requiring critical thinking.[1] It is unclear if students enter their graduate level programs with strong critical thinking skills and dispositions or if they are learned through the rigors and demands of the program. Critical thinking and the ability to think critically has been studied within several health professions including: pharmacy,[2] nursing,[1, 3-5] dental hygiene[6, 7] and physical therapy[8, 9] with mixed results.

Study Purpose

The purpose of this study was to examine correlations between critical thinking skills and

dispositions with graduate level GPA and performance on the Physician Assistant National Certifying Exam (PANCE) in physician assistant (PA) students.

2. Methods, Results, Significance

Methods

Study Design, Subjects and Settings: This longitudinal study used a convenience sample of volunteers from students entering the WSU MPA program in 2006. The WSU MPA program is a two-year, 80 credit hour intensive program of study with 42 students matriculated annually. Throughout the program, students are subjected to multiple variations of teaching methods including: lectures, discussion, case studies, online self-guided tutorials, exams, practical skills exams, group work, and 12 months of clinical rotations.

Tests and Measures: Critical thinking was assessed using two different standardized tests, the Health Science Reasoning Test (HSRT) and the California Critical Thinking Disposition Inventory (CCTDI). These tests were administered within one month of beginning the program in 2006 and repeated one month prior to graduation in 2008. The HSRT uses questions built around healthcare scenarios to assess critical thinking skills, but does not require prior health care experience or knowledge. The CCTDI evaluates critical thinking dispositions and indicates how likely one is to think critically when faced with a problem.

Statistical Analysis: The gathered data were analyzed using SPSS version 15.0. Correlations between GPA, PANCE, pre- and post- HSRT and CCTDI were analyzed using the 2-tailed Pearson's correlation. Statistical significance was set at $p < 0.05$.

Results

Data for 40 MPA students were analyzed; 80% were female; mean age was 26 ± 6.21 years and the mean

graduate GPA was 3.71 ± 0.21 . The mean pre and post CCTDI scores were similar, 313 ± 24.37 vs. 305 ± 24.11 , respectively, $p = 0.075$. The mean HSRT score increased from 21 ± 3.80 to 23 ± 4.51 , $p = 0.012$. There was a positive correlation between PANCE scores and graduate GPA, $r = 0.669$, $p < 0.01$. There was also a positive correlation between graduate GPA and both the pre and post HSRT scores ($r = 0.423$, $p < 0.01$ and $r = 0.350$, $p < 0.03$, respectively). No correlations were found between GPA and CCTDI or PANCE scores and either critical thinking test, see table 1.

Table 1: Correlations Analyzed

	PANCE		GPA	
	r	p	r	p
pre-CCTDI	-0.088	0.595	-0.053	0.747
post-CCTDI	-0.223	0.172	-0.035	0.832
pre-HSRT	0.265	0.103	0.423	0.007*
post-HSRT	0.077	0.640	0.350	0.029*
GPA	0.668	<0.001*		

*statistically significant correlation

Significance

Statistically significant increases in CCTDI were not seen; but, there was a statistically significant increase in the mean HSRT scores pre and post program completion. However, the overall mean change of two points was small and may not be clinically significant.

As expected, PANCE scores and GPA were strongly correlated. It is expected that students who receive higher academic grades have performed well on exams and other graded activities within the graduate program and the PANCE is essentially a cumulative test over material learned throughout the program.

The lack of correlation between PANCE and both the CCTDI and HSRT was somewhat unexpected, especially considering that although graduate level GPA was positively correlated with both the HSRT and PANCE, the HSRT and PANCE were not correlated with each other. This lack of correlation may suggest that the PANCE does not assess critical thinking skills, but mostly assesses academic knowledge. Due to the small sample size of this study, continued research with a larger sample size is warranted to further evaluate these findings.

There was a positive correlation between graduate GPA and HSRT but no correlation between graduate GPA and CCTDI. This finding suggests that if a standardized critical thinking test was going to be

considered as part of the screening process for PA program admission criteria, the HSRT might be the better choice.

Study Limitations

The small sample size of this study must be taken into account when reviewing the results. Further research is needed with more study participants to increase the power and to increase the likelihood of statistically significant findings. Finally, the evaluation of only one geographic location and small sample size limits the generalizability of the results.

Further research is needed to determine how critical thinking is acquired and applied at the graduate level. With an increased knowledge of the relationship between critical thinking skills as well as dispositions and coursework, there may be a way to adjust teaching styles in these intense health care graduate programs to better prepare students for daily clinical practice. Future research should evaluate a larger sample size and a variety of PA programs.

3. Conclusion

GPA was strongly associated with PANCE success and may be a useful way to identify students requiring remediation for certification preparation. Pre-program HSRT was modestly associated with program success as measured by GPA; therefore, the HSRT may be a valuable tool in the program's admission selection process.

4. Acknowledgements

This project was funded by a WSU Multidisciplinary Research Projects Award (MURPA) grant. We acknowledge and thank PA students, Sara Biggs and Ann Sterrett who evaluated relationships between learning styles and personality types in this same population and Kasey Swayden and Chelsea Whitetree who evaluated Doctor of Physical Therapy Students. We also thank the following PA and physical therapy faculty involved in project conception and data collection/analysis, David Day, Audrey Griffin, Robert Manske, Mike Reiman and Barbara Smith.

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Qualitative Data Analysis: Dialogue and Mindsets

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Abstract. Since the late twentieth century, the ability to connect and communicate with others has been available through a variety of information and communication technologies. Access to mobile communication technology is a characteristic that makes today's learners different and which presents challenges and opportunities in the classroom. This study embraced the use of communication technologies by music students in different parts of the world to collaborate on musical compositions. Students and teachers used web based social networks and collaboration software to, communicate collaborate and compose music. Participant communications were captured online and analyzed to determine feasibility of technologically enables collaborations with a global reach to provide an environment for gaining an awareness of intercultural perspectives. Analysis was conducted using the Emerging Mindedness Continuum.

1. Introduction

Internet-based videoconferencing allows students to converse with people living in places that previously they could only read about in books. This phenomenon, called *global reach* [1, 2] provides opportunities for teachers and students to develop *multiple perspectives* and understanding points of view different from their own. Being able to see the world from multiple perspectives is an important element of the *global mindset*—the automaticity of thinking from multiple perspectives [3]. Global and intercultural interactions provide a means to bring about an awareness of multiple perspectives in the classroom. Global reach interactions are possible for all grade levels and in any discipline. However, just because the technological tools are available, does not mean that learners will automatically gain a better understanding of themselves and others.

2. Experiment, Results, Discussion, and Significance

Data in the form of text from Online Asynchronous Dialogue (OAD), video conferencing and records of reflections and co-reflections, including face-to-face, were captured, transcribed and imported into a spreadsheet, sentence-by-sentence. Each sentence was indexed by a combination of date, participant type (student, teacher or researcher), country, an anonymous participant code, and gender. The sentences, or fragments thereof, were classified using the seven categories.

The Emerging Mindedness Continuum (EMC) developed herein, is a graphic representation of a mindset continuum and its relationship to global collaboration supported by improving awareness of multiple perspectives and contexts. The continuum was synthesized from a combination of Murphy's [4] collaboration model and Dweck's [5] approach to defining mindsets (Fig. 1).

The EMC model captures an array of relationships between dialogue, collaboration and mindedness that lead toward development of multiple perspectives. According to the model, individuals may progress through cognitive processes as individuals enter higher levels of collaboration and mindedness, beginning with social presence and fixed mindedness. Individuals may share and reflect on different perspectives. Some may transition to growth mindedness as other perspectives are considered modified or created. Potentially, individuals may collaborate in achieving agreed goals and sustain development of shared artifacts. Such progress is a work in progress that entwines cognitive, interpersonal and mindedness processes to cultivate sustained global mindedness.

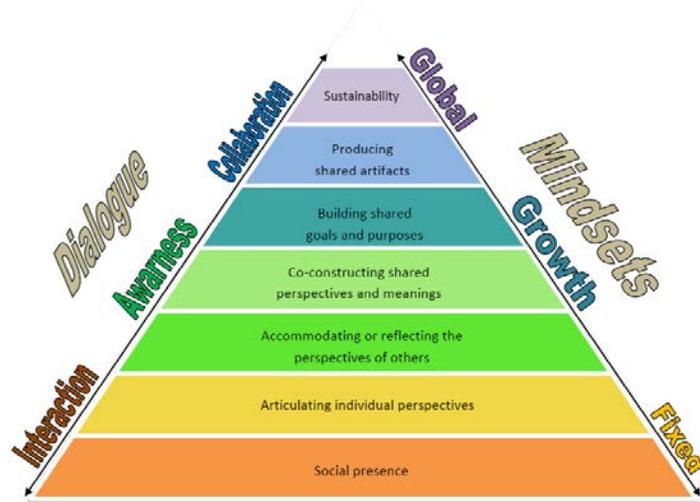


Figure 1. The Emergent Mindedness Continuum model. Derived from Murphy [4, Fig.1] and Dweck [5].

At the base of the continuum is the establishment of social presence. Social presence was recognized when a participant introduced themselves to the group and acknowledged others were present in the social network. This introduction of self is the beginning stage of networking. Social presence is often paired in dialogue with the next level on the continuum, articulating individual perspectives. At this point on the continuum, one's personal perspectives are referenced; however others' perspectives are not yet sought. When interactions remain in this range of the continuum, it can be an indication of a fixed mindset. The third of the seven points on the continuum marks a transition from focusing on self to inquiring about others' perspectives. In the next stage of the continuum perspectives are challenged and refined. This is an indication of awareness of perspectives and a transition point from fixed to growth mindset. Approaching the further reaches of the continuum, dialogue expresses collaboration toward shared goals and purposes, with the next stage being the actual production of shared artifacts [6]. Combination of dialogue and experiences along the continuum has the potential to sustain a collaborative global mindset.

3. Conclusions

Application of the EMC model as an analytical tool revealed differences in student attitudes and commitment based on several factors. Students demonstrated greater success when collaborating with others to co-create a shared artifact if their respective teachers exhibited growth mindedness. This meant that the teachers were willing to take a risk, put effort into being co-learners with their students, and integrate the project into the curriculum.

4. Acknowledgements

This project was generously supported by USD 259, Wichita State University and the Boeing endowment for Global Learning.

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English Vowel Production for Japanese Adults: Comparison of Two Training Methods

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Abstract. American English vowels are challenging for non-native speakers of English, because the vowels' articulation is generally difficult to observe and describe. Although a computer has been applied for language learning, human instructors are still preferred because of pedagogical flexibility and personal interaction. This preliminary study compared two short-term methods: computer feedback only (Group I) and computer feedback with instructor's assistance (Group II), on American English vowel production for Japanese adults. Recordings of Japanese vowel productions of pre- and post-trainings in two groups were evaluated by three native speakers of English. Overall the results demonstrated a slight improvement of the vowel productions for Group II, however, no change was found for Group I.

1. Introduction

Among several hallmarks of developing multilingualism, it is common knowledge that an individual's first language (L1) largely influences learning the phonology of the target languages (Kohnert, 2008). Strange (1995) claims that adults have most difficulty perceiving and producing phonetic contrasts not functional in their L1. The Japanese vowel inventory, in fact, contains only five phonemes, /a, e, i, o, u/, which may cause problems with producing the rest of the English vowels. Also, vowels are challenging, because articulation is difficult to observe and describe without special instrumentation (Wang & Munro, 2004). Moreover, Rochet (1995) argues that the mechanisms tuned to L1 highly influence both articulation and perception of English as a second language (L2).

Numerous studies have investigated the production and perception of both American English vowels and consonants for non-native speakers of English. With an advancement of technology, a computer-assisted language learning system has been adopted in addition to the traditional approach. Although computer provides visual feedback (Ferrier, Reid, &Chenausky, 1999) and is flexible in terms of time, space, and self-pacing (Hoppe, Sadakata, &Desain, 2006), a "personal approach" (p.37) that a traditional approach provides is still supported strongly (Ferrier, Reid, &Chenausky, 1999). Although some investigations on computer-assisted training of English consonants have shown some positive effects (Bradlow, Yamada, Pisoni, &Tohkura, 1999; Yamada &Tohkura, 1992), studies on specific computer assisted training of articulatory placement for vowel production are rather scarce (Nishi &Kewley-Port, 2007).

Given the emergence of technological alternatives to a traditional method, conclusive findings on vowel training are not available from current studies. Consequently, the purpose of this study was to investigate the effects of two short-term treatments on American vowel articulation for Japanese adults, utilizing computer feedback with and without instructor's assistance.

2. Experiment, Results, Discussion, and Significance

The five participants (F=3, M=2) recruited for the study were students from Japan studying at Wichita State University. Their mean age was 31, and mean length of the US residence was three years and seven months. All of them started to learn English at the age of 12 or 13; none of them had received previous specific instruction on vowel perception or production. They were divided into two groups: computer feedback only (group I) and computer feedback with instructor's assistance (Group II). Group I (2 students) practiced only with a feedback of vowel plotting program of Visi-Pitch II Model 3300 and Group II (3 students) practiced with the same computer feedback and instructor assistance. Assistance included specific instruction and feedback on articulation of vowels.

The individual 30-minute training session was given twice a week for three weeks for the both groups. The training consisted of intensive production practice of 10 American English vowels including front and back vowels only, used between consonant and voiceless consonant. The consonants chosen were also found in the Japanese

consonant inventory so that any major pronunciation problems should not occur. They practiced two sets of 10 vowels in real words at each session. Some examples included *back*, *pet*, and *tape*. Data were collected from the scores of vowel production performance, which consisted of 10 monosyllable consonant-vowel-consonant combination words. Audio recordings of words in a carrier phrase, "The word is ____" were made pre- and post-instruction. A few examples included "The word is neck," and "The word is cash." Performances of the speakers were assessed by three female listeners whose first language was American English and were recruited from an undergraduate course of Phonetic Theory at the same university. They listened to all audio recordings of the five speakers randomly presented to determine the vowel sound produced in the words by circling the vowel symbols they heard on the evaluation form. When all of the three listeners heard the correct vowels, three points were awarded. When two heard the correct vowel, two points; when only one heard the correct vowel, one point was awarded. Pearson *r* of intrarater reliability based on remeasurement of 8% of the words was significant at $p < .01$ (ranged from .96 to .99). Interrater reliability was high (intraclass correlation coefficient = .99). After six treatment sessions, Group II improved slightly above the pre-test score in their ability to produce the vowels in the post-test (M of pre-test = 2.20, M of post-test = 2.27). Group I did not differ in performance (M of pre-test = 2.35, M of post-test = 2.35). As literature indicates, vowel articulation is difficult to observe and describe. Instructor's help might have been a contributor to improve the performance even though slightly. The easiest word for both groups to produce was /i/ as in *eat*, whereas the most difficult vowel was the back vowel /ɔ/ as in *caught*. This vowel /ɔ/ is not found in the Japanese vowel inventory and is also one of the hardest vowels to describe how to produce. Moreover, this /ɔ/ was the most difficult vowel for the listeners to perceive. The vowel is dialectally dependent among native speakers of American English. Kansas is the region where people may not produce the vowel (Edwards, 2003). This can be a possible reason that /ɔ/ was difficult for the listeners to perceive. Another vowel /æ/ as in *apple* is not in the Japanese inventory, but it was easy to produce correctly for the Japanese from the beginning. It was observed that the articulation of this vowel was easy to describe and to follow.

3. Conclusions

The goal of this preliminary study was to investigate the effects of the two treatments of the American English vowel articulation for the Japanese adults. The findings demonstrated the effectiveness of the explicit training of the sound mechanism with computer assistance to improve the production of segmental phonemes. The results, however, suggested the positive influence of instructor's involvement by providing encouragement and constructive feedback. Following the study, participants reported they now pay more attention to vowel production/perception than before. Given the small number of the participants and the short length of the research time, more research is warranted.

4. Acknowledgements

Special thanks go to the Japanese participants who stayed with the project for five weeks and the American participants who served as listeners.

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Harvesting Solar Energy via Artificial Photosynthesis

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Abstract Photosynthesis, the process of converting light energy into chemical energy, involves two major steps, absorption and transportation of light energy of appropriate wavelength by the antenna light harvesting molecules to the reaction center, and photoinduced electron transfer (PET) to generate charge separated entities by using the electronic excitation energy. Mimicking these functions using relatively simple synthetic molecules is of paramount importance since they can be directly used to build devices to convert light energy into electricity, like in photovoltaic devices and organic solar.

1. Introduction

In the present study, we report electronic energy transfer (EET) in newly synthesized, covalently linked boron dipyrin (BODIPY) and zinc porphyrin dyads in which the number of boron dipyrin units is increased from 1 to 4. Both steady-state and time-resolved emission as well as transient absorption studies revealed occurrence of efficient singlet-singlet energy transfer from BDP to zinc porphyrin with the time scale of 28-48 ps. A decrease in time constants for energy transfer with increasing the number of BDP units is observed revealing better antenna effect of dyads bearing higher number of boron dipyrin entities. Further, supramolecular triads to mimic the 'antenna-reaction center' functionality of photosynthetic reaction center have been successfully developed by coordinating fulleropyrrolidine appended with an imidazole ligand to the zinc porphyrin. The presentation will focus on the synthesis, characterization, and donor-acceptor assembly formation, and photochemical studies revealing occurrence of electronic energy transfer and electron transfer. Finally, organic photocells to harvest light energy into electricity will also be presented.

2. Experiment, Results, Discussion, and Significance

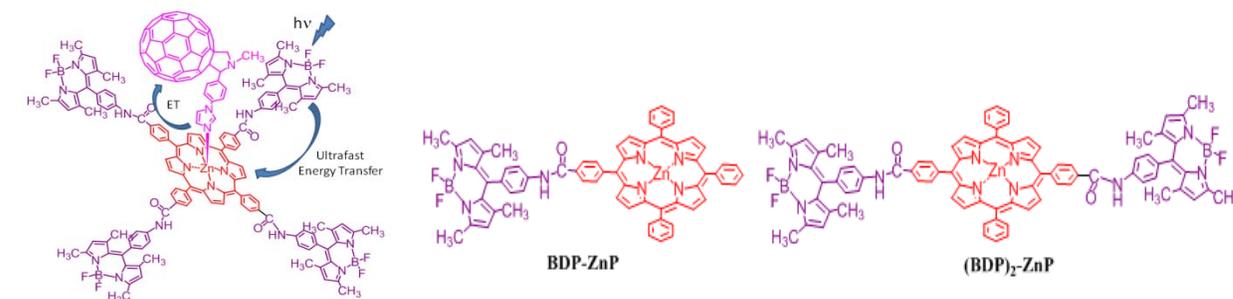


Figure 1. Construction of the supramolecular boron dipyrin-zinc porphyrin-fullerene triad.

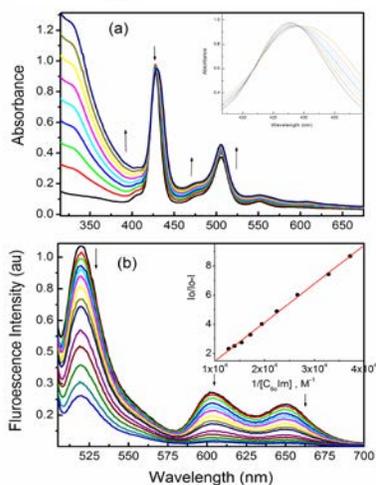


Figure 2. (a) UV-Visible absorption spectral changes observed for (BDP)₂ZnP (1.40 μM) binding to C₆₀Im (1.13 μM) in *o*-DCB. (b) Fluorescence spectral changes observed during increasing addition of C₆₀Im (1.13 μM each addition) to the solution of (BDP)₂-ZnP to form the triad in *o*-DCB. λ_{ex} = 495 nm. The figure inset shows Benesi-Hilldebrand plot constructed by monitoring the emission intensity of the BDP at 520 nm band for calculating the binding constant.

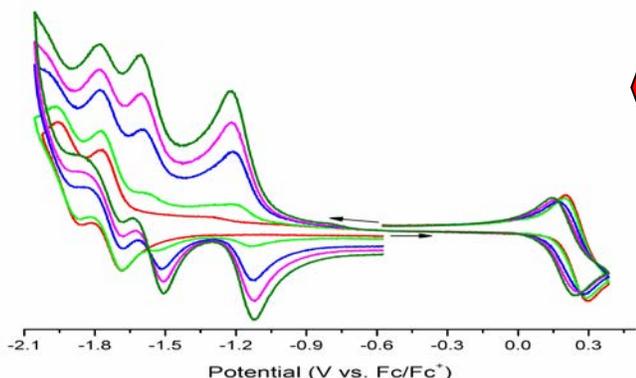


Figure 4. Transient absorption decay component spectra of the BDP-ZnP dyad in *o*-dichlorobenzene. The dashed line shows the differential absorption spectrum right after excitation (at 0 ps delay time)

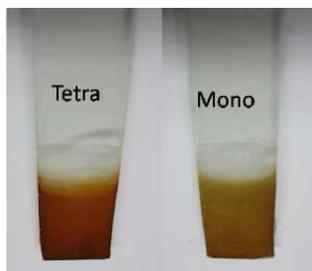


Figure 5. Pictures of electrophoretically Deposited Sensitizers on the ITO/SnO₂ electrodes

Figure 3. Cyclic voltammograms of the ZnP-BDP dyad increasing addition of C₆₀Im (0.2, 0.6, 0.8 and 1.0 eq) in *o*-dichlorobenzene, 0.1 M (TBA)ClO₄. Scan rate = 100 mV/s.

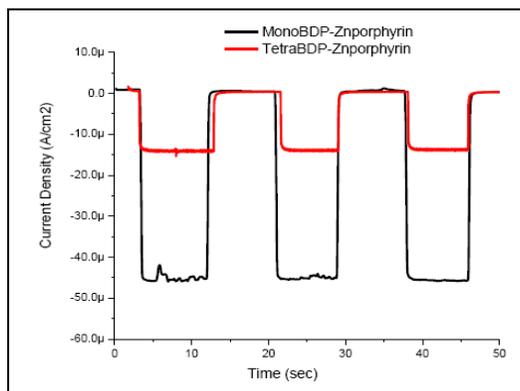
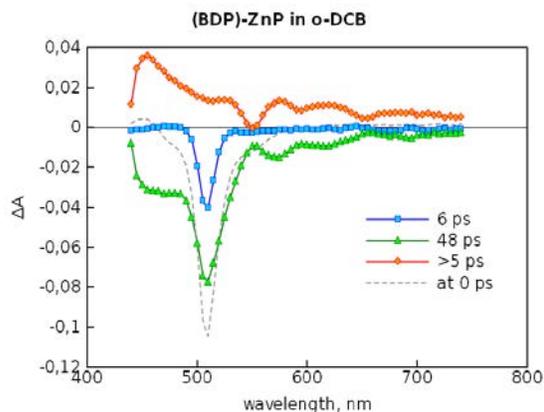


Figure 6. Photocurrent response of ITO/SnO₂

3. Conclusions

Novel supramolecular triads to mimic the ‘antenna-reaction center’ functionality of photosynthetic reaction center have been successfully developed. The antenna mimic, boron dipyrin entities were covalently linked to the reaction center electron donor mimic, a zinc porphyrin. Both steady-state and time-resolved emission as well as transient absorption studies clearly proved occurrence of efficient singlet-singlet energy transfer from BDP to zinc porphyrin with the time scale of 28-48 ps, and a decrease in time constants for energy transfer with increasing the number of BDP units.

4. Acknowledgements

We are thankful to Dr. M. E. Zandler, Dr. N. V. Tkachenko, and N. K. Subbaiyan. The authors are thankful to the National Science Foundation, the State of Kansas through Kansas Technology Enterprise Corporation, and Academy of Finland for support of this work.

Testing Species Limits in the Highly Variable Scarab *Cyclocephalasexpunctata* (Coleoptera: Scarabaeidae: Dynastinae)

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Abstract. Members of the speciose genus *Cyclocephala* (Coleoptera: Scarabaeidae: Dynastinae) exhibit intraspecific variation of elytral patterns and genital morphology, creating diagnostic difficulties that confound study of the group. This study aims to comprehensively describe and explain the maintenance of intraspecific variation in *C. sexpunctata* and *C. brevis* using morphological, molecular and phylogeographic techniques. The mitochondrial gene CO1 was successfully amplified from *C. sexpunctata* specimens. Preliminary analyses of data on elytral and pronotal patterns indicate that populations of *C. sexpunctata* from Panama and Guatemala have different frequency distributions of pattern classes. Variation in these populations is distributed along altitudinal clines.

1. Introduction

Members of the speciose genus *Cyclocephala* (Coleoptera: Scarabaeidae: Dynastinae) often exhibit intraspecific variation of elytral patterns and genital morphology. Monographic works on *Cyclocephala* utilizing large numbers of specimens from different localities provide an excellent taxonomic framework for analyzing geographic patterns of intraspecific variation within this genus [1][2][3]. Species concepts proposed for *C. sexpunctata* Laporte, 1849 and *C. brevis* Höhne, 1923 have undergone successive rounds of synonymy and re-description [1][2][3]. Currently, *C. sexpunctata* and *C. brevis*, as well as *C. tutilina*, are reliably diagnosable only by a small set of variable male characters.

Attempts have been made to characterize the magnitude and distribution of intraspecific variation in several *Cyclocephala* species. A qualitative method to assign *C. sexpunctata* specimens to variant classes was developed [4], but this method is unrepeatable and has yielded ambiguous results. It was proposed that the elytral pattern variation observed within *Cyclocephala* may be the result of a developmentally plastic response to humidity levels in the larval environment [4]. Variation in elytral patterns may also be distributed along altitudinal clines (Ratcliffe, 2010, pers. comm.).

The aims of this study are to comprehensively describe and identify causes of intraspecific variation in *Cyclocephalasexpunctata* and closely allied species using morphological, molecular, and phylogeographic techniques. Species concepts for *C. sexpunctata* and *C. brevis*, will be tested against a robust morphological and molecular data set. Ecological niche modeling will be used to identify environment factors influencing the distribution of intraspecific variation in *C. sexpunctata* and *C. brevis*. Molecular analysis of the CO1 and CAD gene loci will reveal the level of isolation between populations of *C. sexpunctata* and *C. brevis*.

2. Experiment, Results, Discussion, and Significance

Taxa Selection

Ten closely related in-group species were chosen for inclusion in this study based on the following combination of characters: 1) clypeus with apex distinctly emarginate, dorsal surface at least partially setose (especially frons, anterior angles of pronotum and elytra); 2) pronotum on base without marginal bead; 3) dorsal color testaceous or reddish-brown; 4) presence of 6-8 elytral maculae, and; 5) general form of the male parameres (especially presence of a basal process) (Brett Ratcliffe, pers. comm.) [2][3].

Morphological Analysis of Elytral Maculae

A total of 113 *C. sexpunctata* from Guatemala (n=55) and Panama (n=58) were scored for the presence/absence of elytral maculae, clypeal maculae, scutellar maculae and ventral maculae. Specimen length, a surrogate of body size, was measured medially between the apical and basal margin of the pronotum (in mm). Area of elytral and pronotal maculae were measured in mm² using the free program ImageJ (<http://rsbweb.nih.gov/ij/>). In cases where a pronotal macula was non-contiguous, only the portion with the largest contiguous area was measured.

Specimens associated with detailed altitudinal data were pooled into elevation classes and their mean area of maculation (corrected for body size) was calculated. Preliminary results of this analysis support

the hypothesis that the relative amount of elytral maculation increases with rises in elevation (Fig. 1). Frequency bins for relative elytral and pronotal maculae area were constructed around the global mean of these measures and are depicted as histograms (Fig. 2, Fig. 3). The Panamanian and Guatemalan subsamples have pattern morph frequencies approaching a normal distribution, though the Guatemalan subsample has its frequency peak shifted towards higher relative levels of maculation.

CO1 Amplification

Tissue samples were taken from the mesocoxal cavity of 5 Panamanian *C. sexpunctata* specimens preserved in alcohol. DNA was extracted and amplified from these samples using Qiagen kits. CO1 was successfully amplified using the primers Pat and Jerry [5] and an established PCR thermal cycle protocol [6]. PCR samples of the amplified CO1 locus await sequencing and assessment of phylogeographic utility in *C. sexpunctata*.

3. Conclusions

Several additional populations of *C. sexpunctata* await analysis. Preliminary data support the hypothesis that macular variation in *C. sexpunctata* is distributed along clines of altitude and latitude. The results in Figs. 2 and 3 show that patterns of variation differ in *C. sexpunctata* populations from Panama and Guatemala. This may indicate that these populations of *C. sexpunctata* are sharing limited amounts of genetic material or are under different selective pressures. Within these populations variation is distributed along clines of elevation, with macular area increasing with increasing elevation. The level of isolation inferred from the morphological data will be confirmed by molecular analysis of CO1 and CAD.

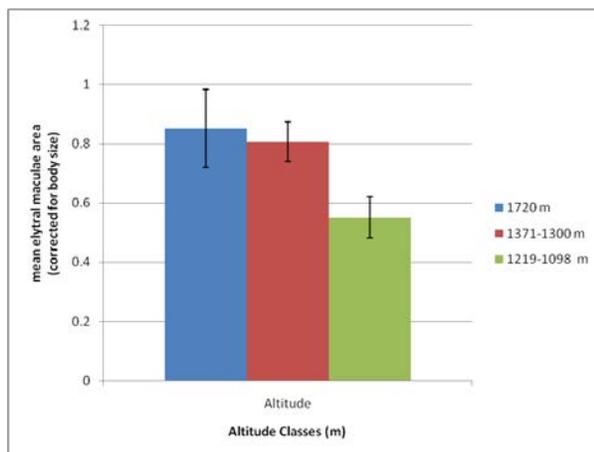


Figure 1. Mean relative macular area of Panamanian *C. sexpunctata* by elevation

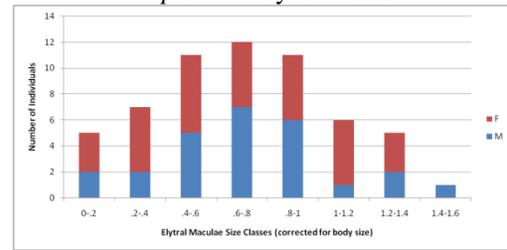


Figure 2. Frequencies of Panamanian *C. sexpunctata* patternmorphs

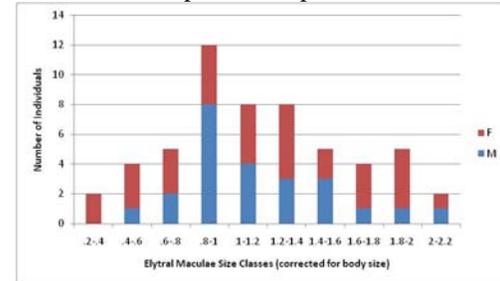


Figure 3. Frequencies of Guatemalan *C. sexpunctata* patternmorphs

4. Acknowledgements

I thank Drs. M.J. Paulsen and B. C. Ratcliffe (University of Nebraska State Museum, Division of Entomology) for their gracious time, funding, and expertise given to this research project. I thank the Biofinity Project team (Stephen Scott, Ian Cottingham, Etsuko Moriyama, Leen-Kiat Soh [University of Nebraska], Federico Ocampo [Instituto Argentino de Investigaciones de Zonas Aridas, Mendoza, Argentina], and Mary Liz Jameson [Wichita State University]) for funding and programmatic support. Funded by NSF DBI-0743783 to Scott, Henninger, Jameson, Moriyama, Soh, and Ocampo; NSF-DEB 0716899 to Ratcliffe and Cave.

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Hip Flexibility and Strength Immediately Following Manual Therapy Interventions

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Abstract. Our study examined hip internal, external, abduction, and extension strength, as well as hip internal and external ROM both before and immediately after manual intervention. Our goal was to determine if manipulation and /or mobilization would increase strength and ROM greater than that of the control group. Sixty-one college aged students participated and were randomly assigned to one of three groups (control, mobilization, and manipulation groups). There was no significant difference within the control, mobilization, and manipulation groups when testing external rotation strength or in pre and post test measurements between the three testing groups in any of the dependent variables.

1. Introduction

Many pathologies of the hip involve weakness of various hip musculature and subsequent dysfunction. Decreased hip strength is linked to lower extremity muscle strains and pathology including patellofemoral pain syndrome (PFPS)¹. The muscles that are most affected by hip pathology are the gluteal muscles; however, our study aims to examine hip rotators and abductors as well. Muscle weakness may be caused by inhibition of a muscle related to hypomobility of the underlying joint². There are five grades of mobilization; Grades I-IV is considered low velocity and V is high velocity manipulation. Grades I and II are used for pain relief, while grades III and IV are used to increase ROM³. Joint manipulation is a passive movement of a skeletal joint that aids in releasing, relieving pain, and restoration of motion and function⁴. This study looks to see if the hip joint gains strength and/or ROM immediately after a manipulation or mobilization. It was hypothesized that those subjects in the manipulation and mobilization groups would have a greater increase in hip flexibility and strength than those subjects in the control group receiving no intervention.

2. Experiment, Results, Discussion, and Significance

Sixty-one male (n=19) and female (n=42) college-aged (mean age=25.1 years) individuals in the College of Health Professions at Wichita State University participated in the study. Subjects were randomly assigned into one of three groups: a control group (n=20), a supine SI joint regional manipulation group (n=23), and a group receiving a grade III/IV P-A side lying hip mobilization (n=18), all performed by a physical therapist.

Subjects were tested before and after interventions for strength using a hand held dynamometer, the Nicholas Manual Muscle Tester (NMMT). All angles of ROM were recorded using a bubble goniometer. Leg dominance was determined by which leg the subject kicks a ball with. Immediately following the intervention, the subjects were tested again for strength and ROM. A double-blind method in which the testers and subjects were blinded was utilized.

Results

There was no significant difference within the control, mobilization, and manipulation groups when testing external rotation strength. Furthermore, there was no significant difference found in the pre and post tests between the three testing groups in any of the dependent variables.

However, within the control, mobilization, and manipulation groups, a significant interaction was found between pre and post test groups when testing for internal rotation strength, abduction strength, extension strength, internal rotation range of motion, and external rotation range of motion. The data, in Tables 1-3, outlines pre and post test means and significant differences for our selected variables in the control, mobilization, and manipulation groups.

Discussion

The purpose of this study was to determine whether subjects in the manipulation and grade III/IV

mobilization groups would have a greater increase in hip flexibility and strength than those subjects in the control group receiving no intervention. Data analysis of this study revealed a significant interaction between pre and post tests within the control and intervention groups for each dependent variable.

Analysis of this data showed that there was a significant difference between pre and post testing in both the manipulation and mobilization groups in all but one or two dependent variables, respectively, which was expected due to the clinically proven effects of mobilizations and manipulations. However, it was expected that the intervention groups would show a consistent significant increase across all dependent variables.

Unexpectedly, analysis also revealed a significant difference between pre and post testing in the control group in three of the six dependent variables measured. This could possibly be attributed to several extraneous variables.

These findings differ from other studies we looked at in that they found a significant difference from pre- to post-testing between a control group and a mobilization group.

Recommendations for further research include implementing a familiarization session prior to testing, in addition to a pilot study to determine how many of those sessions would be needed before performance is considered stable⁵. In addition, a sample size of at least thirty subjects in each group would better follow clinically proven research guidelines.

3. Conclusions

Subjects in the manipulation and grade III/IV mobilization groups did not have a greater increase in hip flexibility and strength than those subjects in the control group receiving no intervention. Additional research is needed to determine the clinical effects of hip mobilization/manipulation on hip flexibility and strength.

Tables

Table 1
Pre and Post Test Results in Control Group

Group	Variable	Pre	Post	Significance
Control				
IR (kg)	14.19±4.3	14.23±4.3	1.00	
ER (kg)	13.70±3.8	13.61±3.7	.135	
Abd (kg)	25.33±3.5	25.40±3.5	.015	

Ext (kg)	22.44±4.6	22.34±4.5	.011
IR (deg)	46.50±10.1	47.85±11.3	.041
ER (deg)	51.67±11.0	53.08±12.3	.067

Table 2
Pre and Post Test Results in Mobilization Group

Group	Variable	Pre	Post	Significance
Mob				
IR (kg)	14.01±3.4	14.86±3.4	.010	
ER (kg)	13.48±2.8	14.08±2.9	.023	
Abd (kg)	26.04±5.4	26.86±5.2	.179	
Ext (kg)	22.98±4.4	23.96±4.8	.003	
IR (deg)	44.36±10.0	46.19±9.4	.001	
ER (deg)	51.44±9.0	51.08±8.6	.611	

Table 3
Pre and Post Test Results in Manipulation Group

Group	Variable	Pre	Post	Significance
Manip				
IR (kg)	12.59±3.1	14.31±5.8	.022	
ER (kg)	13.10±3.8	13.57±4.4	.062	
Abd (kg)	25.20±3.8	26.63±4.2	.000	
Ext (kg)	21.84±4.5	22.88±4.6	.000	
IR (deg)	42.73±9.4	46.51±10.1	.000	
ER (deg)	51.31±10.6	54.37±10.8	.000	

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The Role of Working Memory on Mood and Comprehension

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Abstract. This study examined the relation between emotional experience and working memory, and their effects on reading comprehension processes. Previous research has shown that those with higher working memory feel emotions to the same extent as those with lower working memory, but are better able to suppress emotional responses. Participants were induced to feel a sad, happy, or neutral mood after watching video clips. Although the mood induction was successful, there were no differences based on working memory in the degree to which participants experienced the induced emotions. There was a marginally significant effect in the type of comprehension processes used between high versus low working memory participants as a function of mood.

Introduction

Working memory, which refers to how individuals mentally manipulate information they are currently using in a given task, is vital to processing information. Those with higher working memory capacities are capable of holding more pieces of information at once (Just & Carpenter, 1992). When instructed, those with high working memory, compared to low, also demonstrate enhanced emotion regulation: they are better able to suppress negative emotions while watching gruesome film clips even though there were no differences in the actual experience of emotion between the two groups (Schmeichel, Volokhov, & Demaree, 2008).

Beyond suppression of emotions, working memory and mood are also related to reading comprehension. High working memory is associated with more effective moment-by-moment processing, and enhanced memory for texts (Just & Carpenter, 1992). It is also associated with the ability to utilize different reading strategies depending on the reader's goals (Linderholm & van den Broek, 2002). Mood is related to comprehension: sad moods can impair a reader's ability to recall a text (Ellis, Varner, Becker, & Ottaway, 1995). The current study examines the relations between comprehension processes, mood, and working memory. We hypothesized that, although working memory would not be related to the degree to which participants experienced different induced moods, those with high working memory would experience less interference when processing a text as a function of an induced mood.

Method

Participants

One hundred and ten undergraduate students, all of whom were native English speakers, participated.

Materials and Procedures

Participants first completed the PANAS-X (Watson & Clark, 1994) which assesses mood by providing a list of emotions to rank on a likert scale of 1 (very slightly or not at all) to 5 (extremely). The various emotions group into categories, including positive affect, joviality, negative affect, and sadness. Next, participants were randomly assigned to watch 12-minute video clips that induced a happy, sad, or neutral mood (Rottenberg, Ray, & Gross, 2007). Afterward, participants again completed the PANAS-X. Following the mood induction procedure, each participant was randomly assigned to read one of four expository texts from *Scientific American* (van den Broek, Lorch, Linderholm, & Gustafson, 2001). Participants read the text aloud, one sentence at a time. After each sentence, the participant shared their thoughts aloud. Finally, participants completed the Reading Span Task of working memory (Singer & Ritchot, 1996). Participants were given a set of unrelated sentences in which they had to remember the last word of each sentence. After they recalled the end words of the sentences, they were prompted to fill in missing words from the previous sentences. The final score was the number of correct words recalled when the missing word was correctly identified.

Results

To determine the effects of working memory on the degree to which participants were affected by the mood induction procedure, ANOVAs were employed. Sad-induced participants experienced greater increases in negative affect and sadness than the happy- and neutral-induced groups, $p < .001$. Happy-induced participants experienced greater increases in positive affect and joviality than the neutral- and sad-induced groups, $p < .001$. The neutral-induced participants also had greater increases in positive affect than the sad-induced participants, $p < .05$.

To test the effects that mood and working memory have on moment-by-moment comprehension, additional ANOVAs were employed. Happy-induced participants engaged in more text-based coherence processes, and fewer non-coherence processes than neutral-induced participants, $p < .05$. The condition by working memory interaction was marginally significant, $p < .06$, with neutral-induced participants with low working memory generating the least amount of text-based coherence processes, and the most non-coherence building processes, $p < .04$.

Discussion

Consistent with Schmeichel et al. (2008) the current study found that, although the mood induction procedure was effective, working memory did not affect participants' experiences of induced emotions. Although the current study did not measure emotion suppression, emotion suppression may have been greater in this experiment for participants with higher working memory. The marginally significant difference in comprehension processes used by high and low working memory participants could be attributed to those with a high working memory having the ability to suppress negative emotions that might otherwise interfere with processing (Ellis et al., 1995). A limitation of this study was that the working memory interactions were only marginally significant. However, this could be an issue of statistical power. Further studies should utilize a larger number of participants to account for this challenge.

Conclusions

This study describes the relations between working memory, emotional experiences, and comprehension. After using video clips to induce either a happy, sad, or neutral mood, high versus low working memory participants experienced no difference in experience of emotions. High and low working memory participants did however, experience differences in the types of comprehension processes used. This could be attributed to those with higher working memory being able to suppress emotions better and therefore not letting emotions interfere with text comprehension experiences. Future work should examine the differential effects of emotional experience versus emotional expression when describing interactions with working memory and text comprehension.

Acknowledgements

A special thanks to David Rapp and Vanessa Elliott for their help in conducting this study.

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Inverse Doping Profile Analysis for Semiconductor Quality Control

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Abstract. Inverse doping profile problems are linked to inverse conductivity problems under the assumptions of zero space charge and low injection. Unipolar inverse conductivity problems are analyzed theoretically via three uniqueness proofs. Optimized numerical methods are developed for solving the unipolar direct conductivity problem with a piecewise constant conductivity coefficient. Finally, the unipolar inverse conductivity problem is solved for inclusions defined by as many as 9 entirely unknown parameters, or by as many as 120 parameters when an initial guess for each parameter is known with less than 10% error. Our free boundary identification algorithm produces a sequence of improved approximations in a way that provides both regularization and accelerated convergence towards the solution.

1. Introduction

Once upon a time, about one hundred years ago, the properties of semiconductive materials seemed almost like magical powers, and were poorly understood. For instance, beginning in the early history of radio broadcasting, people discovered that “cat's whiskers” had the mysterious ability to drastically improve the reception of radio waves⁷. Just as magnetism was harnessed and compasses superseded celestial navigation, soon semiconductivity would be enlisted as the foot soldier of a technological revolution. Within the length of one human life, mankind would reach the moon, and civilization would become reliant on strange inventions unlike anything in all known world history.

Physicists and mathematicians could not have predicted the changes that would occur in a blink of an eye on history's timescale, but they did see the great potential of semiconductor devices. The electrical conductivity⁸ of semiconductors falls between that of conductors (typical conductivities range from 10^4 to 10^6 Siemens per centimeter) and that of insulators (on the order of 10^{-18} to 10^{-10} Siemens per centimeter). This great flexibility in the conductivity of semiconductors, combined with the ability of doping to control the conductivity with great freedom in precisely specified areas, is what makes semiconducting materials so useful. Doping allows devices to be created having a built-to-order doping profile, and thus built-to-order electrical conductivity.

The life of a semiconductor device begins as a pure wafer of undoped silicon substrate. A semiconductor's conductivity is sensitive to minute amounts of impurity atoms. For example, the addition of less than 0.01 percent (one ten-thousandth) of a particular type of impurity can increase the electrical conductivity by four or more orders of magnitude. Carefully-controlled addition of dopants forms a doping profile that regulates electrical conductivity. The result of this doping process is one of 28 common types of semiconductor devices, each with unique characteristics based on their doping profiles.

We wish to determine the doping profile, and thus the function and performance of a semiconductor device, by exterior measurements of electrical voltage and current.

Ultimately, our goal is to provide efficient and accurate testing of semiconductor devices for purposes of quality control, directly at the manufacturing stage and in real-time. So far the theoretical basis has been constructed and successful numerical simulations performed, but experiments in industry remain as future work.

2. Discussion

Calculated quantities of voltage and current, as well as the doping profile, are governed by a complex system of partial differential equations known as the Drift Diffusion Equations [1]. In our research we establish links between drift diffusion and conductivity, which permit us to determine the doping profile by solving the so-called “Inverse Conductivity Problem.” The inverse conductivity problem belongs to a class of mathematical physics problems

⁷ So-called cat's whiskers were actually primitive versions of Schottky diodes|a special type of semiconductor diode with a very low forward-voltage drop (resulting in higher efficiency) and a very fast switching action (on the order of one-tenth of one-billionth of one second).

⁸ Units of conductivity, measured in Siemens, are inversely proportional to units of resistivity, which are measured in ohms.

known as Inverse Problems, which include X-ray tomography, seismic analysis, and image processing. All these problems are very difficult, and in many ways wide open for further mathematical research and analysis, even after decades of continual research by top scientists. For instance, no sonar navigation system is yet able to match the natural navigational ability of a bat, even though both the bat and the submarine’s sonar system are based on the same measurements of reflected sound waves.

Sonar is also the perfect way to understand the goal of an “Inverse Conductivity Problem” in a more familiar way. An algorithm for solving the inverse conductivity problem tries to find an object just as a sonar navigation system would do. The primary distinction is in the data that are used. Instead of sound waves, electrical current and voltage measurements from a long distance away are used to find the location of an unknown object which has disturbed the electro-magnetic field by its presence.

We solve the inverse conductivity problem by expressing its solution as the limit of a minimizing sequence for a functional depending on a parameterized class of direct problems defined in terms of the approximate solutions to the inverse problem, which are initialized by an initial guess consisting of a circle—in the case that no prior information is known—, or a “local” initial guess—when some prior information about the object is known.

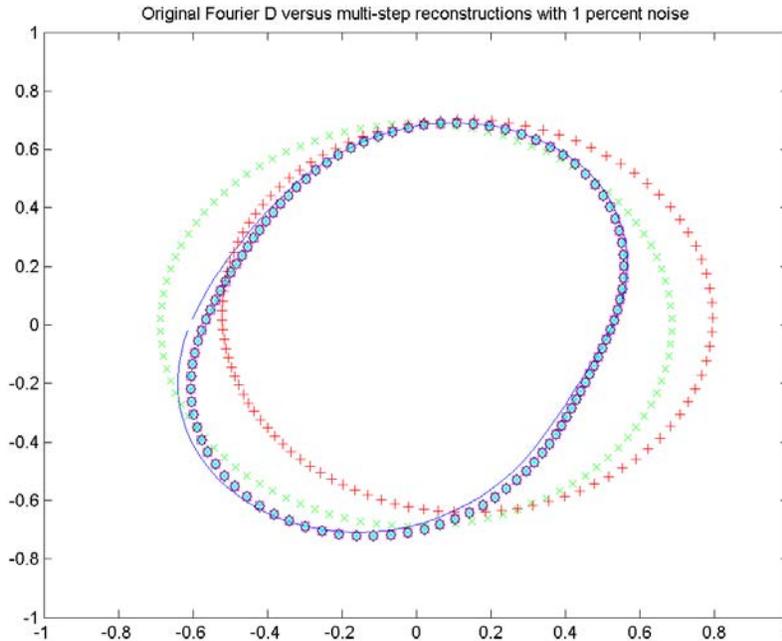


Figure 4: Multi-stage algorithm for locating a nine-parameter domain with one percent noise.

3. Conclusions

We have reduced the stationary drift-diffusion equations into the conductivity equation [2], under reasonable and widely-used assumptions of zero space charge and low injection. The result is a one-to-one relationship between solutions to the inverse problem for the conductivity equation and solutions of the original inverse problem for doping profiles. Then we have proved important global and local uniqueness results for the inverse conductivity problem, as well as a more general class of semilinear elliptic equations. Moreover, we have developed a very efficient and accurate algorithm for solving the direct conductivity problem given in Section 2.7. Finally, we have solved the resulting inverse conductivity problem by finding a minimizing sequence of a suitable error functional, both with and without any initial guess provided.

4. Acknowledgements

Victor Isakov, my dissertation advisor, has contributed to this project by his expert advice, helpful feedback, and his willingness to share his vast analytic experience and knowledge.

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Effects of Negative Middle-Ear Pressure on Auditory Steady State Responses: A Preliminary Study

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Abstract. The auditory steady-state response (ASSR) is a type of auditory evoked potentials, which are electrical activities of the auditory system in the presence of sounds and recorded with electrodes from the scalp. Research has suggested that the ASSR is a useful tool for evaluating the function of the auditory system and is superior to conventional techniques in estimating hearing thresholds in certain special populations. Negative middle ear pressure (MEP) is one of the most common pathologies in humans, particularly among young children. A negative MEP causes retraction of the eardrum which affects the transmission of sounds. However, impact of this condition on the ASSR has never been investigated. The purpose of this study was to make a preliminary observation on ASSR recordings in ears with negative MEP. In 25 human subjects, a positive ear canal pressure (200 daPa) was applied to simulate a negative MEP. The effect of negative MEP is expressed by the change of ASSR amplitude caused by the air pressure. Results show that ASSR amplitudes for all four frequencies were reduced by approximately 12% to 51%, which became larger with increasing frequency from 500 to 4000 Hz.

1. Introduction

Auditory evoked potentials (AEPs) are electrical potentials of the brain in response to sounds received by the ear. Various types of AEPs have long been used in audiology as tools for evaluating the function of the auditory nervous system and estimating hearing sensitivity. Recently, a new type of AEP, auditory steady-state responses (ASSRs), has gained considerable attention due to the growing need for more precise physiological measurements (for a review, see [1]). Investigations in the past decade have established that the ASSR measurement has a good potential to be used in clinical applications such as predicting hearing thresholds in the so-called difficult-to-test populations, e.g., newborns, infants, and patients with mental retardation or developmental disability. The advantages of ASSR over other AEP measurements include the ability to test for frequency-specific data, testing both ears simultaneously, and response detection with a more objective method.

The middle ear system plays an important role in our hearing because sounds must go through the middle ear to reach the inner ear for processing. Problems with the middle ear adversely affect sound transmissions. Negative middle ear pressure (MEP) is one of the most common pathologies of the middle ear, especially in children. When the middle ear functions properly, the air pressure in its cavity is the same as the ambient air pressure. The Eustachian tube, a small passage connecting the middle ear to the back of the throat behind the nose, maintains the pressure balance. Obstruction or blockage of the Eustachian tube gives rise to a negative MEP, resulting in a retraction of the tympanic membrane. A stiffer middle ear apparatus causes an increase in the acoustic impedance of the system. The condition may lead to substantial reduction of sound transmission through the middle ear and thereby likely affects the ASSR measurement.

Literature review shows that a limited amount of studies have been done pertaining to the effect of negative MEP on other types of electrophysiological tests in humans. For example, Ferraro et al [2] studied the effect on electrocochleography using the ear canal pressure (ECP) change to simulate negative MEP. Sun and Shaver [3] investigated the effects of actual negative MEP on otoacoustic emissions, a physiological measurement of the inner ear function. To develop the ASSR technique into a reliable clinical tool, we must document the extent to which ASSRs are influenced by negative MEP. To the best of our knowledge, research on the effect of negative MEP on ASSRs has never been carried out. The objective of the present study was to conduct a preliminary experiment of the effect of negative MEP on ASSR recordings. In this study, the negative MEP was simulated with a positive ECP.

2. Experiment, Results, Discussion, and Significance

A total of 25 young adults (18 to 35 year old) were recruited based on the following inclusion criteria: (1) negative history of otologic disease; (2) no positive findings in the ear canal and tympanic membrane in otoscopic inspection; (3) normal hearing defined by pure-tone thresholds of 25 dB HL or better for the octave frequencies from 250 to 8000 Hz; and (4) type A tympanogram with the tympanometric pressure within ± 50 daPa. An IHS SmartEP system (Intelligent Hearing System, Inc.) was used to measure the ASSR and a GSI TympStar Middle-Ear Analyzer (Grason-Stadler, Inc.) to adjust the ECP in the experiment. The air pump portion of the tympanometer probe assembly was connected to the earphone tube of the ASSR system.

For each subject, the ear with better hearing and/or better middle-ear function was used as the test ear. Through the insert earphone placed in the ear canal, four tone bursts at frequencies of 500, 1000, 2000, and 4000 Hz were simultaneously presented with a presentation rate at 77, 85, 93, and 101 Hz, respectively. For recording ASSRs, three electrodes were placed on the scalp (one on the forehead and one behind each ear). The stimulus sounds were presented at 80 dB SPL. The ECP was set manually at +200 daPa to simulate a -200 daPa MEP and monitored on the tympanometer's LCD screen. ASSRs were repeatedly measured three times: two baselines under normal MEP and one under the introduced ECP. The second baseline ASSR was measured after the ECP was released in the first fifteen subjects and measured before the ECP was applied in the last ten subjects.

Valid data was collected in 22 ears. The effect of negative MEP is expressed by the change of ASSR amplitude caused by ECP, which was calculated by subtracting the ASSR amplitudes measured under the ECP from the amplitudes of the first baseline. Compared to those in the first baseline, ASSR amplitudes for the four frequencies were reduced by ECP by approximately 12% to 51% on average (Fig. 1). The reduction increased with frequency from 500 Hz to 4000 Hz. Large variability among subjects is evident for the ECP effect (Fig. 1) and ASSR measures (not shown), particularly for 4000 Hz. A minimal difference was noticed between the two baselines for all frequencies (Fig. 1) except for 4000 Hz (18% change), which may be due to the large individual variability. The change of recorded background noise in the ASSR measurement under the ECP was minimal (not shown). Statistic test will be performed to examine the significance of the change of ASSR amplitudes.

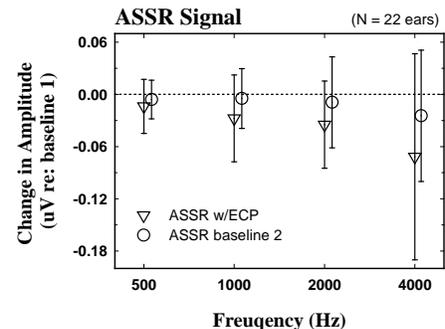


Fig. 1. Change of ASSR amplitude as a function of frequency when measured under +200 daPa ear canal pressure and for a repeated baseline measurement.

3. Conclusions

This is the first study aiming at the effect of negative MEP on ASSRs. Results of the present study show that, as a positive ECP is applied, the ASSR for all frequencies from 500 to 4000 Hz noticeably decreases in amplitude with a larger change for high frequencies. This reduction in ASSR amplitude may result in an inaccurate estimation of the hearing sensitivity of patients when a negative MEP is present. Further investigations in this line with a larger sample size need to be conducted to confirm the findings from the present study.

4. Acknowledgements

This study is a collaborative work conducted in the Auditory Research Laboratory of Xiao-Ming Sun.

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The Implications of Gendering Childhood Obesity PSAs

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Abstract. The percentage of overweight and obese children is at or above 30% in 30 U.S. states. In light of this nationwide epidemic, examining messages concerning childhood obesity becomes increasingly important. One strategy employed to help combat childhood obesity is public service announcements (PSAs). In marketing, gender is one of the leading variables employed to tailor messages to audiences. The Constant Comparative Method was used to content analyze 20 childhood obesity PSAs found on YouTube and 10 PSAs found on the Let's Move Website. Analyses indicate that PSAs on YouTube, while still biasing the male population, represented females more often than those on the Let's Move Website. Implications for obesity prevention are discussed.

Introduction

Effecting approximately one third of American children [1], childhood obesity has been recognized by the World Health Organization as an epidemic [2]. Medical complications include, but are not limited to: high blood pressure, type II diabetes, and sleep apnea [2]. Children also suffer mentally as they are often the subjects of ridicule by their peers [3]. Not only do children suffer both physically and mentally, but treating the symptoms associated with it costs the United States \$150 billion annually [4]. Many organizations, both public and private have spent millions of dollars in attempts to curtail the climbing rates [5]. Most recently, childhood obesity has caught the attention of many policy makers. First Lady, Michelle Obama has recently announced her "Let's Move" campaign targeting childhood obesity [4]. Prevention efforts often employ media campaigns, which utilize PSAs to warn both parents and children of the negative effects of a poor diet and lack of physical activity. In marketing, gender is one of the leading variables employed to tailor messages to audiences. Because we live in a media saturated environment and because we are often consumers of PSAs it becomes crucial to analyze their contents from a gender based perspective [6].

Experiment, Results, Discussion and Significance

This study reports the results of a content analysis of childhood obesity PSAs that urges children and/or parents to become more physically active and/or eat a healthier diet. Two strategies were employed to search for PSAs involving the prevention of childhood obesity. The first involved utilizing YouTube. The following terms were used to find PSAs directed toward parents or children urging children to eat healthier and/or exercise regularly: "childhood obesity p.s.a.," "child nutrition p.s.a.," "child fitness p.s.a.," and "child exercise p.s.a." Upon searching YouTube 153 videos were obtained using the previous search terms. All videos were then viewed to determine if they met the following criteria.

- P.S.A.s must not be over one minute long.
- P.S.A.s must be produced by a professional organization.
- P.S.A.s must be produced in the English language.
- P.S.A.s must not be over ten years old.

After videos were determined to meet all criteria, 20 were retained for analysis.

The second search strategy involved accessing The "Let's Move" Website. The site included ten P.S.A.s which were determined to obtain all criteria.

Using the Constant Comparative Method, each video was first viewed in its entirety. Viewing videos determined PSAs directed at children often employ the use of cartoon characters or animation. PSAs that utilized animation and or cartoons and those cartoons that were given gender qualities were counted as representing either a female or male gender. After videos were viewed a code sheet was developed and the following categories emerged from initial viewing: "voiceovers," "gender representation," "gendered language" and "activities." Videos were then viewed again to determine if a voice over was employed and whether it was a female, male or an undeterminable gendered voice. The videos were then viewed a third time to determine how many times each gender was represented. It was

noted that at times it was impossible to determine the gender of characters in the PSAs. When this occurred, neither female nor male was marked on the code sheet. Videos were then viewed a fourth time to determine what types of activities characters participated in. The gender of background characters or members of crowds was not counted. Only when the camera focused on a female or male specifically, was gender representation noted. At the same time gender representation was noted, videos were analyzed to note any gendered language. Due to the nature of childhood obesity PSAs that promote physical activity, often represent characters participating in sporting activities. These activities often promote stereotypical activities where boys are seen participating in activities such as basketball and football and girls are seen participating in activities such as jumping rope and playing volleyball. Videos were analyzed to determine if male or female characters participated in stereotypical activities. This often necessitated pausing the video to determine what characters were participating in which activities. After all categories were coded, the result of each one was noted. The results of the PSAs viewed on YouTube were then compared to PSAs viewed on the “Let’s Move” Website.

	YouTube PSAs		Let’s Move PSAs	
	Females	Males	Females	Males
Gender Representation	31	53	11	32
Voiceovers	5	8	3	5
Activity Participation	7	7	1	10
Gender Biased Language	0	0	0	0

Conclusion

Based on the findings of this study, the following conclusions are drawn. The majority of PSAs represent males more often than females. When PSAs from the YouTube site were viewed, they contained more equal representation of females and males participating in activities, even though the overall number of males to females was still biased. However, when PSAs were viewed on the “Let’s Move” Website, only one female was featured playing soccer. When males were featured in “Let’s Move” PSAs they were often prominent sports figures participating in activities such as football and basketball. Females who were featured in the PSAs were Michelle Obama, Nelly Furtado and Mo’Nique who spoke about the dangers of childhood obesity and the importance of lowering rates, but were never seen participating in any activities. Childhood obesity rates for females and males are high for both genders [7]. Both females and males need to become more physically active. Therefore, both genders should be represented in PSAs promoting physical activity, especially PSAs featured on the “Let’s Move” Website. PSAs need to employ female and male role models engaging in physical activity. Just as PSAs already use males engaging in activities like football and basketball, females should be engaged in similar activities. Girls need active female role models, not just women, no matter how appealing or credible sitting passively talking about the need to be more active. Those children and parents who view First Lady Obama’s website could draw the conclusion that only male children need to increase physical activity as those PSAs that feature children being active are targeting male children. The “Let’s Move” Website needs to employ more PSAs directed at female children to encourage them to be more active.

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Measuring the Effects of Rhythmic Movements Implemented in a High Poverty Elementary Classroom

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Abstract. This study investigated the effects of rhythmic movements on students' behaviors, emotions and academic growth. The study concentrated on a fourth grade class from a Title 1 building, where the majority of students were from poverty and scoring below grade level in reading and mathematics. A series of exercises were implemented in the classroom for 15-20 minutes daily for nine weeks. The behavior, emotions and academic growth of the students were monitored and recorded. Results showed a decrease in negative behavior from 35 interruptions per hour to 5 and an increase in student engagement by 15%. Results also showed less stress and worries among the students. Academically, reading scores significantly increased as compared with the control group.

1. Introduction

With the growing diversity in America's classrooms, many new issues have emerged. Students are faced with more challenges and pressures than ever before. Students, especially students from poverty, are coming to school with high stress rates, and this stress is having a direct effect on the students' academic and behavioral success [1].

After an extensive literature review, it was found that exercise and movement can reduce stress, and thereby increase academic success [4, 5]. The purpose of this study was to then evaluate the effects of rhythmic movements implemented in a high poverty classroom. Other studies have been conducted in which exercise is increased in schools with positive results [2, 3, 6] However, all of the previous studies have occurred outside of the classroom and for more than 30 minutes. There is a need for strategies that individual teachers can implement into their own classrooms on a daily basis, and this became the foundation for this study.

2. Experiment, Results, Discussion, and Significance

The study was performed in a fourth grade classroom, in a Title 1 building, where the majority of students were scoring below grade level in reading and math. A series of exercises were implemented in the classroom for 15-20 minutes daily for nine weeks. The exercises were inspired from Bill Hubert's Bal-a-vis-x, but his program was not implemented in this study [3]. During this time, the behavior, emotions and academic growth of the students were monitored and recorded by the researcher. The behavior was recorded a total of nine times throughout the study (three times in the first week, fifth and ninth weeks). The students' behavior was observed for an hour during these sessions, and the number of students on task was recorded along with the number of interruptions. Student surveys were also given at the beginning and end of the study to measure their emotional responses to the study. In addition, the Northwest Evaluation Association's computerized adaptive tests were used to measure the students' academic growth in reading and mathematics. Another fourth grade classroom was used as the control group.

Results showed that negative behaviors considerably decreased while student engagement considerably increased. Overall, student interruptions were cut down drastically from 35 interruptions per hour to 5. In addition, 15% more of the students were on task in the lesson during that hour. This 15% increase brought the class up to 98% of its students being engaged and participating in the lesson. The student surveys showed less stress and worries among the students. At the beginning of the study, 47% of the student responded that they often worried in school; by the end of the study only 14% felt that they still worried frequently during school (see Table 1). Academically, math scores did increase, but did not show considerable gains or losses, as compared with the control group. However, reading scores significantly increased over the national standards and the control group. Classroom B (the control group) increased by about 4 points, which parallels the national average. However, Classroom A increased

by 10 points total, which is more than three times the national average growth (see Table 2). This equates to over a year's worth of academic learning completed in one semester.

These results are similar to findings from other studies (2,3, 6] in the sense that they all showed positive results after implementing more movement and exercises in schools. However all of their activities were done outside of the classroom and required a minimum of thirty to forty-five minutes. Although all results are positive, it is not something that teachers could implement easily in their classrooms. More research should be done on how exercise or movement could be implemented into individual classrooms.

Table 1

Question: How often do you worry about things in school?

Survey	Low (not often worried)	Medium	High (often worried)
Pre-survey	33%	20%	47%
Post-survey	65%	21%	14%

Table 2

NWEA Reading Scores

Group	Fall	Winter	Gain
Class A	187	198	11
Class B	193	197	4
National Average	201	205	4

3. Conclusions

Results from the current study suggest that rhythmic movement is effective in lowering student worries and negative behaviors, while increasing academic achievement. In conclusion, it would be advantageous of teachers and researchers alike to continue to study the effects of movement and exercise on student achievement. The ideas are becoming increasingly clear on how movement does actually increase student achievement. More methods should be discovered and adopted that would increase the use of movement strategies in classrooms by individual teachers. Therefore, more movement based exercises should be implemented into classrooms.

4. Acknowledgements

I would like to thank Dr. Fuchang Liu, Dr. Mara Alagic, and Scott Dellinger for their support and guidance during this study.

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Overcoming Disorienting Dilemmas in Global Intercultural Encounters: An Online Role-Play Simulator CMS

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Abstract. Breakdowns in communication between members of multi-cultural, multi-national, globally-distributed project teams represent a significant challenge for ventures such as designing and building new passenger aircraft, air traffic control systems, or space craft; or overcoming the effects of climate change, pandemics, and terrorism. An important element of the preparation of global graduates is learning how to systematically overcome disorientation that arises from the *unexpected* during global teamwork. An online role-play simulator—*Cultural Misconceptions Simulator (CMS)*—has been enhanced to allow users and authors from multiple language and cultural backgrounds to play scenarios and to write new scenarios. To date, CMS has been available in English only, with scenarios written from a *Western* perspective. The goal of this project is to make CMS available initially in Chinese, Russian, Kanji, Hindi, Arabic and English and later in many more languages. CMS comprises an SQL database for storing multiple interface elements and scenarios. Global collaborators and their students continue to test CMS. They are located at Australia, Austria, Canada, China, Germany, India, Japan, and Russia. As well as being a learning tool, CMS is also a research tool. CMS captures patterns of learning that help us to understand Intercultural Communication Competence development.

1. Introduction (Describe your idea)

Misunderstandings and miscommunication between people from different cultures provide a significant challenge as the world globalizes. Participants in global collaboration and communication across cultural boundaries need strategies that will allow them to routinely work in teams, whose members are distributed internationally from a changing mix of cultural backgrounds. Among the approaches to developing such strategies have been the classifications of national cultures according to a limited set of dimensions (e.g. Hofstede); or simply allowing time to develop strategies experientially. The former strategy becomes problematic when dealing with individuals from particular regions and sub-cultures within any given country. Most countries exhibit a diversity of cultures and language groups. Culture continues to evolve through interactions with other cultures and a changing environment. Often there is cross-fertilization or hybridization between cultures because of migration and inter-marriage.

The approach described here comprises some simple learning strategies that can be practiced using a role-play simulator and then applied to real situations. In 2005, a CD-based simulator was developed with only 3 different scenarios, all in English and all with a Western perspective. Based on testing with faculty, international visitors, graduate students and K-12 teachers, improvements were made. The simulator was redeveloped as an online tool and a repository of scenarios was added. This allowed the more experienced user to write their own scenario and to make it available online. Further testing was carried out in India, Mexico, Russia, Australia and different parts of the United States.

- A simulator was developed in 2005 on CD with 3 scenarios in English only
- Later put online with a repository of scenarios all in English
- Tried in India, Mexico, USA and Russia and improved based on feedback
- Need to increase the number of perspectives and allow scenarios in different languages
- New version was developed in 2009-2010
- This will allow many more people to use it and allow many more perspectives

This section should describe the background of the project and explain how your own research, essay, experiment, or creative work fits into that context. For example, you might describe the motivation for your project and then say how it is related to other similar scholarly or creative work. Remember to allow a “lay” reader to understand the fundamental aspects and current state of the subject area, as well as the significance of the project to that area.

2. Experiment, Results, Discussion, and Significance (Describe how you developed your idea)

- Developed entirely with MS SQL and ASP.net
- Database stores scenarios, users, performance data and labels for interfaces in different languages
- Number tables, scripts, languages
- Collaboration with colleagues in Russia, Japan, China and Wichita to translate interface
- Can now switch between languages for interface and enter new scenarios in any language
- Screen snapshots

The bulk of the paper, this section will take on different appearances for different types of projects. For research projects, this section should describe the research methodology; the principle parts of the argument, or the stages of inquiry; the results of the research and their significance. For creative projects, this section might include a description of the composition or performance; the materials and techniques; and the significance of the piece. For both types of projects, this section may include figures (drawings, pictures, graphs, etc.), which should be included in the electronic document.

3. Conclusions

- New simulator has been developed
- Will be moved to large server
- Users of different language backgrounds encouraged to contribute new scenarios
- Feedback from people of multiple languages
- Study patterns of learning and reflection about the PSPT strategies
- Next steps to develop and understanding of how people of different cultures and languages develop PSPT strategies

This section should be a short summary of the major results. In effect, it is a final brief description of the project, the statement you want readers to remember. This section should not introduce any new material.

4. Acknowledgements

- Boeing Company, Dmitry Galenko, Junko Saruhashi, Liang Weili and Drs Mara Alagic and Olga Kovbasyuk and their students

This section should briefly acknowledge any person or organization, who participated in the project by providing funding, advice or assistance, and who is not listed as an author.

Numerical Simulation of Heat Transfer in Cryoprobe

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Abstract. Computational Fluid dynamics (CFD) analysis was used to evaluate the heat transfer performance during the freezing process in cryotherapy. Cryoprobes are generally used for the treatment of diseased tissue in cryotherapy. As the hydraulic diameter of the cryoprobe is very small, it was considered as a mini/microchannel. CFD software packages FLUENT and GAMBIT were used for the simulation of a cryoprobe. Nitrous oxide at a very temperature of 183K was used as the working fluid. The simulation was carried out for different channels with hydraulic diameter varying from 20 μ m to 1500 μ m. Reynolds number were varied between 0.01 and 10 in order to vary the velocity at the inlet. It was found that with an increase in hydraulic diameter, there was a delay in the saturation boiling of the working fluid. The investigation also shows that the delay in boiling process occurs with an increase in Reynolds number as well. The pressure drop decreases with an increase in the hydraulic diameter of the channel. On the other hand, pressure drop increased with an increase in the Reynolds number.

1. Introduction

The cryosurgical approach is an elegant method that has become an important branch of surgery, with a wide variety of applications across the range of medical specialties from dermatology to oncology. Over the last 4 decades it has become an important and widely used technique for the treatment of tumors. This technique provides excellent results that are equivalent and often superior to other surgical technologies [1]. Further development of cryosurgical apparatus will allow it broaden the usefulness of cryotherapeutic applications [2, 3, 4]. Cryotherapy is a treatment that uses extreme cold to freeze and destroy diseased tissue, including cancer cells. In this process liquid nitrogen, nitrous oxide or argon gas is used as the working fluid. Cryoprobes are generally designed by using microtechnology. So it can be considered as a mini/microchannel and the flow and heat transfer in the channels can be analyzed.

2. Problem Definition and Solution

Two dimensional model of a 300 mm long l is considered with different hydraulic diameters .The mesh was gradually smooth to ensure boundary layer solving. Physical properties of nitrous oxide are shown in the Table1. The velocity at the inlet is calculated based on the Reynolds number, the hydraulic diameter of the channel and the physical properties of the fluid. The wall of the microchannel is assumed as a stationary wall that is no-slip wall condition. Different Reynolds numbers are considered in between 0.01 to 10.

Property	Value
Density (ρ)(kg/m ³)	1
Viscosity(μ)(kg/m-s)	1.72e-05
Standard state enthalpy(j/kgmol)	8.208e+07
Standard state entropy(j/kgmol-k)	219874

Table 1: Properties of Fluid

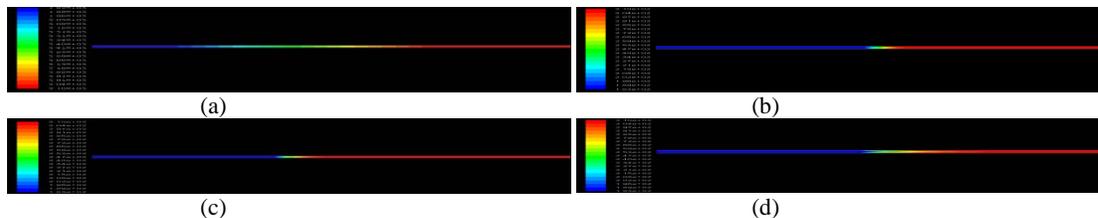


Fig 1 : Delay of saturation boiling for different channels with hydraulic diameters of (a) 50 μ m, (b) 750 μ m, (c) 1000 μ m, (d) 1500 μ m.

When the nitrous oxide passes through the cryoprobe at very low temperature heat transfer takes place in between the nitrous oxide and the diseased tissue. The simulation is carried out to study how the boiling process is affected in different channels for different Reynolds numbers. Figure 1 illustrates how the temperature of fluid is varying for different hydraulic diameters, and how the boiling process takes place. As the Reynolds number increases, the velocity of the fluid passing through the microchannel also increases. Hence, as the size of the channel increases the length at which the complete boiling is initiated also increases. The freezing process also becomes easier as the channel size decreases. Comparison is carried out for both of those channels. The analysis showed that with increasing hydraulic diameter, saturation boiling was delayed. The investigation also showed that the delay in boiling process occurred with an increase in Reynolds number as well. These variations are clearly observed from Figure 2. The pressure drop in the channel is high for both the minichannels and microchannels. As the hydraulic diameter of the channel increases the pressure drop also increases. It is also observed that for different Reynolds numbers in the range of 0.01 to 0.1. As the Reynolds number increases the pressure drop inside the channel decreases. This is shown clearly in Fig 2.

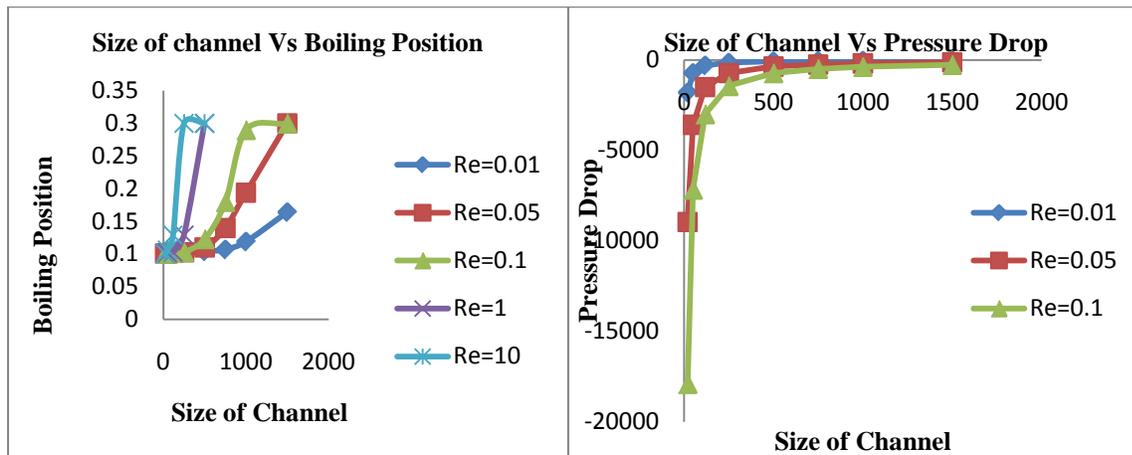


Fig 2: Size of channel Vs Position (b) Size of microchannel Vs pressure drop

Conclusion

Computational Fluid dynamics (CFD) analysis was carried in this study to evaluate the heat transfer performance during the freezing process in cryotherapy. CFD software packages FLUENT and GAMBIT were used for the simulation of a cryoprobe as a mini/microchannel. Nitrous oxide was passed through the channel at a very low temperature of 183K. The simulation was carried out for different channels with hydraulic diameter varying from 20 μ m to 1500 μ m. Reynolds numbers varied between 0.01 and 10 in order to vary the velocity at the inlet. It was found that with an increase in hydraulic diameter, there was a delay in the saturation boiling of the working fluid. The investigation also showed that the delay in boiling process occurred with an increase in Reynolds number as well. The pressure drop was very high in the channels and it decreased with an increase in the hydraulic diameter of the channel. On the other hand, pressure drop increased with an increase in the Reynolds number.

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Acknowledgements

The author would like to thank Dr. Ravigururajan of the Mechanical Engineering department at Wichita State University for his guidance and support throughout the entire project.

Test-Retest Reliability of Various Measures for Limits of Stability Using the Balance Master 6.1

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Abstract.Objective— Determine test-retest reliability of dynamic measures of balance using Balance Master 6.1 (BM6.1) with adults.Setting— University Campus.Participants— 15 adults, ages 18-30 years without balance deficits. Intervention— Participants completed pre-test and post-test limits of stability (LOS) testing. LOS testing was completed under four conditions: eyes open on platform, eyes closed on platform, eyes open on foam, and eyes closed on foam. Post-testing was completed within two weeks from initial testing. Main Outcome Measures— Movement Velocity (MVL), Endpoint Excursion (EPE), Maximum Excursion (MXE), Directional Control (DCL). An intra-class correlation coefficient (ICC) determined reliability. Results— Eyes closed platform condition exhibited the highest ICC with the exception of backward movement. Conclusions— BM6.1 cannot solely measure LOS changes for this age group.

1. Introduction

The purpose of this study is to determine the test-retest reliability of dynamic measures of balance using the Balance Master 6.1 with healthy adults between the ages 18-30 years old who have no known balance deficits.

2. Experiment, Results, Discussion, and Significance

Fifteen healthy volunteers from Wichita State University (WSU), ages of 18-30, were a sample of convenience. Subjects were screened to meet the following inclusion criteria: (1) no serious ankle injuries or sprains within the last 6 months, (2) if participants were participating in any type of vigorous strengthening program that involved the lower extremity, the program did not change between test dates, and (3) participants did not have any visual, vestibular, somatosensory or balance deficits. Subjects were assumed to give their maximal effort during testing.

The Balance Master 6.1 required the participants to stand on two force plates (without shoes) placed side by side, while a monitor with visual feedback of the center of gravity (COG) was positioned at eye level. Four postural measures were acquired from the COG readings during the movements to each limit of stability (LOS) target: (1) Movement Velocity (MVL) average speed of COG movement, (2) Endpoint Excursion (EPE), amount of movement on the first attempt, (3) Maximum Excursion (MXE), how far they moved their COG, (4) Directional Control (DCL), quality of movement. LOS is defined as the maximum anterior, posterior and lateral sway angles without a fall [1]. The theoretical limits of stability and height of COG were attained by entering the subject's height into the program while the participants were standing on the platform [2]. This machine was chosen because it was readily available and is a commonly used measure.

All testing was completed at the Heskett Center on WSU campus. Participants were involved in a familiarization session immediately prior to the first testing session and were asked to stand on the force platform without shoes. Participants received instructions on how to complete the test and were given two attempts to acquaint themselves with eyes open and closed on both platform and foam before testing begun.

The two testing sessions were no more than two weeks apart. The baseline and final testing involved the participants to complete four testing conditions: (1) Eyes open on platform, (2) eyes closed on platform, (3) eyes open on foam, (4) eyes closed on foam. During all aspects of testing, participants had a gait belt placed around the waist, a precautionary chair placed in front, and two researchers providing contact guard assist to ensure safety.

A visual representation of nine boxes, one being the participant's COG, was shown during testing. The participants maintained COG in a centered position until the target box was highlighted. Next, they were asked to move their

COG to that position as quickly and accurately as possible and hold for the duration of the trial. The same verbal directional cues were given for all testing conditions.

Data analysis was done using SPSS v.17. Results are found in the table.

Table. Intra-class Correlation Coefficients

Eyes Open Platform	ICC	Eyes Closed Platform	ICC	Eyes Open Foam	ICC	Eyes Closed Foam	ICC
FMVL	-0.953	FMVL	0.405	FMVL	0.363	FMVL	-0.096
BMVL	0.736	BMVL	0.695	BMVL	0.685	BMVL	-0.335
RMVL	0.352	RMVL	0.757	RMVL	0.593	RMVL	0.118
LMVL	0.095	LMVL	0.696	RMVL	0.397	LMVL	0.632
FEPE	0.589	FEPE	0.754	FEPE	0.561	FEPE	0.563
BEPE	0.179	BEPE	0.358	BEPE	-0.152	BEPE	0.102
REPE	-0.267	REPE	0.692	REPE	0.575	REPE	0.654
LEPE	0.397	LEPE	0.915	LEPE	0.227	LEPE	0.718
FMXE	0.702	FMXE	0.881	FMXE	0.670	FMXE	0.310
BMXE	0.439	BMXE	0.468	BMXE	-0.220	BMXE	0.250
RMXE	0.521	RMXE	0.725	RMXE	0.767	RMXE	0.655
LMXE	0.859	LMXE	0.807	LMXE	0.929	LMXE	0.936
FDCL	0.466	FDCL	0.196	FDCL	0.683	FDCL	0.727
BDCL	0.308	BDCL	0.370	BDCL	0.548	BDCL	0.736
RDCL	0.612	RDCL	0.083	RDCL	0.579	RDCL	0.025
LDCL	0.677	LDCL	0.059	LDCL	0.133	LDCL	0.569

ICC = intraclass correlation coefficient; F-,B-,R-, LMVL =forward, backward, right, left mean velocity, respectively; F-, B-, R-, LEPE = forward, backward, right, left end point excursion respectively; F-, B-, R-, LMXE = forward, backward, right, left maximum excursion respectively; F-, B-, R-, LDCL = forward, backward, right, left directional control respectively.

As a group, the eyes closed platform testing condition exhibited the highest intra-class coefficients with the exception of backward movement. The other three testing conditions contained at least one negative correlation which skews the outcome of the data. In terms of the backwards movement in the eyes closed platform group, it is hypothesized that the reason for the unexpected outcome could be due to the participant's sense of safety on the stable platform and their willingness to move further into their LOS which may result in more erratic movement, as compared to the foam where the participants felt less safe and had a decreased willingness to push their LOS.

3. Conclusions

The results of this investigation are practical in showing that the Balance Master 6.1 cannot solely be implemented to measure improvements and declines in LOS for this particular age group.

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The authors would like to acknowledge Dr. Michael E. Rogers, the Human Health and Performance Lab teaching assistants.

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Implementation of an Asthma Prompting Form to Improve Asthma Care in a Pediatric Office

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Abstract. Asthma, the most common chronic illness of childhood, can be a life-threatening experience. This project tested the effectiveness of a prompting form to improve preventive asthma care during a non-asthma office visit. Thirty randomly selected charts from 2008 without a prompt form were compared with thirty randomly selected charts from 2009 with a completed form for differences.

The number of medications reviewed ($p = .001$) and the frequency of refills written ($p = .024$) were significantly higher in the prompt group. Education was higher ($p = .000$) if smoking was included. Use of an asthma plan was not significantly different between groups. Triggers were more frequently discussed in the prompted group. The use of a prompting form facilitates discussion and improvement of preventive asthma care.

Introduction

Asthma is the most common chronic illness of childhood in the United States. According to the latest published statistics from the Centers for Disease Control (CDC) 6.8 million children are living with asthma [1]. An asthma attack is a distressing and potentially life-threatening experience. Asthma is a major cause of childhood disability. It limits children's ability to sleep, learn, and play. Medical care and the indirect costs of missed work days for parents are issues that burden families with children living with asthma. Receiving asthma education is one way that children and parents can take a proactive role in managing asthma and preventing exacerbations. As children are diagnosed, an in-depth explanation of asthma, symptoms, treatment, home management plans, and resource information should be provided.

The new asthma guidelines, from the National Asthma Education and Prevention Program (NAEPP) published in 2007, stress treatment based on symptom management rather than by asthma classification [2]. To effectively meet these guidelines, a practitioner must evaluate asthma status at each visit, non-asthma related and asthma related [3]. Medications are to be reviewed and treatment altered as needed to manage the symptoms of the patient. To facilitate routine asthma assessment, structures must be developed that incorporate assessment in a time efficient manner for the practitioner during each visit with the child. Use of an asthma prompting form in the office setting provides that structure. Use of the prompting form was to prompt practitioners to evaluate asthma status on non-asthma related office visits. Nola Pender's Health Promotion Model (HPM) [4], which considers cognitive recognition of needed behavioral changes served as a basis for the theoretical framework of this project.

Experiment, Results, Discussion, and Significance

This project assessed the effectiveness of an asthma prompting form in a pediatric office to improve asthma care. The specific project question was: Would asthma symptoms and treatment be evaluated and discussed more frequently at non-asthma pediatric office visits if the practitioner received a parent completed prompting form as the practitioner entered the examination room?

The prompting form addressed key points from the revised asthma guidelines. This included asthma classification by patient experienced symptoms over the past 2-week period. The practitioner was also prompted to review current medications, discuss triggers (events or situations that caused an exacerbation of asthma symptoms), perform spirometry, instruct patient perform peak flow measures daily, and discuss the child's exposure to second-hand smoke.

Seven pediatricians and five nurse practitioners provided care for the children in this pediatric office. The subjects in this project were between the ages of 1-21 years, had an asthma diagnosis and had an office visit for a non-asthma related health concern during the project timeframe. After IRB approval, thirty randomly selected charts, based on ICD-9 codes for asthma diagnosis and non-asthma visit between June 2008 and August 2008 were

reviewed to establish baseline for evaluation and education provided about asthma. The asthma prompting form was introduced to the practitioners in June 2009. Thirty randomly selected charts, based on ICD-9 codes for asthma diagnosis and non-asthma visit between June 2009 and August 2009 were reviewed to assess change in asthma evaluation and education provided. The same chart review tool was used in both samples.

There were 29 (48%) females and 31 (52%) males aged 1 to 21 years of age included in the chart reviews. Groups were examined for differences in demographic data by using *t-tests*. Child age and gender did not differ significantly between groups nor did the percentage of nurse practitioners to physicians. Chi square was used to measure homogeneity of proportions of characteristics with no significant differences ($p \leq .05$). All aspects of education, asthma management, and medication changes between the non-prompted (2008) group and the prompted (2009) group were analyzed. Education, other than smoking, was documented more frequently in the non-prompted group without statistical significance (60% vs. 12%; $p > .05$). Smoking education was one of the most significant changes between the two groups. The office made the transition from paper records to electronic records just a few weeks before this project started. One of the “flags” on the electronic record of a patient diagnosed with asthma was discussion of smoking. It was a mandatory prompt that requiring a response before other documentation could be accomplished. This could explain the 100% improvement in this particular education topic. However, the fact still remains that the practitioner had a “prompt” on this topic resulting in significant improvement. Education also included discussion of triggers, which were discussed more in the prompted group (37% vs. 3%; $p = .001$). Written asthma treatment plans doubled in the prompted group (4 vs. 2). This was not a significant difference due to low numbers.

Asthma medications were reviewed significantly more often in the prompted group (96% vs. 63%; $p = .001$), however, medications and treatments were changed more frequently in the non prompted group (20% vs. 0%; $p = .010$ and 20% vs. 10%; $p = .278$). There were increased numbers of prescription refills written with the use of the prompting form in 2009 as opposed to the numbers seen in 2008 (43% vs. 17%; $p = .024$). This was a significant difference. A prompting form, either in paper or electronic form, should be utilized in any practice treating asthmatic children.

Conclusions

The prompting form is a useful clinical tool in pediatric patients who have asthma. Aspects of asthma and asthma control were discussed more frequently with the use of the prompting form. Asthma plans were discussed twice as often with the prompting form. Refill prescriptions were written 2.5 times more often and medications were reviewed with the patient 20% more frequently.

Acknowledgements

I wish to acknowledge my project committee, Jan Riordan, EdD and Heather Baker, MSN, PNP. A special thanks to the practice office participating in this project.

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Autism Spectrum Disorders Screening and Diagnostic Practices: A Survey of Physicians

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Abstract.In 2007, AAP issued a policy statement recommending physicians screen all children for autism spectrum disorders (ASD) two times prior to child's second birthday. It has been documented, however, that children are not being diagnosed with ASD until they are six years of age. In this study, physicians from Kansas ($n = 69$, 15.33% response rate) responded to a survey regarding screening practices for children with ASD. Of the respondents, 56 Pediatricians and Primary Care Physicians were included in the analysis. Only 21 (39%) of the respondents indicated that they routinely screened for ASD. Physicians who reportedly screen routinely were more likely to be pediatricians, female, and younger in age. They also felt confident about screening and diagnosing for ASD.

Introduction

Autism spectrum disorders (ASD) are pervasive developmental disorders affecting as many as 1 in 170 births [1]. A national survey of parents in 2007 indicated the prevalence of parent-reported diagnosis of ASD was approximately 1 in 91 U.S. children [2]. Though there is widespread increase in the awareness of ASD, most children with ASD are not identified clinically at a very early age [3]. A 2004 survey of pediatricians showed that only 8% of them routinely screened for ASD [4]. Early identification of ASD is essential as it allows for early intervention specifically designed for their unique learning needs. Studies show that children who receive intervention by age 3 years show significant developmental gains and significantly reduced associated deficits like impaired communication and social skills [3]. In 2006, the American Academy of Pediatrics (AAP) issued a policy statement and a follow-up clinical report in 2007 recommending physicians screen all children for developmental disorders during regular doctor visits at age 9, 18 and 24 months, respectively and at any other time when parents raise a concern about a possible ASD [5]. Based on the AAP's recommendation, this study was initiated to conduct a state-wide survey of physicians in the state of Kansas who regularly care for young children to identify their current screening and diagnostics practices for ASD.

Method

Participants

The study participants included a random sample of 450 physicians (family practice physicians, internal medicine physicians, pediatricians, and psychiatrists) in Kansas, randomly selected from a public mailing list of 1352 physicians acquired from Kansas Medical Society.

Procedure

The study instrument was a survey questionnaire consisting of 16 items regarding demographics, training and practice information specifically related to screening, diagnosis, and treatment of ASD. The survey was mailed to physicians and all surveys were coded to maintain individual anonymity and to monitor the return rates. Demographic variables were compared for physicians who screened routinely and those who did not using chi-square statistics. Frequencies of screening tools used were calculated. Spearman's correlation was used to identify the relationship between these physicians screening practices and their confidence and training related to ASD.

Preliminary Results

Of the 450 surveys mailed, we received 69 responses, a response rate of 15.33%. Based on responses, only Pediatricians and Primary Care Physicians (response rate of 18.6%), regularly cared for young children. Therefore, only those two groups were included in the analysis. The results indicated that Pediatricians were more likely to screen and Primary Care Physicians were more likely not to screen $\chi^2(1, n=54) = 10.42, p = .001$. Of the 21 physicians who screened routinely irrespective of the specialty, only four (19%) routinely screened at 9, 18 and 24 months in accordance with the AAP recommendations but 17 (81%) physicians screened before 2 years of age. Of the physicians who screened routinely, 52.4% used the Modified Checklist for Autism in Toddlers (M-CHAT) as the screening tool for ASD. There was a significant relationship between gender and routine screening practices $\chi^2(1, n=54) = 5.61, p < .05$ revealing that female physicians were more likely to screen routinely and male physicians were more likely not to screen routinely. Though the influence of age of these physicians on their screening practices did not reach statistical significance, it was interesting to note that physicians who were aged 55 and older did not screen routinely compared to physicians who were younger. Spearman's correlational analysis between confidence of these physicians and training with their screening practices showed a significant positive relationship. According to the responses, the most commonly recognized barriers to routine screening were time limitations, not having enough training and not being familiar with the screening tools.

Table: 1
Screening practices for ASD by professional role and gender

Professional Role	Gender	Routine Screening for ASD/PDD	
		Yes	No
Pediatricians	Female	6 (60%)	0 (0%)
	Male	4 (40%)	3 (100%)
	Total	10 (47.6%)	3 (9.1%)
Primary Care Physicians	Female	5 (45.5%)	7 (23.3%)
	Male	6 (54.5%)	23 (76.7%)
	Total	11 (52.4%)	30 (90.9%)
Total		21 (38.9%)	33 (61.1%)

Discussion

Though there was significant influence of professional role and gender on the screening practices, the study is limited by low response rate. A follow-up survey has been mailed to the non responders in an effort to increase the response rate which is important to make meaningful interpretations.

Conclusions

Based on the preliminary results it is evident that Primary Care Physicians and Pediatricians who are often the first point of contact for parents are not confident about recognizing the signs and symptoms of ASD. It is important to organize workshops both onsite and offsite to help them be better prepared to screen, diagnose and treat children with ASD and also strengthen the medical school and residency training in the area of ASD for future physicians.

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The effects of two phytohormones in *Medicago truncatula* plants infected with *Macrophominaphaseolina*

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Abstract. *Macrophominaphaseolina* is a soil-borne fungal pathogen that causes a disease known as charcoal rot. This fungal infection dramatically decreases the crops' yield due to loss in biomass, low seed quality and plant death. Currently, there is not an effective method for managing this disease. Jasmonate and ethylene are two phytohormones that are important for triggering biotic and abiotic stress responses in plants, therefore, we propose to study the effect of these two hormones on *Medicago truncatula* plants infected with *Macrophomina*. Our results indicate that jasmonate or ethylene slightly increase the resistance of *Medicago* to *Macrophomina*. This investigation may lead to the development of chemical treatments that will help to reduce or avoid the disease symptoms caused by *M. phaseolina*.

1. Introduction

Charcoal rot is a root disease caused by the soil borne fungus *Macrophominaphaseolina*. It is also called summer wilt or dry weather wilt because it often occurs during the summer, when plants are under heat and drought stresses. This disease has been an endemic problem in soybean growing areas where summers are dry, especially in the central part of the Midwest: Kansas, Nebraska and part of Missouri being the most affected regions [1].

M. phaseolina infects its plant host by penetrating plant cell wall via the growing hyphae and it grows rapidly in the plant transportation system, causing disease symptoms ranging from leaf yellowing to plant death. When severe, the disease reduces yield by killing plants at early reproductive stages.

This fungus survives from year to year as microsclerotia in soil and infected crop residue. Microsclerotium is a compact mass of hardened mycelium stored with reserve food material, and they remain dormant until a favorable opportunity for growth occurs.

A number of management measures have been applied to control *M. phaseolina*. Crop yield loss can be reduced by making rotations with small grains such as wheat and barley (poor hosts) for one or two years. Wheat and barley are considered poor hosts because they do not bloom and set pods during the normally dry months of July and August, so they are more likely to escape infection by charcoal rot. Charcoal rot incidence can also be reduced through proper fertilization, weed control, and irrigation. However, none of these management measures is completely effective.

Results from controlled studies have demonstrated that *M. phaseolina* can reduce plant height, root volume, and root weight by more than 50% [2]. Damage to the root system is most evident during the pod formation and filling stages, when demand for water and nutrient absorption is high. Because diseased plants have smaller root systems, resulting seeds tend to be fewer and lighter. Diseased plants will mature several weeks earlier, which further contributes to yield loss. Consequently, it is necessary to find a solution to the disease caused by *M. phaseolina*.

The purpose of this research is to study the effects of jasmonic acid and ethylene in the plant species *Medicago truncatula* in its interaction with the *M. phaseolina* fungus. Jasmonates are a group of plant hormones which help regulate plant growth and development. The level of jasmonate in plants varies as a function of tissue and cell type, developmental stage, and in response to several different environmental stimuli [3]. Jasmonate levels also increase rapidly in response to mechanical perturbations such as tendrils coiling, when plants suffer wounding and during the plant defense response [4, 5]. Ethylene exists as a gas and acts at trace levels throughout the life of the plant by stimulating or regulating the ripening of fruit, the opening of flowers, the abscission of leaves and the resistance to wounding and disease. Previous investigations have revealed that in the plant defense mechanism many genes are induced by jasmonate and ethylene; in fact, they may act together in defense responses [6].

By understanding how the phytohormones affect the interaction between the plant and the fungus, a chemical treatment could be developed to control this pathogen. It has been demonstrated that disease resistance in *Arabidopsis thaliana* is regulated by multiple signaltransduction pathways in which jasmonic acid and ethylene function as key signaling molecules [7].

One hundred twenty 4-week-old plants were divided into four groups; each group was treated with mock control, methyl jasmonate (MJ), ethylene (ET) or MJ plus ET for three days prior to inoculation. Our results indicate that jasmonate, ethylene or a combination of both slightly increase the resistance of *M. truncatula* to *M. phaseolina*. The disease symptoms took longer to appear.

2. Experiment, Results, Discussion, and Significance

To prepare the appropriate concentrations of jasmonic acid and ethylene we used methyl jasmonate and ethephon. The jasmonic acid was made with a concentration of 0.1% of methyl jasmonate and 0.01% of tween-20 in distilled water. The ethylene was made with a concentration of 3mM of ethephon in distilled water. The mixture of jasmonate and ethylene was made with a concentration of 0.1% methyl jasmonate, 3mM ethephon and 0.01% tween-20 in distilled water. The plants were sprayed for 3 consecutive days and a plastic transparent dome was used to cover the plants to avoid as much gas leak as possible. To do the inoculation, *M. truncatula* roots were submerged in a water solution with 0.015% w/v agarose and 10% w/v grinded *M. phaseolinasclerotia* for 30 seconds. Then, the plants were transplanted to a combination of 1/2 original soil and 1/2 new sterilized soil. The disease symptoms were monitored from 1 day post-inoculation (dpi) to 7 dpi, and a scale ranging from 0 to 6 was used to score the disease severity, where 0 is no detectable symptom and 6 is dead plant.

Our experiments showed that the disease symptoms took longer to appear in the plants treated with jasmonic acid or ethylene. In addition, all the untreated plants died at 5 dpi, while the plants treated with jasmonic acid, ethylene or both survived up to 7 dpi.

Studies have shown that jasmonic acid and ethylene are key signaling molecules that play important roles in plant defense against necrotrophic fungal pathogens, and this investigation tries to understand how those signal transduction pathways are regulated. Understanding legume molecular genetics is vital to facilitate breeding of important grain and forage legumes.

3. Conclusions

Charcoal rot is a disease of increasing economic importance around the world, especially in the Midwest area of the United States, including Kansas. There is relatively little information about this disease so still there are no adequate ways to prevent or treat it. Our investigation has generated first-handed information regarding the role of jasmonic acid and ethylene in disease response in *M. truncatula*, which will allow us to get a better understanding of this disease and assist in the development of an effective chemical treatment for charcoal rot.

The impact of charcoal rot disease on many legume species will become more devastating, as the dry and warm weather become more prominent in many parts of the world as a result of global warming. We hope that our research will be valuable for future development of much-needed disease-resistant crop plants.

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Metafilm: Visual Storytelling in the Postmodern Age

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Audio-visual communication in the form of film and television has formed a language of its own, and this emergence begs both scholars and artists to put it to use in creative ways. The term “Metafilm” here refers to a film *composed of* other films, rather than a film *about* film. This paper proposes a set of technical and aesthetic guidelines and considerations for creating new stories from the existing film and video footage which informs much of our culture. This proposal, and others like it, must work toward balance between the conflicting ideas of private media ownership of, and public cultural ownership of, art and artistic expression.

1. Introduction

As books and television and films and technology intermingle and breed, new and sometimes remarkable hybrids are born. Anyone who grew up watching television or movies in America has a personal perception of culture and of language which strongly favors the audio-visual. Sound bites from film or television become quoted dialogue among friends or even among strangers, forming a sub-language which reflects a common cultural experience. The Metafilm concept represents an opportunity to draw upon the video version of *spiritus mundi*, the reservoir of shared cultural imagery, to tell new stories while deliberately connecting the viewer to their familiar past. It provides a latticework which allows the storyteller to work in multiple dimensions simultaneously. Short clips are chained together so that the dialogue in each clip advances a new scripted storyline. Like hyperlinks, these clips allow the viewer to branch off from the original story into a nostalgic mode from which they can return at any time.

Careful selection of clips can reward the experienced viewer and establish a larger thematic pattern or counter-narrative. Some legal and technical challenges exist, but Metafilm represents a refinement to the postmodern manifestation of interconnectedness known as the mash-up. Its low-cost nature gives artists of limited means the opportunity to push back against institutional encroachment upon the collective human experience and to reassert the right to use one’s common audio-visual culture to explore, explain, and enjoy that culture.

2. Proposed Process

The artistic intent behind the Metafilm is the creation of new narratives using pieces of existing public narratives. “Public” refers to film or television footage with a high nostalgic value, specifically that which is or was available to, consumed by, and incorporated into the culture of a reasonably large group. Private footage such as home movies would not generally serve this purpose. Unlike its ancestor the clip show, the Metafilm is made entirely of outside content and is not limited to footage from one show. Much as photos can be chosen based on color and shape to produce a larger mosaic image, the Metafilm can manipulate the qualities of existing material to create new experiences for the viewer. It would be possible and easier to assemble a random string of clips and create a Dadaist film with inscrutable meaning, but that would undermine the essence of this project. New and understandable meanings are primary among the desired results.

Each Metafilm is driven by a script, written with the intent of telling a complete and viable story. Access to suitable footage may constrict the project in some ways; however, the script need not be limited by the availability of actors, sets, or special effects. First-generation scripts will use dialogue as their primary mode of storytelling; character activity or body articulation, while not unimportant, will be less significant. Second-generation Metafilms will emerge as video indexing tools become more refined; this will allow the writer or director to find footage which matches the necessary dialogue and also provides some continuity of character motion, appearance, or activity.

Equal in importance to the script is the choice of footage. While any public footage may be considered fair game, footage which is pornographic, of poor quality, or too neutral (such as stock footage) should generally be avoided. The footage advances the script and also triggers memories in the viewer. It does not need to come from only the most popular films or television shows, but the viewer’s full enjoyment depends upon recognizing at least some of

the clips. A wide variety of sources improves the chances of attracting and retaining the viewer's attention and enhances repeat screenings by providing the option to focus on the storyline or the clips. The ideal viewer response is to try to recall their memories of each clip. This provides many potential Easter eggs for any given viewer; those who have seen an obscure film or whose favorites make an appearance will feel especially rewarded for their efforts.

Within this broad range of possibilities, some potential patterns for the director to follow are worth mentioning. Continuity of age and gender: use voices from similar-sounding sources to minimize confusion over which scripted character is speaking. Judicious use of voice-tuning software may be helpful. This is especially important due to the lack of a specific visual marker signifying each character in the script. An alternate marker system may be useful for early productions when footage availability is low, such as a color-coded dot on the screen for each script-speaker.

Aspect ratio: footage should be selected from compatible video aspect ratios or cropped to fit a default aspect ratio.

Depth of field: footage characters who shift back and forth in the z-axis will excessively emphasize the necessary jump-cuts in the film; a base depth of field should be maintained for each scene.

Viewer generation: any available time period may yield useable footage, but focusing on a specific block of years allows the director to target or reward the generation for whom the footage will have prominent cultural significance. People who grew up in the 1950s will tend to appreciate different film, television, or even advertising clips than those who grew up in the 1970s. Ads can become culturally embedded as easily as any other type of presentation.

Body position: if a scene uses ten clips, and if script character A appears visually in those clips (rather than just aurally), the ideal selection of clips would present a fluid motion of the composite character on the screen. Truly fluid transitions between clips may depend upon advances in both editing software and video indexing capability. Heavy use of video morphing software will add excess frames and thus excess dialogue gaps between each clip.

The Metastory: this is the most difficult and potentially rewarding area for development; telling a story by stringing together pieces of dialogue is rudimentary in comparison. Each clip can serve both as a self-contained sign and as a stand-in for a larger sign; the larger signs thus invoked can also be pieced together to form a supporting narrative. Larger themes at work in a television episode or film are brought into play through a commonly-known piece of footage. Clips can be chosen based on compatibility of themes, character types, story moral, humorous or ironic juxtaposition, and so forth. This provides a potential third layer of meaning for the Metafilm, the other two being the original storyline and the nostalgic treat that each clip may provide to the viewer.

Technical challenges: storage, availability, and indexing present the most significant challenges. Digitized video footage requires a sizeable storage capacity. Many TV shows and films are not yet available in a digital format. Some mechanism, most likely software-based, will need to be developed in order to index video footage by speech and other audio content, actor demographics (age, gender, race, and so on), and body articulation information.

3. Conclusions

The MetaFilm is an artistic project more than a commercial project, although some overlap exists. The film's creator employs targeted nostalgia within cultural subgroups by selecting footage from the appropriate time period; a skilled director may select external sources whose presence particularly enhances the story being told, by invoking related or explanatory ideas or cultural history. A discussion on the legality of using video clips from so many copyrighted sources will clearly be necessary at some point. It may be that this project will serve as an impetus for reclaiming the "Fair Use" concept from corporate powers whose control of cultural content unfairly inhibits artistic development.

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A fully Bayesian approach for sample size determination

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Abstract

The sample size determination plays a significant role in design and analysis of many engineering problems plus data sampling projects. There is a number of sampling techniques including both classical as well as Bayesian techniques and only some of them consider the economical aspect. The objective of this paper is to offer an economic Bayesian approach for determination of sample size. Mathematical models are derived and used to establish implementation boundaries from economic and technical viewpoints. In addition, numerical examples are used to highlight the economic advantages of Bayesian approach. Using simulated data, the performance of the proposed approach is compared to the classical methods in terms of the number of sample size criterion.

1. Introduction

The Sample Size Determination (SSD) has a critical role in design and analysis of data sampling projects. The sample size impacts all steps of analysis explicitly or implicitly. The main purpose of this research is to explore an application of a fully Bayesian approach for SSD to verify a shift in the process average. This research also compares classical and Bayesian methods from number of sample size view point.

2. SSD Techniques

SSD methods are divided into two major groups [1]. These include both classical as well as Bayesian techniques. In classical method, two values are pre selected before sampling; the interval half width H and confidence level of the interval $(1 - \alpha) \% 100$. If a random sample of n observations are to be drawn from a normal distribution with mean μ and variance σ^2 , then the requirement that the unknown population mean μ lies within $\pm H$ of the sample mean with probability $(1 - \alpha)$, results in:

$$n \geq \left(\frac{z_{\alpha/2}}{H} \right)^2 \sigma^2 \quad (1)$$

Where, the statistic $z_{\alpha/2}$ is obtained from the table of standard normal distribution and σ^2 is known [2]. This method has been criticized because the hidden uncertainty in σ^2 is ignored [3]. Calculating the sample size without considering the prior information and uncertainty, may result in a larger sample size than is necessary. The Bayesian approach is accompanied by uncertainty of prior knowledge and is a powerful tool for SSD. Berger discussed that the fully Bayesian treatment of SSD (FBSSD) involves utilizing loss function, and economical criteria [1]. The whole idea of FBSSD is to minimize cost and avoid oversampling. In the FBSSD method, the observations are taken one at a time and a decision is made after each observation, either to stop sampling and choose an action, or to take another observation [4]. Hence, one can collect the exact amount of observations for making a decision with desired accuracy. This attribute results in minimizing the sampling cost.

Choosing a loss function has a crucial role in FBSSD methods. Loss function is a mathematical function that explains the relationship between estimation error and the economic loss associated with that error. In this research, the Taguchi's quality loss function is used as:

$$L(x) = k(x - T)^2 \quad (2)$$

Where, K is a positive constant, x is the value of the quality characteristic and T is the target value.

3. Mathematical Modeling Development

One of the discrete manufacturing of a single quality characteristic x is brought into consideration. The specification limits for x are expressed as $m \pm \Delta$ where m is target and Δ is one half of the tolerance spread. It is also assumed that a state of statistical control has been established and that x follows a normal distribution with mean μ_0 which is off target and variance τ^2 with lot size of N units. Two actions could be imagined. The first (a_1) involves

taking no action and continue operation at an estimated per unit loss. The second (a_2) involves making corrective changes to re-center the process closer to the target while σ^2 will not be changed. This would require an initial investment of \$W for setup and sampling cost of \$C per unit. However, operation at the new level is expected to reduce the per unit loss to \$L₂. Based on engineers' experiences, the probability of success for process improvement is p and the probability of failure is 1-p. This would result in the economical criterion which requires that the average risk under the second option be less than that under the first. i.e.

$$pN(L_2 - L_1) + (1 - p)(W + nC) < N(L_1) \tag{3}$$

Where, $L_1 = Nk \left[\tau^2 + (\mu_0 - m)^2 \right]$, $L_2 = k(\tau^2 + \rho_n)$, and ρ_n is posterior variance. When the criterion (3) holds true, a_2 would represent the optimal Bayes rule. However, calculation of r (a_2) requires knowledge of the sample size n. Now, suppose that an unbiased gauge with variance σ_g^2 less than process variance will be used to collect the observations. This would result in a second criterion regarding the feasibility of improvement. That is, the value of N should be large enough to allow for n* to exceed zero. This can be expressed in the form of:

$$N > \frac{(1-p) C \Delta^2}{p A \sigma_g^2} \tag{4}$$

This criterion should be satisfied before calculation of n*. Once the criteria (3) and (4) hold true, the sample size is computed by:

$$n^* = \sqrt{N \frac{A \sigma_g^2}{C \Delta^2} \frac{p}{(1-p)}} \tag{5}$$

4. Numerical Example

A control chart indicates that the current process for producing a component with dimension x is in a state of statistical control. The needed information about the process is given in Table 1.

Table 1 The given information of numerical example

N	Δ	σ^2	σ_g^2	$\sigma_{\bar{x}}^2$	m	W	C	p	1-p
200	0.0025	100	0.0004	0.000025	8.02	100	20	0.7	0.3

Utilizing the given information, the criteria (3) and (4) are satisfied. Thus n* is determined as 4.768 which could be approximated by 5. Applying the classical method, by substituting in the inequality (1), n is computed as 15.37 which is much larger compared to the sample size of n*=5.

5. Conclusion

In this research, a fully Bayesian approach for sample size determination was proposed. At the same time, a mathematical model accompanied with economical and technical criteria was developed. Utilizing the numerical example this method was compared to the classical. Classical methods do not take into account prior and loss information and consider the information of only the last sample. On the other hand, the Bayesian approach considers the information related to all earlier samples for making an inference. The Bayesian method is more efficient than traditional methods when the decision making is desired in terms of loss associated with every scenario and when prior knowledge is available. However, Bayesian analysis is not recommended when there is no good perception of the procedure, since the objectivity of the prior information is crucial in determining the sample size and decision making.

6. Acknowledgement

I am sincerely grateful to my advisor Dr. Weheba for his dedicated supervision, critical views and the countless amount of time spent. Obviously, without his generosity of knowledge sharing and meticulous vision, this paper was impossible to prepare.

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A Model of Cocaine Supply Transformation and the Efficiency of U.S. Federal Interdiction

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Abstract. This paper develops a model to illustrate factors that may reduce cocaine supply from its original production level in South American countries to its arrival on U.S. streets for final retail sale. Some of the variables in the model must be estimated due to the inherent lack of data on illegal drug trade, while others such as seizure quantities are directly observable. Using data from four U.S. federal agencies and the annual potential production of cocaine as estimated by the United Nations, the agencies' annual seizure rate is calculated at 26.4 percent of the world supply. However, the proposed model shows that this figure underestimates the actual seizure rate from the U.S. market as it does not account for variables that may reduce cocaine supply to the U.S. The paper suggests that the agencies on average seize more than 26.4 percent of the U.S. supply.

1. Introduction

A fierce and expensive war is being fought in the U.S. against cocaine use. The majority of expenditures on the drug war focus on reducing the supply of cocaine in the U.S. market [1]. Because the U.S. accounts for nearly half of the world's cocaine consumption [2], this is a daunting task for those charged with disrupting traffickers. The clandestine nature of illegal drug trade makes it difficult to estimate the effectiveness of these efforts. This paper provides a framework in which this effectiveness can be better estimated by identifying major factors that alter the supply of cocaine as it is trafficked to the U.S.

2. A Model of Cocaine Supply Transformation

The best indicator of initial world supply of cocaine is the potential production of cocaine, calculated by the United Nations Office on Drugs and Crime (UNODC) as the estimated hectares used to grow coca plant multiplied by an estimated yield per hectare in kilograms. Using this measure as a proxy for world supply, the following model illustrates important reduction stages during trafficking as they occur from left to right.

$$US_{retail} = PP \cdot (1 - \pi) \cdot \phi \cdot \mu \cdot (1 - \theta) \cdot (1 - \psi) \cdot (1 - \delta) \cdot (1 - \sigma) \quad (1)$$

Potential Production, PP , is first reduced by the percentage of coca plant growth lost due to production reduction efforts such as aerial eradication and manual destruction, π , which decreases the amount of coca available to convert into cocaine. Since there is no way to measure the extent of destruction by aerial spraying and other methods, this variable may be estimated by observing production reduction efforts.

The variable ϕ represents the efficiency of harvesting and converting coca leaves into cocaine. This variable could equal one if all growers are perfectly efficient in harvesting their crop and extracting the cocaine. Some product will inevitably be lost during the process, however, and individual producers will have different levels of efficiency during conversion. Observing the process could yield a useful estimate.

Once the cocaine has been produced and is ready for transportation, the cartels decide what proportion, μ , to direct to the U.S. market. The fact that cocaine can be found in Europe and Asia [2] indicates that this is not equal to one. Since drug traffickers' transportation records are not available, μ must be estimated.

Of the supply bound for the U.S. a percentage, θ , will be seized en route by foreign interdiction agencies. This quantity could be found for each year by collecting data from all interdiction agencies that seize U.S. bound cocaine, which would require a large-scale, multi-lingual approach beyond the scope of this paper.

As the supply approaches the U.S. market, federal agencies such as the Drug Enforcement Administration (DEA), U.S. Coast Guard (USCG), U.S. Customs & Border Patrol (USCBP), and Immigration & Customs Enforcement (ICE) seize a proportion, ψ . Annual seizure quantities were gathered for these four agencies and averaged, then divided by the annual potential production estimates. This yielded an estimated annual average of 26.4 percent of the world supply seized by the agencies.

The cocaine that escapes federal seizure then makes its way into the hands of dealers on U.S. streets. The proportion, \hat{c} , seized by local law enforcement agencies such as state and city police reduces this supply further. This value could be obtained in future research by collecting data from all U.S. local agencies.

Finally a portion, σ , represents the quantity lost to spoilage, abandonment, disposal, or dealer consumption. These quantities are unobservable and difficult to estimate, so σ remains unknown.

These variables have a significant aggregate effect in reducing the initial supply of cocaine throughout the trafficking activities en route to the U.S. consumer market. For this reason, it can be concluded that the quantity available for U.S. retail sale is considerably lower than the initial world supply.

3. The Efficiency of U.S. Federal Cocaine Interdiction

U.S. officials are interested in finding the effectiveness of their federal agencies at removing cocaine from the U.S. market. In the previous section, the four agencies investigated for this paper were found to seize 26.4 percent of the world supply, proxied by the potential production estimates.

Since this seizure rate is calculated as a percentage of potential production however, it understates the true effectiveness of the federal agencies in seizing cocaine from the U.S. market specifically. Looking back to equation (1), plant eradication, $(1 - \pi)$, U.S. allocation, (φ) , and international interdiction, $(1 - \theta)$, are all determined prior to the U.S. federal agencies' interdiction efforts and must be accounted for.

As an example, if traffickers allocate 50 percent of their product to the U.S. instead of 100 percent, thereby reducing φ by one half, and if all else stays constant, the 26.4 percent seizure rate of world supply would translate into 52.8 percent of the U.S. supply of imported cocaine seized among the four agencies.

Further research could generate values for other variables in the models, especially international and local law enforcement interdiction (φ and \hat{c}), while conversion efficiency (φ) could be estimated by observing production trends, and U.S. allocation (μ) could be estimated by comparing U.S. seizure and usage rates to those of other countries. Defining the values or estimates of these variables could greatly improve the model's ability to determine the true U.S. market seizure rate for both federal and local agencies. It could also give a clearer picture of the supply of cocaine available to consumers on U.S. streets.

4. Conclusion

By developing a model to describe factors that alter the quantity of cocaine reaching the U.S. market, this paper sought to quantify the effectiveness of the interdiction efforts of U.S. federal agencies. The combined average seizure rate of cocaine for the four agencies investigated in this paper was calculated to be 26.4 percent of the world supply. Using this figure in conjunction with the model, the paper posits that the true seizure rate of the U.S. market supply of cocaine by the agencies is greater than 26.4 percent, due to reductions in supply that are determined prior to the cocaine arriving to the U.S. market and the subsequent U.S. federal interdiction efforts.

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Dynamic Capacity Apportionment Procedure Exposed to different Business Conditions

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Abstract. Revenue management (RM) is a methodology used to allocate resources in order to maximize revenue. Capacity allocation is one of the problems in RM when demand surpasses the available capacity. This problem is addressed by allocating capacity using a dynamic capacity apportionment procedure (DCAP). In this study, the objective is to analyze the effectiveness of DCAP and present its behavior under different scenarios and business conditions such as, non-decreasing due dates, multiple products, and contracts for capacity reservation. Simulations showed that among 600 experimental conditions replicated 10 times, DCAP resulted in a maximum total profit increase of 51.3% increase and a minimum of -0.18% compared to the first come first serve policy. Additionally, results also demonstrated that factors such as capacity tightness, profit attractiveness, and order rate scenarios significantly influenced DCAP's performance.

1. Introduction

The constant pursuit of improvement in different industries has given birth to techniques, methodologies, and procedures such as Lean, Six Sigma, and Revenue Management (RM) that intensively seek increases in productivity, quality, and revenue. RM is a methodology that began to be developed in the late seventies by airlines which after the Airline Deregulation Act of 1978 [1] had control over the fare prices. The main objective of RM is simply to manage resources and information in order to maximize revenue. One of the problems faced by RM is related to capacity allocation. This problem was addressed by Barut and Sridharan [2, 3] who designed a dynamic capacity apportionment procedure (DCAP) that allocates short-term capacity conveniently. DCAP is a procedure that reserves short-term capacity by discriminating different categories of demand to maximize the total profit. This objective is achieved by prioritizing and characterizing the demand which in this case is considered stochastic. For this particular study, this procedure will be contextualized in two scenarios which are the motivations of this research. The first scenario occurs in data storage services when the storage space is scarce and the demand surpasses it. In this scenario there are two solutions; either to increase the storage space which represents high

investments, or to manage conveniently the current available storage space using RM. The second scenario occurs in the QC department at NIAR. In this scenario, the objective is to maximize service levels by reserving capacity for high priority customers. The capacity is represented in this case by the stations and operators available to provide service.

In what follows, first a summarized mathematical description of DCAP is presented. This is followed by some results that demonstrate the effectiveness of the procedure compared to FCFS. Finally, a short discussion about the results is provided along with some conclusions.

2. DCAP Procedure and Results

Barut and Sridharan[1, 2] performed an incremental expected profit analysis along with probabilistic approaches in order to obtain a generalized mathematical form Eq. (1) that provides the amount of capacity that needs to be reserved:

$$\sum_{i=1}^{j-1} \frac{A_i}{\theta_{it}^{dr}} e^{-\theta_{it}^{dr} q_{j-1}^{*t}} = \frac{\bar{p}_{[j,L]}}{\bar{p}_{[1,j-1]} - w[\bar{p}_{[1,j-1]} - \bar{p}_{[j,L]}]} \quad (1)$$

This hyperexponential form includes stochastic factors such as demand, order rate, order arrival, and order size. Since Eq. (1) is not a closed form for the reserved capacity q_{j-1}^{*t} , a search algorithm was used to solve equation (1) in Matlab®. The DCAP algorithm operates under the conditions of having segmented and prioritized demand. In DCAP, the reserved capacity for each class is calculated using an iterative process starting from the highest priority class to lowest priority class. Therefore, the highest priority is always served as long as there is available capacity. Using Eq. 1, first, the capacity reserved for the highest priority demand is calculated. Next, with the remaining available capacity, the capacity with the next highest priority class is estimated. This process is utilized to calculate the demand for all other priority classes.

The Matlab® implementation was done for the experimental factors in Table 1 having each combination replicated 10 times. The simulations results were in terms of the increase in total profit (ITP) which was calculated comparing DCAP with the first come first serve (FCFS) policy..

Table 1
Experimental Factors and their levels

Factors	Levels
Order rate scenarios	Linearly increasing, decreasing, and stable (LDOR, LIOR, SOR)
Profit attractiveness	0.5, 0.6, 0.7, 0.8, 0.9
Capacity tightness	0.5, 0.6, 0.7, 0.8, 0.9
Order size structure	0.75, 1.25
Order rate structure	0.75, 1.25
Coef. of variation	0.25, 0.5

Simulations were performed by 600 test cases running each case 10 times resulted in 6000 runs. Among these runs, 51.3% was the maximum ITP obtained, while -0.18 was the minimum, the average ITP for all the runs was 6.0%, and 99.52% of the total runs ended up in positive results which means that 5971 of the runs resulted in ITPs greater than zero. In addition to these results, a factor interaction analysis was done in order to determine the conditions under which DCAP better performs (see Fig. 1. and Fig. 2.).

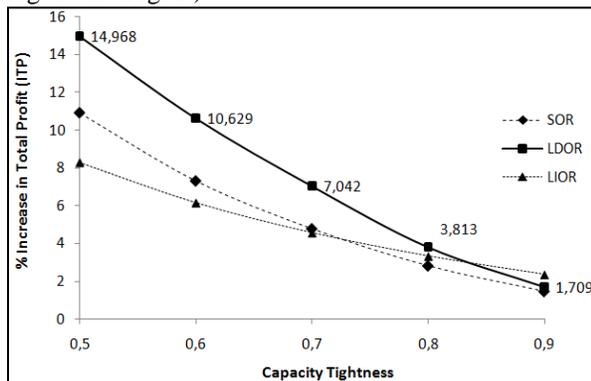


Fig. 1. Interaction between capacity tightness and order rate scenario

Four major observations can be drawn from these two figures. The first one is that ITP is a positive function of the experimental factors which means in most of the cases DCAP is better than FCFS. The second one is that the more the demand surpasses the capacity, the better DCAP performs; in other words, when capacity tightness (Capacity/(Expected Demand)) decreases the ITP tends to increase. The

third one is that the bigger the profit difference between priorities, the better ITP results, and finally the fourth one is that under the linearly decreasing rate scenario (LDOR), DCAP performed better than under the other two scenarios (LIOR, SOR).

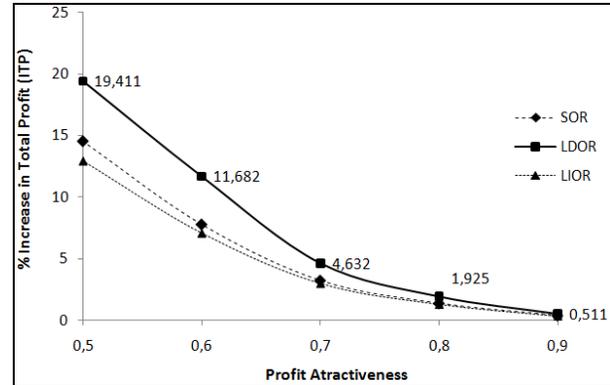


Fig. 2. Interaction between profit attractiveness and order rate scenario

The reason why DCAP performs better under the conditions mentioned above is simply because DCAP tends to reserve more capacity for higher priority demand when capacity is scarce, the priorities profit difference is wide, or the order rate peaks at the beginning and steadily decreases over time.

3. Conclusions

In this study, a capacity allocation procedure DCAP was tested in order to determine its effectiveness. Additionally, an experimental design consisting of different business conditions were tested under several scenarios. The simulations showed that 99.52% of the times ITP results were positive having as a maximum ITP of 51.3% and a minimum -0.18%. Finally, it was also observed that the capacity tightness, the profit attractiveness, and the order rate scenario are factors that play an important role in the DCAP performance.

4. Acknowledgements

I would like to acknowledge Dr. Mehmet BayramYildirim and Dr. Mehmet Barut who provided me the information, guidance, and advice to perform this research.

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Maternal and Neonatal Post Partum Behaviors Related to Early Breastfeeding

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Abstract. As part of a larger study, two low-risk primigravida (first pregnancy) women who intended to breastfeed and their newborns were audio- and videotaped in the first two hours after delivery. Recordings were analyzed to investigate early infant crying patterns and the duration of skin-to-skin contact between mother and baby that may be associated with breastfeeding outcomes. One mother-infant pair remained in close contact immediately following delivery with short periods of separation. The other mother-infant pair experienced longer periods of separation during the first two hours. Although data are preliminary, the separation cries of the infants were noticeably different perceptually than the cries produced in contact with mother. This finding contributes to existing data on factors involved in mother-infant bonding and successful breastfeeding outcomes.

1. Introduction

Newborn humans are developmentally immature at birth and rely upon close contact with a nurturing adult (typically the mother) to sustain life. All mammals have behavioral adaptations that serve to keep the adult and newborn together. Separation of term (mature, 37 to 42 weeks gestation) human newborns from skin-to-skin contact with their mothers immediately following birth has been associated with a number of adverse physiological changes for the infant. These adverse changes include increased heart rate, decreased temperature, higher respiratory rate, higher base excess, and lower blood glucose values than infants who are held continuously skin-to-skin¹. Decreased breastfeeding duration² and increased amounts of crying^{1,3,4} also have been demonstrated. The advantages of breastfeeding for mothers and their babies are many and breastfeeding is advocated by the World Health Organization⁵. Despite the documented adverse effects of mother-infant separation, routine childbirth practices in many hospitals continue to move the infant to a warmer or bed immediately following birth and to maintain this mother-infant separation during the first hours of life⁵. By observing infant cries in relationship to mother-infant interactions during the first two hours after delivery, it may be possible to identify and characterize a unique separation distress cry. Such a separation distress cry has not yet been documented in the literature^{4,6,7}. It could serve as an additional motivating factor to prevent the separation of mothers and infants immediately after birth.

2. Experiment, Results, Discussion, and Significance

Institutional Review Board (IRB) approval was obtained from WSU and the Wesley Medical Center. Participants were two women pregnant for the first time who experienced an uncomplicated delivery and intended to breastfeed their infants. These participants were recruited from prenatal childbirth classes within 8 weeks of their estimated due date. Written informed consent to videotape both mother and infant in the two hours following delivery was obtained from each participant. Each participant also provided demographic information, pertinent pregnancy history and labor-delivery-postpartum medical data from her medical chart. Participants notified a supervising physician (Dr. Powers) when they went to the hospital for delivery.

In the delivery room a microphone and digital audio recorder were placed in the same location on each mother's bed prior to delivery. A videographer (an experienced nurse) filmed each mother and infant for the first two hours following delivery using a high-quality video recorder. The video recorder also captured audio signals via a built-in microphone.

Two students not directly involved with the study independently coded the duration, intensity, and spectral characteristics of each infant's cries and rated the type and frequency of mother-infant behaviors, specifically:

stroking baby (+ location), looking at baby, touching breast, moving breast or nipple, examining baby, talking or cooing, smiling, frowning, crying, and whole body shaking. The behavior of the infant, including crying, before and after maternal behaviors also was documented to enable a sequential pattern of mother-infant behaviors under conditions of separation and no separation. These students underwent a period of training to familiarize them with the behaviors being documented and the rating scales being used.

Although born at the same medical center, the two mother-infant pairs were treated differently in the delivery room. One infant remained with his mother for sustained skin-to-skin contact with minimal separation. The other infant was separated from mother for extended periods of time for cleaning and weighing. Data analyzed to date include the cry sequences of the infant experiencing minimal periods of separation. Two sets of cries were identified: cries during skin-to-skin contact with the mother and cries when the infant was separated from mother.. There were no significant differences between the two sets of cries in several quantifiable dimensions (e.g., cry durations, time lags between sequential cries); however, the perceptual qualities of the two cry types were distinct, with the separation cries suggesting a level of physiological stress that was not associated with the cries during skin-to-skin contact. This perceptual difference in the two sets of cries also was confirmed for the second infant. Quantitative analysis of the two cry types has yet to be completed.

3. Conclusions

The cries of both infants during skin-to-skin contact were perceptually different from the cries during periods of separation. Findings support earlier speculations³⁻⁴ regarding a separation distress cry and argue for continued emphasis on sustained skin-to-skin contact for infants and mothers immediately following birth.

4. Acknowledgements

The author gratefully acknowledges the University's support of this project through a Multidisciplinary Research Project Award (MURPA) to her faculty advisors.

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The Case of Wichita: The Influence of Regional Print Media on Long-term Care Decision-making

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Abstract. As the baby boomer generation begins to fill nursing facilities nationwide, the prospect of elder abuse and negligent facility practice becomes a growing concern for key decision-makers. This study evaluates a sample population in Wichita, KS of 17 independent, long-term care facilities by charting their bed numbers and occupancy rates over a five year period. In comparison to the 17 care facilities, the study evaluates over 200 regionally printed articles associated to long-term facility care between the dates of January 1, 2004 to December 31, 2008. By using thematic analysis, a correlation was discovered between the use of negative media and the projected occupancy rates for subsequent years. Although not statistically significant, the data collected by this study provides substantial information concerning the relationship between regional print media and long-term care facilities.

Introduction

From Gutenberg's invention to the modern hype surrounding internet news, the positive and negative effects of media upon the masses have always been important to the understanding of human interaction and culture at large. The Wichita Case Study provides a critical insight to the potential of print media as a component for decision-makers regarding retirement living. For the purpose of finding just how vast these media related effects can be, this study is based on the following research question; Do enrollment rates between the years of 2004 to 2008 in elderly care facilities correspond to the negative or positive media portrayal in Wichita, KS retirement home communities?

Significance

This study features an exploratory research design with two variables being analyzed; occupancy rates and negative print media. Research participants include *The Wichita Eagle* and seventeen long-term care facilities in Wichita, KS. *The Wichita Eagle* is a state-wide newspaper that features local, regional and national news columns. The distribution numbers released by *The Wichita Eagle* in May of 2009 suggest circulation rates of over 90,000 daily and 140,000 for Sunday publications. In comparison to the other two top circulations, the *Topeka Capital Journal* and *Lawrence Journal World*, *The Wichita Eagle* ranks first by over 20,000 circulation subscribers. *The Kansas Department of Aging* (KDOA) provided occupancy data for the seventeen, Wichita-based, residual long-term care facilities. These reports provide the number of beds in the facility and their occupancy based on percentage. Five reports were analyzed in the study, ranging from the years 2004 to 2008.

A time frame between the dates of January 1, 2004 and December 31, 2008 was selected for analysis pertaining to the two variables. These dates were used as search cues for the initial exploration of print media using an online database operated by *The Wichita Eagle*. Search queries used included the terms/phrases; nursing home care, long term care and retirement. This search revealed over 3,800 potential articles for review between the years 1984 and 2010. Further limits were established by framing the research to the five year time frame, revealing 256 total articles. Analysis upon the titles and newspaper assigned section of each article determined a majority of the 256 were obituaries referencing the location of death. Omitting the terms "death" and "obituary" limited the number of relevant articles to 20.

Coding: Content Analysis

In the work 'Campaign Media Content Analysis,' Susan A. Banducci highlights two forms of code existing in content analysis, emergent and a priori (Banducci & Karp, 2002). Emergent coding occurs when the researcher begins analysis of the artifact and throughout initial observations records codes that are forthcoming. In opposition

to emergent coding methods, a priori coding occurs when the researcher pre-determines codes before initial observations. In this study the initial review of the 20 relevant articles involved the production of an emergent coding system by highlighting negative terms and analysis in each article. Articles not featuring negative text were labeled as positive.

Negative terms emerging through initial analysis were; “lack,” “crisis,” “difficult,” “risk,” “struggle” and “cuts.” All negative labeled articles featured one, if not more, of these terms. A second session of coding confirmed these articles to be either positive or negative based on the arguments made in text by the authors. Upon further review, two featured articles in the search query were omitted as memorial articles and thus irrelevant to the research question. A third article was omitted as an advertisement, leaving a total 17 articles for analysis. The remaining articles were evaluated with the research question as a criterion for inclusion to the study. Seven of these articles were then omitted as interest and or elderly health related articles. The final summary report for data analysis features the content analysis of 10 remaining articles over the appropriated five year time frame. These articles exclusively relate long-term care facilities as being either positive or negative as a retirement option.

Chronological & Statistical Methods

After featured articles had been coded, a five year time line was created featuring the seventeen KDOA recognized Wichita, KS, long-term facilities. These organizations were listed alongside their bed numbers and occupancy rates for each of the five years. From the information provided by the KDOA, averages were figured for occupancy rates and beds available based on each year. The years of each article, whether labeled positive or negative, were then assigned to their appropriate year alongside the KDOA results. Thematic analysis was then used to determine trends in negative and positive print media as compared to occupancy rates.

Literature

From the Journal of Health Affairs in 1998, Brodie, Brady and Altman’s coverage of negative media relating to long-term care argues from a contextual standpoint, suggesting that location is crucial to the reactionary tendencies of mass audiences to print media. The authors contend that the late 1990s featured resurgence in re-evaluating the disciplines of long-term care facilities and as such a plethora of criticism from numerous fields began to encroach upon print media regarding elderly care (Brodie, Brady & Altman, 1998). Their study determines that the “tone of coverage has become more critical over time” and therefore deciphering the population’s reaction has also become more important to understanding print media effects (Brodie, et. al. 1998, pg. 4). Among their implications, an outline is provided of their difficulties with the coding of negative print media. Because perception is subjective to the receiver, all authors agreed that coding data as either negative or positive can often be more complex than a simple analysis of titles or sections. The technique of Brody, Brady and Altman’s research served as a guide to the coding conducted in this study.

Conclusion

Based on the thematic analysis of the selected articles, 25% of the coded negative print media were published during the year 2005. An overall 2% decline in occupancy rates was calculated for the year of 2005 between all 17 long-term care facilities in Wichita, KS. These figures suggest the among the most concentrated years for negative print media there in turn is a percentage decline in admission levels among elderly care organizations. Specifically, five of the seventeen facilities analyzed reported substantial losses of 5% or more during 2005. Although these figures are not statistically significant to project any reactionary tendencies of the public to negative print media, there still exists a question as to the power of media over decision-making. Future studies may attempt to account for the percentage shortfalls by following up on the organizations reporting them. Furthermore, interviews may prove beneficial in proving the media as an important facilitator of knowledge regarding long-term care decisions.

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Evaluation of Energy Efficient Medium Access Control (MAC) Protocol for Data-Intensive Sensor Networks

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Abstract. Data-Intensive Sensor Networks (DISNs) are sensor networks where large amount of different types of sensory data are sensed from physical environment and accessed by multiple users through networks such as the Internet. In such scenarios, networks are under heavy load and the role of an energy efficient medium access control (MAC)⁹ becomes more significant than a typical wireless sensor network due to energy constraints. Rather than evaluating MAC protocols using typical metrics such as comparing energy consumption among different MAC protocols, this paper compares different radio devices impacting on battery life, finding which radio device is suitable for DISNs. In experiments, two radio devices RF230 and CC2420 are compared, showing RF230 is more energy efficient and suitable for DISNs.

1. Introduction

The wireless sensor network (WSN) applications are becoming more popular and deployed in various fields such as habitat and environmental monitoring [1], and patient monitoring and tracking in the hospitals [2]. Data-Intensive Sensor Networks (DISNs) are enhancement of such typical WSNs applications. DISNs enable large amount of different types of sensory data to be generated and accessed simultaneously. Take patient monitoring in a hospital for example, a life-critical patient may carry more than one sensor devices such as a blood pressure sensor, a sensor for monitoring heart rate, a thermometer sensor. Those different types of sensors are also accessed and viewed by doctors, nurses, patient's family and researchers. Intuitively, the more data is generated and accessed, the more energy is consumed and lifetime of WSNs is shortened. Therefore, the issue of energy consumption in DISNs becomes more significant comparing to a typical WSN application. Particularly, energy efficient medium access control (MAC) protocols is the critical part. Unlike the devices in Internet, WSNs have many constraints such as wireless medium, memory, battery-powered, and bandwidth.

⁹ MAC provides addressing and channel access control mechanisms so that multiple nodes can communicate.

Consequently, it is very difficult to process large amount of data comparing to Internet.

In a typical WSNs application, extensive researches have been done about the energy efficient MAC protocols [3] [4] with various typical metrics such as sampling interval¹⁰, duty cycle¹¹, and energy consumption among different MAC protocols. These are important metrics in order to improve energy efficient protocols; however, since DISNs application absolutely consumes more energy than typical WSNs application, evaluating these metrics are not enough and finding other metrics which contributes on reducing energy consumption are necessary. In this paper, instead of comparing energy consumption of different MAC protocols, energy consumptions of different radio devices are compared, finding which radio device is suitable for DISNs application.

2. Experiment, Results, Discussion, and Significance

In this paper, an experimental TDMA¹² MAC protocol is developed to compare energy consumption of different radio devices. In evaluation, crossbow IRIS mote (RF230) and MICAZ (CC2420) mote are used. IRIS has 250 kbps for data rate. Comparing to the mote MICAZ, IRIS has double program memory (8KB) and also provides three times longer radio ranges.

In order to implement an energy efficient MAC protocol, it is necessary to check energy consumption of each radio state and sampling period of each radio. Oscilloscope device is used to measure such energy consumptions. Table 1 shows the summary of

¹⁰ Sampling interval is the amount of time sensor node waits before collecting each sample.

¹¹ Duty cycle is the proportion of time during which sensor node is active across sampling interval.

¹² TDMA is Time Division Multiple Access. Each sensor has an allocated time to transmit data to avoid collision from data transmission of other sensor nodes.

energy consumption of RF230 and CC2420.

Table: 1
Energy comparison for two radio devices in each state

Radio	RF230		CC2420
	1.6 (dBm)	-0.2 (dBm)	0 (dBm)
Transmit State	18 (mA)	17 (mA)	18.2 (mA)
Receive State	17 (mA)	17 (mA)	20.4 (mA)
Sleep State	6.2 (mA)	6.2 (mA)	6.2 (mA)
Idle State	12.2(mA)	12.2(mA)	12.2 (mA)

Figure 1 is a snapshot of energy consumption of RF230 mote for one sampling period. In order to obtain energy consumption of a sampling period, one sampling period is divided into k sections so that each section can have a linear equation. X-axis presents time (ms) and Y-axis presents a corresponding voltage value of kth section.

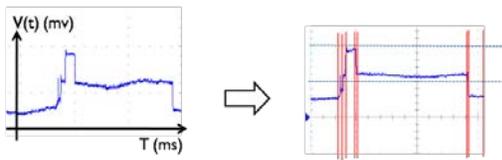


Fig.1. Dividing one sampling period into k sections

Therefore, the total energy consumption (E) of one sampling period from time t to $\Delta t * n$ where n is the number of the divided sections can be calculated with the following formula:

$$E = \sum_{k=0}^n \frac{V_{in}}{R} \left(\int_{\Delta t(k-1)}^{\Delta t k} a_k t + b_k \right) dt \quad (1)$$

In the experiment, the input voltage V_{in} is 3.0 (V) and, the resistance R is 1.0 (Ω), and a and b are constant values. The equation (1) is used to calculate energy consumption of a sampling period with duty cycle 20%, different transmission power levels and different radios as shown in figure 2 that more sampling period contributes on saving energy due to a decrease in the number of transition operation by increasing sampling period. When comparing various transmit power level of RF230 itself, it is obvious that higher transmit power level consumes more energy. Interestingly, when power level of RF230 is 1.6dBm, its energy consumption is close to the energy consumption of CC2420 when its power level is 0dBm. The result clearly says that RF230 consumes less energy with more radio ranges comparing to CC2420.

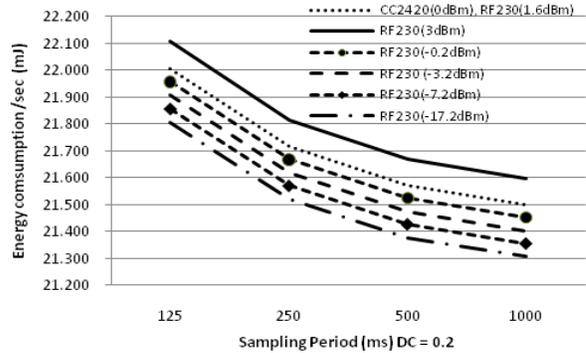


Fig.2. Energy consumption (mJ/sec) for various transmission power levels for MICAZ (CC2420) and IRIS (RF230)

3. Conclusion

As the experiments show that RF230 is more energy efficient and suitable for DISNs than CC2420, selecting a right sensor device with less energy consumption is one of important factors in order to evaluate energy efficient MAC protocols in DISNs, where extremely energy saving condition is required. Current phase of evaluation compares two different devices. The future work includes comparison of other various radio devices, and implementation and evaluation of configurable MAC protocols based on different radio.

4. Acknowledgement

Authors appreciate Dr. Vinod Nambodiri and Dr. Bin Tang for valuable suggestions and guidance.

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Load Rate Effects on the Crush Response of Laminated Corrugated Beams

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Abstract. This experimental study addresses the progressive crushing responses of laminated corrugated beams fabricated using Newport NB321/7781 E-glass prepreg material. Stacking sequences of $[0]_n$ and $[45]_n$ where $n=4,8$ and 12 have been used. The progressive crushing behavior has been studied at quasi-static rates and at selected dynamic loading rates. The test data indicates that the peak load levels increase with load rate, while the sustained crushing load decreases. $[0]_n$ surpass $[45]_n$ in terms of energy absorbing capability at various loading rates by at least 30%. The failure modes in $[0]_n$ beams was observed to be rate sensitive with the number of fronds and frond fragmentation changing with test speed.

1. Introduction

Aircraft structure is designed in such a way that it absorbs crash energy and protects the occupants. Energy absorbing devices in composite materials are frequently used for dissipating kinetic energy in airframes to enhance their crashworthiness. The geometry of the corrugated beams is chosen as energy absorbing device because it promotes stable crushing behavior thereby maximizing the crushed volume of the material. To investigate its energy absorption and failure mechanism, constant stroke rate experiments with test speeds ranging between 0.001in/s to 100in/s have been used in this study.

2. Experimental Set-up

The corrugated laminates were fabricated using Newport NB321/7781 E-glass fabric prepreg. Stacking sequences of $[0]_n$ and $[\pm 45]_n$, where $n=4,8$ and 12 have been used. Corrugated laminated were fabricated using a closed mold process where the prepreg assembly was cured between two matching molds made of aluminum. The prepreg assemblies were cured in the matched molds in an oven at a temperature of 275°F for 90 minutes. The match molds were encapsulated in a vacuum bag and subjected to vacuum pressure during the curing cycle. Corrugated laminates of length of 14” were obtained using the molds, from which specimens with a height

of 2” were cut. One edge of the specimen was chamfered at 45° using a grinding wheel. The chamfering was done to initiate failure along this edge and reduce the peak loads under compression. The quasi-static compression tests were conducted using a 22kips capacity MTS electromechanical testing machine. The dynamic compression tests were conducted using a 5kips capacity MTS high rate servo hydraulic testing machine. The specimens were crushed to a nominal length of 1”. The data acquisition rate is defined as 2Hz, 100 KHz and 1 MHz for the three loading rates. All the test data is collected and reduced for comparison purposes.

3. Results and Discussion

The behaviors of corrugated specimens have been characterized in terms of their load displacement behavior and the specific energy absorption (SEA). The specific energy absorption is defined as the energy absorbed per unit crushed volume of the specimen. The load displacement behavior of the $[0]_4$ and $[45]_4$ corrugated beams are illustrated in figure 1. The plots compare the behavior at different test speeds. The load-displacement behavior was characterized by an initial peak load followed by a sustained crushing region.

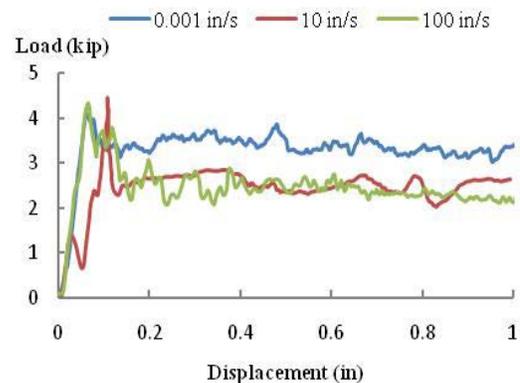


Fig.1: Load-displacement response of $[0]_4$ E-glass prepreg at various loading rate.

Specific energy absorption for $[0]_8$ and $[0]_{12}$ are higher than $[45]_4$, $[45]_8$, and $[45]_{12}$ as seen in figure 2. Data shows that $[0]_8$ and $[0]_{12}$ are at least 30% greater than $[45]_4$, $[45]_8$, and $[45]_{12}$ in energy absorbing capability.

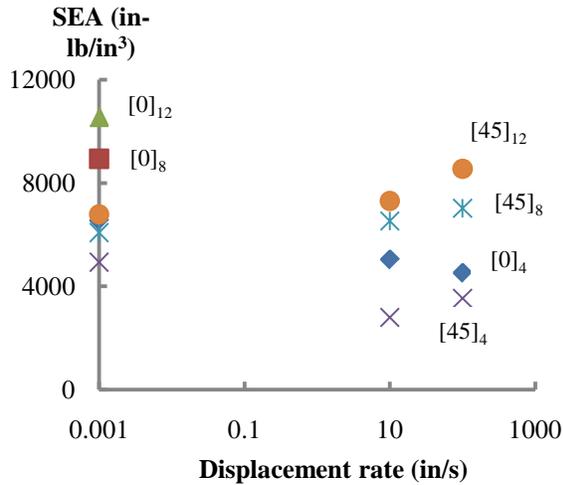


Fig.2: Specific energy absorption for different ply stacking sequence at various loading rates.

The correlation between energy absorption and complex failure mechanism such as fiber and matrix failure, delamination, etc are extremely critical to understand energy absorbing capabilities of composite materials. The failure modes in the corrugated specimens were observed to be dependent on the test speed. The failure modes observed in $[0]_4$ and $[45]_4$ corrugated beams tested at different speeds are compared and shown in figure 3 and figure 4.

In the $[0]_4$ test specimens tested at quasi-static rate, the fronds were not clearly visible, i.e., tearing of the plies was not clear. However, at higher speeds, the fronds were clearly defined and the numbers of fronds were observed to increase with test speed. The fronds formed at quasi-static speed further tended to break-off into fragments while at the higher speeds, long fronds were found intact at the end of the test. The failure modes in $[45]_4$ specimens tested at different speeds were however not clearly distinguishable. The specimens tested at higher speeds broke into several smaller fragments from

shear cracking, while larger fragments were found in tests conducted at quasi-static rate.



Figure 3: Failure mode of $[0]_4$



Figure 4: Failure mode of $[45]_4$

4. Conclusions

The initial study indicates that the load rate effects on laminated corrugated beam cannot simply be ignored during design of energy absorbing devices. Also, delamination and tearing of plies contribute to energy absorption process. Rate sensitivity of each individual failure mechanism must be further investigated.

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Health Care Occupations: Road to Success or Path to Dead End?

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Abstract. Health care provides an attractive career choice for individuals seeking employment in a growing field with livable wages and quality benefits. Jobs in health care services are projected to increase rapidly in the coming decades. Like other skilled professions, significant disparities exist regarding who works in the positions that are highest paying and often most rewarding. This project investigates the representation and incomes of minorities in health care professions. Using secondary data, a sample of 19,693 health care workers were used for this study. The findings of this research indicate that net of other factors, minority health care workers earn \$3,026 less annually than non-minorities. Additionally, minorities are disproportionately concentrated in lower compensating occupations.

1. Introduction

A broad field like the health care sector provides an opportunity to assess series of jobs and positions that are clearly defined and segmented. Differences in the credentials necessary to work in a specialized job, such as a nurse or radiology technician, make tracing the qualifications of applicants relatively easy. Queneau (2006) found that despite years of job proliferation and growth in the health care sector, the labor market is still gender/racially segregated. Between the years 1983 and 2002 racial composition of occupations within health care became more integrated, but distribution is not representative of the population [1]. Minority enrollment in professional programs has increased in the last 20 years; however minorities and women are over-represented in lower-paying and lower-status occupations [2]. Nearly 50% of medical school students are women, yet most female physicians are concentrated in family specialties [3]. Minority medical students are more likely to anticipate working in organizations and areas that provide services to underserved populations [3]. Working in specialties that focus on family services or underserved populations reduces income potentials for the physicians as compared to their peers providing private or specialized services.

2. Experiment, Results, Discussion, and Significance

Methodology

Prior research guided the development of the theoretical models investigated in this study. Individual models of earnings potential assert challenges in wage inequality can be overcome by utilizing and gaining access to resources. Jobs in health care offer wages that reward individuals based on competitive skills, education, and abilities. Structural models assert that wage determination is based upon the position occupied, and hierarchies are necessary to attract the most qualified persons to positions. Theories used to support the race model borrow from gender theoretical perspectives. Gender theorists suggest that the gender/racial composition of an occupation influence the pay and prestige of jobs. The composite model used in this research is composed of theories that suggest systemic processes influence health care industry labor pool patterns. These processes support income stratification by sorting minorities into low-paying occupations and fields. Hypotheses tested are as follows: Individual model 1(a): Net of other factors, increased age will increase income and 1(b): Net of other factors, as years of education increase income will increase. Structural model 2(a): Net of other factors, employment in a large organization (core sector) will increase income and 2(b): Net of other factors, employment in higher skilled occupations (primary market) will increase wages. Race model 3(a): Net of other factors, disadvantaged minorities will have lower income. 3(b): Disadvantaged minorities will be disproportionately represented in lower-skilled health care occupations.

This research uses data from the Current Population Survey (CPS) March 2008 Annual Social & Economic Supplement [4]. The narrow scope of this project warranted restriction of the sample to select only individuals employed in the previous year in the health care sector. Additionally the sample included only individuals between ages 18 and 65, and those not serving in the military. Only individuals with incomes above \$5,000 annually were

included in the sample and income was top-coded to avoid inflating the mean. The final sample size for this study is 19,693. The dependent variable used in this study is an interval level measurement of income in dollars for annual earnings. Variables used in the individual model include age, education, region, and residential location in terms of rural or urban. Independent variables used to analyze the structural models include worker status and hours and weeks worked in the previous year, sector, company size, occupation, and occupational prestige. Independent variables used in the race model include race and ethnicity, minority status based upon income, immigration status, sex, occupational and industry sex segregation indices, marital status, and parental status. Univariate, bivariate, and multivariate tests were used to analyze the data.

Results

Regression analysis indicates that hypothesis 1(a) of the individual model is supported: net of other factors increased education results in increased income. Non-minorities with an advanced degree make \$20,150 more than non-minorities without a high school diploma, whereas minorities with an advanced degree make \$14,440 more than minorities without a high school diploma. According to a modified chow test the difference across minority models is statistically significant. Hypothesis 1(b) of the individual model is somewhat supported, with age income increases until flattening out and eventually declining. Age is used as a proxy for experience in this project. Both non-minorities and minorities experience an increase in annual earnings with age, however there is a significant difference between non-minorities and minorities. Hypothesis 2(a) of the structural model is supported, that net of other factors employment in higher skilled occupations increases wages. This is particularly true for minority groups. Non-minorities working in medical direct occupations earn \$51,377 more annually than non-minorities employed in medical indirect assist occupations. Minorities working in medical direct occupations earn \$63,995 more annually than minorities working in medical indirect assist occupations. The difference across minority models according to a modified chow test is statistically significant. Analysis supports hypothesis 2(b), that net of other factors employment in a large organization results in increased wages.

Discussion

Significant findings include support for hypotheses of the race model: hypothesis 3(a) net of other factors, disadvantaged minorities have lower incomes than non-minorities. Minority health care workers earn on average \$3,026 less annually than non-minority health care workers. Analysis also supported hypothesis 3(b), that minorities are disproportionately represented in lower-skilled health care occupations. Nearly 51% of minorities employed in the health care sector work in lower-skilled health care occupations such as nursing assistant and home health care aid. This finding is consistent with previous research by Queneau (2006) and Gabard (2007), that minorities are over-represented in the lowest compensating health care occupations.

3. Conclusion

This research contributes to the growing body of research investigating the income disparities and representation in health care occupations. Structural factors explain the majority of the income differentials between non-minority and minority health care workers. More research is needed to address the processes of sorting minorities into the lower compensating occupations.

4. Acknowledgements

I would like to thank Dr. Twyla Hill for the guidance and assistance over the course of many projects.

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Computational Fluid Dynamics for Condensation in Mini and Microchannels

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Abstract: Computational fluid dynamics (CFD) analysis was performed to evaluate and compare the condensation of steam in mini and microchannels with hydraulic diameter of 2mm, 2.66mm, 200 μ m and 266 μ m respectively. The simulation was run at various mass flux values ranging from 0.5 kg/m²s and 4 kg/m²s. The length of the mini and microchannels were in the range of 20 mm to 100 mm. CFD software's GAMBIT and FLUENT were used for simulating the condensation process through the mini and microchannels. Steam flowed through the channels, whose walls were cooled by natural convection of air at room temperature. The outlet temperature of the condensate was in the range of 25°C to 90°C. It was found that the outlet temperature of the condensate decreased as the diameter of the channel decreased. It was also evident that the increase in length of the channel further decreased the outlet temperature of the condensate and subsequently the condensation heat flux. The investigation also showed that the pressure drop along the channel length increased with decreasing hydraulic diameter and length of the mini and micro channel. Conversely, the pressure drop along the channel increased with increasing inlet velocity of the stream.

1. Introduction

Wind energy is a major component to eliminate the use of fossil fuels for several reasons. It is generally the most economical source of renewable energy, competitive with and sometimes cheaper than electricity from fossil fuels and nuclear power. Fuel cells can play a major role in renewable energy storage and be cost effective [1]. These fuel cells have many advantages over conventional batteries yet they are not widely used. The fact that they have some drawbacks is still putting these fuel cells on the back foot. Five parameters affect the performance and durability of fuel cells [2]. A detailed description of the five major parameters is given. Water management is the parameter which plays a major role in the performance of a fuel cell [3]. Based on the reviews, improvement of condensation on the cathode side of a fuel cell is expected to improve the performance of the fuel cell by reducing cathode flooding. Microchannels and minichannels can enhance condensation on the cathode side of a fuel cell [4].

2. Experiment, Results and Discussion

This paper deals with a computer aided simulation of condensation of steam in mini and microchannel. The hydraulic diameters of these channels vary between 0.2-2.66mm. The length of the channel was varied between 20mm to 100mm. Steam was injected at an inlet temperature of 393K. The condensation process through the channel takes place by natural convection to air, such that the temperature of the wall is maintained at 295K throughout the simulation. The mass flux of steam was varied from 0.5 kg/m²s and 4 kg/m²s. In order to simulate the flow of steam through the mini and microchannel FLUENT and GAMBIT were used. Gambit was used for modeling the 2-D mini and microchannel and Fluent was used to analyze the condensation flow of the steam. The analysis was run for various mass flux values and the length of the channel was varied from 20mm to 100mm in all the four channels. The rate of pressure drop was found to be high as the hydraulic diameter of the channel decreased. This clearly proved the fact that pressure drop was very high in microchannels when compared to minichannels. It is also clearly evident that the pressure drop increased along the length of both mini and microchannels with an increase in the mass flux of steam at the inlet. The temperature of the steam flowing through the channel varied with the variation in mass flux values. It was evident that the rate, at which the temperature of the condensate decreased, varied with the channel sizes. Similar results were obtained for all the channels at various mass fluxes and channel length. It is clearly seen in Figure 1 that with an increase in mass flux the outlet temperature increased rapidly for minichannels. The outlet temperature was as high as 363 K for a channel length of 100mm. In order for the condensate to have a low outlet temperature the mass flux should be decreased. But it is interesting to see that the

outlet temperature of the condensate was around 296K for microchannel, meaning the heat transfer rate is high and the condensate attains a temperature closer to that of the wall.

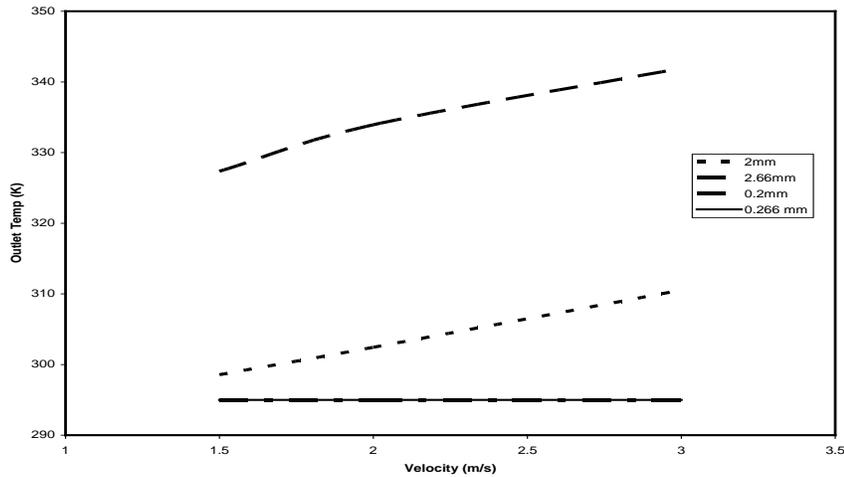


Figure 1 Outlet temperature of the condensate with respect to velocity for different channels. Mass flux varied between $0.5 \text{ kg/m}^2\text{s}$ to $4 \text{ kg/m}^2\text{s}$

3. Conclusions

A computer aided simulation of condensation of steam was carried out for two mini and micro channels with hydraulic diameters of 2mm, 2.66mm, 200 μm and 266 μm respectively. Under different cooling conditions and mass fluxes the following conclusions can be drawn. The rate of pressure drop increases as the hydraulic diameter of the channel decreased. As expected the pressure drop is high in microchannels. Outlet pressure of the condensate decreases with an increase in the channel length. Outlet pressure of the condensate decreases with an increase in the mass flux, resulting in low heat transfer rates. The rate of heat transfer is high in microchannels when compared to minichannels. The outlet temperature of the condensate is low for a microchannel when compared to a minichannel for a given mass flux. Moreover the outlet temperature of the condensate decreases with a decrease in mass flux.

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Enhancing the Development of Phonological Patterns in a 2-Year-Old Child

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Abstract. Most 2-year olds use many words and are understood at least 50% of the time. The child in this case study (age 2 years; 1 month) experienced difficulty communicating because of word omissions and a limited speech sounds repertoire. She often refused to attempt talking. It was hypothesized that Focused Auditory Input (FAI), which involved auditory stimulation of Primary Phonological Patterns during parallel play, would be the first semester's optimal intervention. Throughout treatment, the child increased willingness to talk to the clinician. The next semester, focus shifted to phonological patterns productions that were still deficient. The client was willing and able to produce target patterns in carefully selected words. Remarkable phonological system gains were found at the second term's end.

1. Introduction

Unintelligibility (i.e., not producing understandable speech) is a common communication difficulty for many young children [1]. Children often become frustrated when their attempted words cannot be understood by others. In addition, there may be some later difficulties in literacy related to earlier intelligibility issues. [2].

One approach to expediting phonological development and increasing intelligibility is the Cycles Phonological Remediation Approach [3]. In this approach, stimutable phonemes (i.e., speech sounds) within phonological patterns that are lacking in the child's phonological repertoire are targeted in succession [1]. Some children are not developmentally ready for the production portion of the Cycles Approach. This was true for the highly unintelligible 2-year-old in this case study. For such toddlers, Focused Auditory Input (FAI) [1] is utilized as a precursor to the Cycles Approach production-practice phase. FAI eliminates production demands and alternatively only requires the toddler to listen to and focus on the clinician's productions of phonological patterns in words [3]. The child is not required to talk during FAI sessions.

Several researchers have assessed the effectiveness of the Cycles approach [4]. Only a few researchers [5; 6], however, have conducted research to assess how well FAI primes a toddler for success in producing phonological patterns and becoming more intelligible. The goal of this case study was to contribute to the understanding of the transition toddlers undergo between FAI and production practice and thus, to examine the efficacy of FAI with this client. This case study involved tracking a 2-year-old's intelligibility progression during the two phases of the Cycles approach treatment.

2. Methodology and Results

This case study tracked the phonological abilities of a 2-year-old toddler. Her mother reported that at age 12 months, the client used no words. When she was evaluated at the WSU speech-language-hearing clinic, at the age of 1;10 (years; months) she produced only 8 to 10 words. It was also stated that the client babbled in long words and used gestures but often screamed due to frustration when not understood.

The WSU diagnostic team administered *The Preschool Language Scale* (4th ed.) [7] and *The Receptive-Expressive Emergent Language Test* (3rd ed.) [8] to assess the client's receptive and expressive language abilities. Results of these tests indicated that her receptive and expressive language skills were in the high-average range. It was not possible to administer a phonology test during this diagnostic evaluation, but the child did say a few words on her own, which revealed that her phonemic inventory consisted primarily of vowels with an extremely limited repertoire of consonants.

Due to the client's age (2; 1) and unwillingness to say words, FAI [1] was selected as her initial treatment. The FAI sessions focused on Primary Phonological Patterns ("Syllableness," Final Consonants, /s/ Clusters, Velars, and Liquids), one at a time for 60-minutes each. The sessions were conducted by using parallel-play activities (e.g.,

feeding a doll). These activities consisted of a steady stream of narrative and interactive speech filled with words containing target sounds/patterns. The toddler also listened to a short rhyme at the end of each session to facilitate the development of her metaphonological skills. Along with the rhyme, a list of 15 words containing the targeted pattern was sent home for her parent to read to her once daily. At the semester's end, the client willingly completed the *Hodson Assessment of Phonological Patterns-3rd* ed. (2004) preschool screening tool [9]. Results indicated that the client reduced consonant sequences (e.g., for the 'gl' in 'glasses', only 'l' produced), omitted consonant singletons (e.g., leaving off the 'z' in 'nose'), lackedstridents (e.g., leaving off 's' in 'boats') and velars (i.e., substituting 'n' for 'g' in 'gum').

The full HAPP-3 [9] was administered at the beginning of the second term. Results placed the client's phonological system in the "low severe" level of phonological impairment with a Total Occurrences of Major Phonological Deviations (TOMPD) of 101. The client then began the production phase of the Cycles approach [1]. The same primary patterns were targeted during this term, but at this time, the child was required to say the production-practice words. Drill-play activities were incorporated where the client was required to produce the target pattern in words before participating in the activity (e.g., throwing a ball). Listening lists and short rhymes were to be read at home daily for 2 minutes. At semester's close, the client's TOMPD on the HAPP-3 was 58, which placed her phonological performance in the "low moderate" severity range. Four months later, the client returned to the clinic for a recheck. She had generalized all of the phonological patterns that had been targeted except /r/. (This was not a concern because of her age.) At this time, the client was essentially intelligible and it was determined that she did not need to return to the clinic for additional intervention.

3. Conclusions

This case study followed an unintelligible 2-year-old girl with highly unintelligible speech, but no other presenting developmental deficits. The researcher hypothesized that Focused Auditory Input would improve the participant's phonological abilities. FAI consisted of the clinician providing correct target productions and language-rich models during parallel play. The client received one semester of FAI and one semester incorporating production practice. Her intelligibility improved remarkably.

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The Effects of Computer Animations on High School Students Performance and Engagement in Biology

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Abstract. Technology and computers today play a huge part of how society and education function. The learner has been shaped by digital media such as computers, internet, iPods, and Xbox. Research has shown that learning in biological science is enhanced with the use of computer animations. This study involved 79 biology students from an urban high school participating in a three-week study. In this study a pretest, post-test and retention test was given for assessment. The study focused on the use of computer animations to increase the performance and engagement of cell transport and movement. This research shows that computer animations accompanied with traditional teaching increases the performance of high school biology students and should be recommended to aid the teaching of biological concepts.

1. Introduction

Why is it that Microsoft has sold over 10 million Xbox 360s in the U.S. and over 19 million worldwide with over 12 million Xbox Live registered users (Terdiman, 2008)? Why is that kids are more likely to stay at home in front of the TV and play Madden football than to actually go out and physically play football with their friends down the street? Why is it that a majority of the country is tagged as obese? Why is that we all have cell phones, text messaging, computers and face books? The reason is that we are a three-dimensional visually stimulated technology driven society. Diana and James Oblinger (2005) of *Educating the Net Generation*, found that 13 to 17 year-olds spend 3.5 hours a day using digital media which include computers, games and internet. Technology is continually changing, but is our instruction changing with it? In order to truly leave “no child behind” classrooms and instructional methods must stay up to speed with technology and our learners. Since over 60% of learners are visual and many stimulated on a daily basis by computer animation such as Xbox then our instruction needs to contain computers and animation (Martindale, 2007). There are still teachers that use the old Socratic methods of teaching supplemented with note taking and worksheets. What changes in instruction can lead to better engagement and performance in the biology classroom?

2. Research Questions

Research Question from the literature review, one can surmise that computer animation would be more engaging and could thus increase student performance. The research questions for this project are as follows:

1. Will computer animations added to traditional lecture provide higher engagement in the learning process than traditional lecture alone?
2. Will computer animations added to traditional lecture provide a better understanding and long-term retention of biological concepts than traditional lecture alone?

The purpose of this study is to research the effectiveness of adding computer animations to traditional lecture for understanding and retention of cell biology concepts. The concepts being studied are cellular transport and movement. The study involves 79 Biology 2 students in three different classes of 25 to 28 students each. The students are from an urban school in south central Kansas with approximately 1600 total students.

3. Methods and Procedure

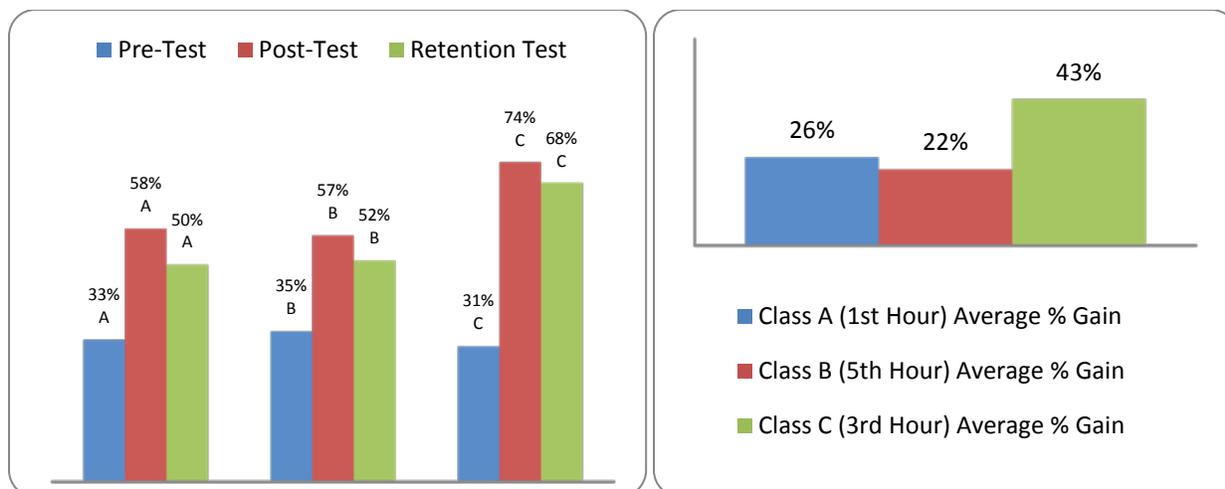
Class A was given traditional lecture and notes accompanied by two dimensional textbook illustrations, textbook worksheets and questions. Class B was given traditional lecture and notes accompanied by non-illustrated worksheets. Class C was given traditional lecture and notes accompanied by computer animations of cellular transport and movement. The traditional lecture, notes and lab activities are the variables held constant. The variables changing were non-illustrated worksheets and questions, illustrated worksheets, and computer animations. The ages of the students were from 15 to 17 years old.

4. Assessments

A pretest was given on the concepts at the beginning of the three-week period. After the three-week period or seven 90-minute block classes, a post-test was given. During the three-week study field notes and informative assessments to study engagement were monitored. Included in the twenty multiple choice post-test are ten level-one questions and ten level-two questions. In order to also test for retention and understanding of the concepts, the post-test was given again after two weeks of not studying the concepts.

5. Results

Class A had 28 students present during the pre and post-test exams. Class A had an average standard deviation for all three tests of 13.0%. All three class averages of the three tests are shown below on the left. Class A as shown below on the right had an average gain of 26% on pre and post-test scores. Class B with a total of 25 students in the class period directly after lunch had an average standard deviation of 13.1%. Class B had a 22% average gain between pre and post-test scores. Class C had a total of 26 students that took the pre and post-test. Class C was held right after Class B and the period just before lunch. Class C had an average standard deviation of 12.6%. Class C had an average gain of 43% between the pre and post-test scores. As shown below in the chart, Class C (computer animations) had the largest percent of gain per student by 17% over Class A and almost doubles that of Class B. The retention test showed that all three classes had dropped or had a loss of retention. However, Class C had a smaller percentage at 4.8% of decreased scores than that of Class A with 8.4% and Class B with 5.8%. The results below show that when computer animations are shown the last 15-minutes of class after lecture, notes and activities that students understand and retain more of the biological concepts presented in the high school biology classroom.



6. Conclusions

There are many factors that can play a role in the classroom and on student performance. The results of the post-test as a whole, meaning all three classes, were a little discouraging in that the overall percent gain was not enormous. Some of the factors that could have inhibited the ability to understand the concepts are sleep, food, absences, school activities, behavioral disruptions, class passes, hour of the day, and difficulty of the content. However, the results do show that computer animations when shown after concepts are introduced provide increased performance, engagement, and retention of biological concepts with high school students. Therefore, computer animations should be continually developed and used to teach these concepts in the high school science classroom.

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Risk Assessment Disparities for Females in the Criminal Justice System

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Abstract. Female adult and juvenile offenders are a forgotten group within the Criminal Justice System. This is one of the primary causes in the lack of research of how females may possibly be assisted to reduce recidivism and avoid future incarcerations. Due to the lack of emphasis on assistance for this particular group of offenders, they have become an expanding group within correctional facilities. Many testing methods used in the criminal justice field do not take into account the difference in gender and therefore analysis should be done into how the questions in these tests can be designed to predict recidivism in females offenders as well as they do in male offenders. Realistic options for female offenders will be defined through qualitative analysis in how females can be helped to adapt after being released from incarceration as well as how to avoid becoming another statistic of future offenders in the female generations.

A group that seems to be showing an upward trend in its representation within correctional facilities is both adult and juvenile females. There is very little research that is performed in regards to the individuals in these group and the laws tend to underestimate the crimes that this group is capable of performing. The lack of regard for this group of forgotten offenders seems to imply that there needs to be work done in the area of how to handle the delinquency of women and girls.

Some of the problems with current assistance is that they are weighted towards being for males but do not take into account the gender factor. This leads to the developing rehabilitation methods focusing on risks for young girls regarding their behavior, which is not going to be effective due to the constantly changing factors of this type of assistance. These factors tend to be associated with the environment of the female offender, including the possible history of abuse, which is not easily controlled in a rehabilitative program (Stephanie R. Hawkins, 2009). One of the primary ways in which a female juvenile can avoid the possibility of recidivism is through a supporting and caring adult, who acts as a protector in their lives. A feeling of safety can lead to the motivational factor of becoming a successful and productive member of the free society decreasing the possibility that they may perform acts which will place them in correctional care.

In a recent study from the “National Longitudinal Study of Adolescent Health,” two questions were asked: 1.) “Does the presence of a caring adult, connection with and success in school, and religiosity protect girls from involvement in delinquent behaviors?” and 2.) “Do these protective factors operate differently for girls exposed to known risks for delinquency?” (Stephanie R. Hawkins, 2009). There are many factors that can lead to the possibility of delinquent behaviors but the aforementioned research seems to focus on the “personal victimization” as a cause. It was concluded that the predominant number of delinquency cases was in the group of girls at age 15. This was the age when a large number of negative experiences may become ingrained in their behavior. At this point it is a very difficult task to reduce the impact of these negative factors. Risk factors identified in the study are: physical assault, sexual assault, neglect, and neighborhood disadvantage; protective factors: Caring adult, school connectedness, school success, and religiosity (Stephanie R. Hawkins, 2009). The findings of this study were that the factors varied based on the age of the juvenile female and the environment in which they lived.

The scarce amount of research regarding the causes of female recidivism does not help in the field of rehabilitation for female offenders (Hamilton, 2007). There is some minor research showing that girls that recidivate are most likely to be victims of physical or sexual abuse and are likely to run away leading to the life on the streets of society where crime is the only option. For these groups of female juvenile delinquents placing them within a correctional facility may only agitate the situation and create a repeat offender seeking a way out.

Many girls within facilities tend to feel as though it is the only place they are safe. Once released they seek out ways in which to be returned to these facilities and return to the normalcy they perceive behind the walls. This too may be an important factor in the statistics in relation to females who recidivate and how to assist them in becoming a part of today’s society. Assistance that includes the family, and those who have relationships that may

become an important part of the gender-specific programs to help young female delinquents. Only through understanding gender differences can society help the female juvenile delinquents who find themselves within the justice system. Important gender factors can include: pregnancy, motherhood, sexual abuse, sexual assault, domestic violence, and depression. These factors are identified as more influential in how females cope with their situation. There has been some "gender-responsive treatment approach" developed since the realization of these influential factors (Poels, 2007). Through the development of gender appropriate rehabilitation, successful help can be given to female juvenile offenders giving them the assistance they need.

Risk assessment predictors for recidivism based on gender can help identify the high risk and low risk offenders, and help increase the effectiveness of assistance for female offenders. A list of questions in relation to the specific parts of the juvenile's life can help professionally trained individuals in breaking the problems of "anti-social personality patterns" (Poels, 2007). Still so many programs seem to simply modify assessments for boys to use for girls and this does not help in predicting the future behavior of young female juvenile offenders.

Offense categories in which female juveniles are having rate increases is in simple assault, drug abuse violations, liquor law violations, driving under the influence, and disorderly conduct. These statistics in 2006 showed that the number of juveniles arrested who were female was 30% (Hamilton, 2007). Females are generally perceived by society to be the victims of crime due to issues that are exclusive to their gender. These issues include pregnancy, motherhood, sexual abuse, sexual assault, domestic violence, and depression. These issues for females have led society to begin to conclude that this group of offenders may require "gender-responsive treatments" to assist them in dealing with their problems (Poels, 2007). Yet despite the new concern for female offenders, research for this group has been largely ignored or neglected. Due to the lack of rehabilitative assistance prior to release, the percentage of incarcerated females has been increasing over the last few decades at a rate of 500 percent (Heilbrun, DeMatteo, Fretz, Erickson, Gerardi, & Halper, 2008).

In 2006, the U.S. Department of Justice made a review of the figures associated with correctional populations. Its findings show that the number of female offenders held in correctional facilities increased by 4.5 % in relation to the fact that male correctional inmates increased by 2.6%. The final statistics show that by the end of 2006 females were 7.2% of all prison inmates, an increase from 6.1 percent in 1995 (Heilbrun, DeMatteo, Fretz, Erickson, Gerardi, & Halper, 2008). This means that there will be a large percentage of females released back into their communities, where they account for 9.9 percent of entries in the parole system. The alarming facts of this information is that this is an increase of 2 percent from 1990 and these percentages increase at an alarming rate as the years progress. Also alarming is the fact that the recidivism rates for this group are excessive. Recent statistics show that after one year 34.5 percent are likely to recidivate, and after 3 years, 46.3 percent are likely to commit another crime (Heilbrun, DeMatteo, Fretz, Erickson, Gerardi, & Halper, 2008). Consequently, there is a cry for gender-specific programs within the correctional community that takes into account all factors related to the rehabilitative return of female offenders to society.

Through proper risk assessment testing, early intervention can stop delinquent behavior and help create individuals become a viable part of society. Few services are available for young girls between the age of 8 to 11 and at this important step helping the developing minds of these young girls will create an environment suitable for growing and learning. By providing the gender-based community services, society becomes an important part of the intervention and can give hope that the juveniles will be able to escape a possibly harmful environment. These services can include family counseling, substance abuse prevention, specialized educational services and mentoring services (Acoca, 1999). This could include an all-girls school environment, which, although controversial, would allow girls to learn without distraction or fear. This can create an environment that is very therapeutic and can promote public safety while bringing about a reduction to recidivism, and the simple statistics of first-time delinquent girls who may become future women inmates.

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Molecular tetrads comprised of Zinc porphyrin-boron dipyrin-triphenylamine triad to probe sequential energy/electron transfer events via axial ligation with C₆₀imidazole entity

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Abstract. There is a growing interest to mimic major processes in natural photosynthesis via artificial systems in order to harvest solar energy.

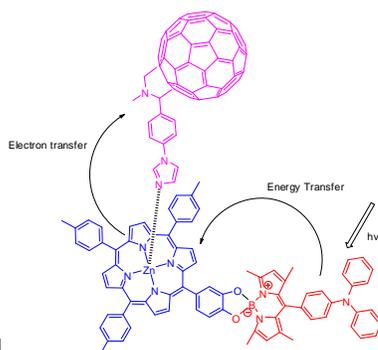
In the present study, we wish to report newly synthesized molecular triads comprised of Zinc porphyrin-boron dipyrin-triphenylamine entities. Further, supramolecular tetrad is formed by axial ligation of imidazole functionalized fullerene. Systematic spectral, electrochemical and emission studies are performed to probe sequential energy transfer followed by electron transfer events in the newly synthesized triads. Computational studies using B3LYP/3-21G* are performed to arrive at the geometry and electronic structures. Photochemical study using time-resolved emission is performed to probe electron transfer events. Further, organic photocells are being built to directly convert light energy into electricity.

1. Introduction

Green plants, algae and certain types of bacteria are capable of converting light energy into chemical energy. This light harvesting process is known as photosynthesis and it involves two main processes, transportation of absorbed light energy by antenna molecules to the reaction center and generating a charge separated entities via photo induced electron transfer (PET) [1]. In natural systems the antenna and reaction center entities are arranged in non-covalent fashion in order to achieve efficient solar energy conversion [2].

Mimicking the fundamental processes involved in natural photosynthesis using model systems is an interesting, challenging and demanding area of research in modern sciences. Many artificial systems have been studied to mimic antenna-reaction center functionality using porphyrin as an electron donor and fullerene as an electron acceptor linked via either covalent or non-covalent approach [3].

In present study we report artificial model system (Scheme 1) to mimic antenna –reaction center functionality using non-covalent supramolecular approach.



In scheme 1, triphenylamine (TPA) appended borondipyrin (BDP) acts as an energy absorbing and transferring antenna and Zinc-porphyrin (ZnP) acts as energy acceptor from antenna and promotes electron to electron accepting fullerene moiety (C₆₀-Im) using absorbed energy. TPA-BDP is used stabilize charge separated entities other than antenna functionality. ZnP-C₆₀-Im is used due to their characteristic properties in electron transfer reactions.

2. Experiment, Results, Discussion, and Significance.

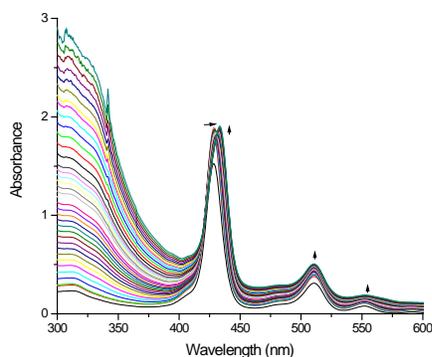


Fig.1. Optical absorption spectral changes of C60Im with the TPA-BDP-ZnP triad.

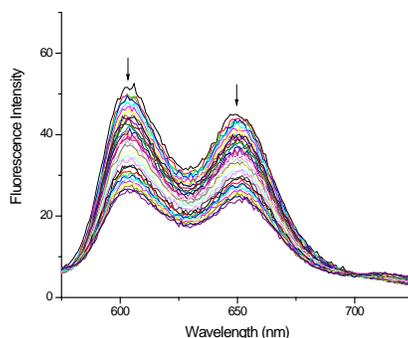


Fig. 2. Steady state fluorescence spectral changes of C60Im with TPA-BDP-ZnP triad.

In order to study ground state interactions between TPA-BDP-ZnP triad and C60-Im UV-Visible titration was performed (Fig.1) in *o*-dichlorobenzene. Spectral changes (425 nm band) were observed during addition of C60-Im and binding constants were calculated. These results indicate stable supramolecular tetrad formation by the axial ligation approach.

Steady state fluorescence studies were carried out to investigate electron transfer events between TPA-BDP-ZnP triad and C60-Im. Upon photo excitation of 550 nm band corresponds to ZnP, emission spectra were observed during addition of C60-Im. The quenching of fluorescence emission (605 and 650 nm bands) attributed to electron transfer reaction from ZnP moiety to C60-Im entity.

3. Conclusions

As revealed by the absorption and emission studies a stable supramolecular tetrad is formed between TPA-BDP-ZnP and C60-Im via axial coordination and TPA-BDP moiety acts as an antenna in this tetrad and ZnP-C60-Im moiety functions as reaction center entity. However further studies are going on to get more data to support these conclusions.

4. Acknowledgment

The authors are thankful to National Science Foundation, NSF EPSCOR for funding and Dr. Nikolai V. Tkachenko for collaborating with this project.

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Editorial Response to President Obama's School Speech

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Abstract. This study seeks to determine if editorial coverage was supportive or critical of Obama's September 8, 2009 school speech. Newspapers serve as the government's "Fourth Estate" by shining a spotlight on politicians and commenting on their activities. History proves that the public and the government are influenced by opinions printed in newspapers, and the content of the proposed speech was altered following the outcry from parents and the media to address what some called, "an invasive abuse of power." Understanding the position of the editorial boards could be an indication of support Obama will have for his policies. The subject was hotly debated in the media and extreme interests were noisily presented, however, the newspapers did perform their role.

Introduction

"In the old days men had the rack. Now they have the press," writer Oscar Wilde commented in 1891 about the role of newspapers in society [1]. Newspapers continue to maintain a vital role in protecting the integrity of the American government, acting as the "Fourth Estate" and keeping government officials in check. In the first year of Barack Obama's presidency the press has been closely monitoring and reporting on the nation's first African-American leader's every word. In fact, during the first 50 days in office, the three broadcast network evening news shows devoted 1021 stories lasting 27 hours, 44 minutes to Barack Obama's presidency, five hours more than the combined totals devoted to George W. Bush and Bill Clinton during their first 50 days [2]. When Obama announced that he would be giving a back-to-school address to the nation's school children, the press pounced with voracious vigor on the news.

Splashed across the media were outrageous claims of Obama's audacity to enter the classroom. Newspaper headlines claimed that "Parents see sinister goals in Obama's school speech," [3], and warned the public to get ready for "All Barack's Children"[4]. Other newspapers put a positive spin on the speech. "Work Hard and Dream Big, Obama Tells Students," [5], and "Bi-Partisan Praise For School Speech," [6]. The coverage included cries of racism, threats of socialism and reminders that the Democrats had been similarly outraged over George Bush's school speech in 1991. The public reacted by announcing their plans to keep their children out of

school and refusing to let them hear the speech, claiming the speech was political in nature.

Considering the role of the press to provide the public with information sufficient for use in the evaluation of matters of policy and governance [7], it is important to truly understand the press' response to the uproar. Separate from the news coverage, editorials have a duty to offer readers clarification on the truth or fairness of the claims and to present vigorous commentary on the choices facing voters [8]. This research examines the editorial response to President Obama's school speech and to determine if the newspaper editorials were supportive of his speech or critical. Understanding the position of the editorial boards could be a likely indication of what type of support Obama will have for his policies.

Experiment, Results, Discussion, and Significance

Method

Focusing on the nation's top ten newspapers for circulation, the papers with the broadest reach to the public, the study relied on a data set collected via the LexisNexis database and the ProQuest database to examine the supportive (positive) position and the non-supportive (negative) position of the newspapers, and if there are any neutral comments. The phrase "Obama School Speech" was used as the search parameter and a population of articles was created. The final population was eight editorials. Each editorial served as a unit of analysis. Each editorial was studied and coded from printouts from the Lexis-Nexis database. *The Los Angeles Times* and the *New York Daily News* both printed two separate editorials, followed by one editorial from each *The Washington Post*, *The Wall Street Journal*, *The New York Post* and the *Philadelphia Inquirer*. No editorials covering the speech were found in *USA Today*, *The New York Times*, *The Chicago Tribune*, *Houston Chronicle* and *Philadelphia Inquirer*. Following previous studies, the method used to determine the supportive or critical nature of the editorials was to examine for the use of evaluative adjectives describing the speech [9]. Terms such as 'foolish', 'fretting', 'important', 'ridiculous', 'worthy', 'lunatic', and 'petrified' were

some of the words used to judge the nature of each editorial.

Results

Of the eight editorials, five were coded as supportive, two were coded critical and one was neutral. With 62% of the results being supportive of Obama, these findings express that the president's choice to give a pep-talk to school children is not considered a negative thing by newspaper editors. 25 % of the results were critical and 12.5% were neutral of the speech.

Discussion and Conclusion

The purpose of this study was to see if the editorials that commented on President Obama's school speech were supportive of the speech or critical. Editorials are focused on commenting on issues of merit, and this issue did warrant some comment, but not as much as all the media fuss would imply. The event may not have a significant impact or meaning in the broad look at Obama's presidency, but it does provide a snapshot of the public's view of Obama and also an indication of changes afoot in the way the media behave.

Further study of Obama and the media is needed. The first African-American president does create a new paradigm that begs to be explored in depth. The issue of race could retard America at establishing a foundation for helping to shape America's global competitive strategy, and for reaffirming America's leadership as a balanced and reasonable world power; one that retains the moral authority throughout the world [10]. Studies need to be conducted to determine just what role race has regarding Obama and to see if the problem is growing or lessening with his presidency. It would be useful to use a similar method to check editorial reaction to additional Obama events and to watch for trends. In a similar study by Druckman&Parkin [11] it is pointed out that, "we see our methodology as one that can and should be replicated in different markets with different campaigns at different times."

The changes in media coverage for events, such as the school speech, shows that in the era of Facebook and cell phone cameras, newsrooms are adopting a siege mentality as they further circumscribe what is acceptable behavior for their editorial employees [12]. Creating stories about the story is bigger than ever and the public is growing to prefer a strong point of view in their news. A Pew Research Center project shows a 20 year long decline in the public's esteem for the press and the reason

cited is that journalists are too involved personally. This study shows that in the news there is a great deal of personal involvement from the press, but the editors decline to get too involved [13]. In the future it seems that reporters will be disclosing their points of view and explaining where that perspective comes from, which could impact the educated viewpoint that we expect from the editorials in the newspaper.

Acknowledgements

The author would like to sincerely thank Dr. Patricia Dooley, from Elliott School of Communication, for assistance with the research design and support.

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Using graphene in coating materials to prevent UV degradation on advanced composite materials

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Abstract. The objective of the project presented here was to develop a new nanocomposite coating materials for protection of advanced fiber reinforced composite wind turbine blades against UV degradation and corrosion from weathering. TRIZ method was initially used to create the ideas about how to solve the challenging situation about advanced composite materials having a weak property to sustain UV degradation with its high specific modulus. This paper discussed about to apply graphene as inclusion in coating material, and it successfully increase its ability to resist degradation from Ultraviolet. The results were compared in mechanical strength, water contact angle test, and AFM surface study.

1. Introduction

Composite materials will eventually be applied for a wide variety of applications in industries such as aerospace and automobiles. As green energy is the trend to be used, wind-power energy is getting more attention in both industrial and academic research. Using composite materials for wind-power turbine blade has many tremendous advantages, such as, weight saving, higher specific strength, energy transition efficiency, however, it faces damage or degradation from UV light due to environmental exposure. The most researches show the lifetime of the convention coating methods and materials are much shorter than lifetime of the composite materials itself[1].

A new coating material was developed by adding the graphene powder as inclusion in paint, and using air-gun to spray them on surface of advanced composite materials. Recently, graphene has drawn a lot of research attention in materials science due to its special nano-properties and it has certain advantages over silicone material, which is the traditionally used material [2]. Graphene is the strongest known material so far. It has a fundamental structure of carbon nano-tubes and fullerenes [3](Figure 1). It has a-atom-thick allotrope of carbon with planer honeycomb lattice. More importantly, it is inert, and it has very high aspect ratios, which is an important factor to be utilized in coating industry and academic research. Contact angle property and AFM image are

the other important factors to be studied and analyzed.

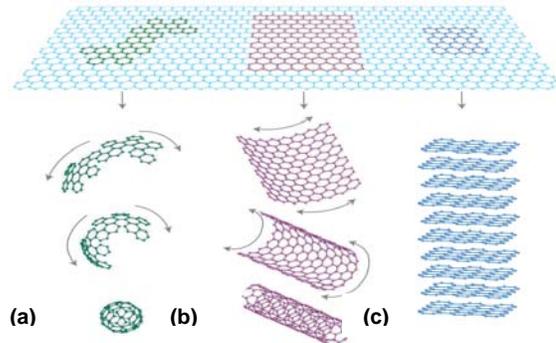


Figure 5 Mother of all graphitic forms[3]. Graphene is a 2D building material for carbon materials of all other dimensionalities. It can be (a) wrapped up into 0D buckyballs, (b) rolled into 1D nanotube or (c) stacked into 3D graphite.

2. Experiment

The nanocomposite coatings are prepared by individually combining inorganic nanoparticulates into polymeric matrices, and then sprayed on advanced composite materials at 3ml thickness. Air nozzle spray coating method is used in this study. Once the specimens were coated, according to ASTM B117, they were put into UV chamber for 4, 8, 12, and 16 days to observe damage differences. The UV intensity of 16 days exposure is equivalent to 2 years of regular sunlight in Wichita, KS. In the meantime, specimens were put into salt fog corrosion chamber for simulating the real weathering conditions.

3. Results and Discussion

Following are the tensile tests, new water contact angle tests, and AFM studies on the coating specimens after UV and salt corrosion exposure. From previous research, it tells UV radiation damages glass-fiber composite material about 1% every year[4], and my research clearly shows that UV radiation reduces the elastic modulus by 2% in glass-fiber coated with pure paint coating as compared to glass fiber coated with 2% graphene inclusions in

coating after about 2 years sunlight UV intensity (Figure 2).

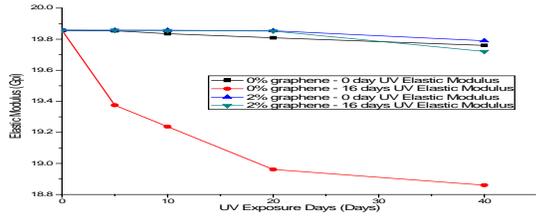


Figure 6 Elastic Modulus Comparisons

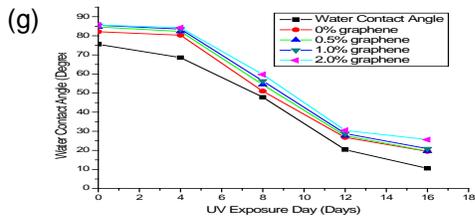
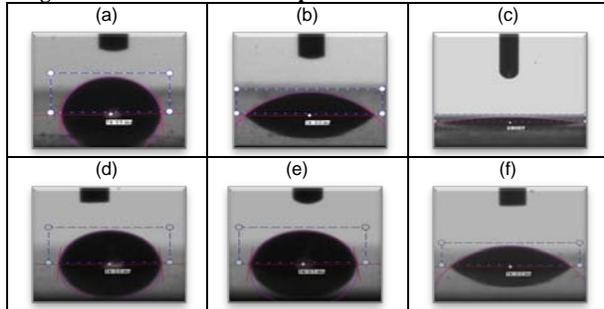


Figure 7 Water contact angle comparisons. (a) 0% Graphene, 0 days UV exposed (b) 0% Graphene, 8 days UV exposed (c) 0% Graphene, 16 days UV exposed (d) 2% Graphene, 0 days UV exposed (e) 2% Graphene, 8 days UV exposed (f) 2% Graphene, 16 days UV exposed (g) overall contact angle tests comparison

Water contact angel test shows the surface characteristic, roughness, and surface energy[5]. There are two kinds of surface properties, hydrophilicity and hydrophobicity. Different applications require a different specific surface roughness. This experiment needs the surface to show water-repellent properties. From Figure 3, UV lights damage the surface roughness, and water contact angle decreases as UV exposure days increases, however, by adding up graphene as inclusion in pure painting, it shows the water contact angle decreases less. AFM images Figure 4, (a), (c), and (e) are the images of glass-fiber with pure paint, exposed to UV light for 0 days, 16 days UV exposure, and 16 days UV exposure with 40 days corrosion test respectively, the surface roughness deteriorates rapidly (e) shows the worst surface over all. Image (b) shows a smooth surface as image (a),

but with graphene particles on surface, (d) and (f) images are damaged, but not as bad as (c), (e).

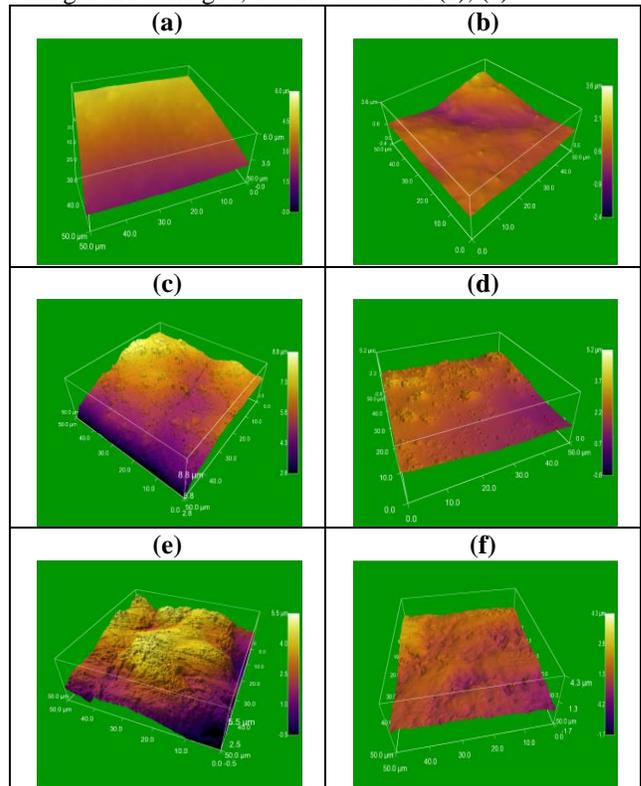


Figure 8 AFM images, (a) 0% Graphene, 0 days UV exposed, 0 day corrosion (b) 0% Graphene, 16 days UV exposed, 0 days corrosion (c) 0% Graphene, 16 days UV exposed, 40 days corrosion (d) 2% Graphene, 0 days UV exposed, 0 days corrosion (e) 2% Graphene, 16 days UV exposed, 0 day corrosion (f) 2% Graphene, 16 days UV exposed, 40 days corrosion

4. Conclusions

The tensile test, water contact angle test, and AFM imaging shows that graphene is a good inclusion to be mixed with original paint. It helps maintain tensile strength, it helps prevent surface from UV damages and degradations

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