2008 Master Teacher Program Project Anthology

A collection of papers completed by MTP participants as part of the completion requirements of the MTP

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Master Teacher Program Project Guidelines

Classroom Research Project

The capstone experience of the USMA Master Teacher Program is a Classroom Research Project and paper. According to Pat Cross, Classroom Research is "the careful, systematic, and patient study of students in the process of learning, and more specifically of how students are responding to our efforts to teach them. The task for Classroom Research is not so much to study learning in general, as to study learning in particular as it takes place -- or fails to -- for your students, in your classroom, and in your subject matter, with your particular teaching skills and preferences."

The characteristics of Classroom Research define it – at its core, it is learner-centered, teacher-directed, and context-specific. You're going to assess an issue that matters to the learning of your students, based on what you see in your classroom and your course.

The process:

(1) Pick a focus. Think about your classroom – how do you interact with cadets, what classroom activities predominate, why did you choose them, through what activities does learning occur, and where could you use a little improvement? Brainstorm the issues that you tend to think about. What activity(s) would you like to focus on for classroom research?

(2) Survey the literature to see what other teachers have done with that topic. What strategies have they used; what conclusions have they drawn? You will better formulate your own plan, and possibly branch into a new area you've just discovered as a result of your literature search.

(3) Develop a plan. How can you look at the issue? Can you try a new strategy with each new unit, and then compare at the end of the semester? Maybe develop five or six small group activities, conduct one per lesson, and then assess them at the end of two weeks? How will you assess the outcomes? There are obvious indicators – grades on projects, homework, and exams. You can look at student participation and interaction, tracking how often and how well your students speak up. You can ask your department peers to observe a few classes and provide feedback about how they think your new technique worked. You can – and should – also ask your students, using surveys or minute papers. After you've tried something new, ask them to assess what they liked and didn't like about it. Refer to Angelo and Cross (1993) for more classroom assessment techniques.

(4) Analyze your information. You've gathered grades, surveyed your students, and made notes after every class. What does all of the information add up to? You might use statistical techniques, but you might also look at the information in a holistic and qualitative manner – what patterns do you see?

(5) Report the information. Write it up for your MTP project, and potentially to submit it to a journal or academic conference.

Literature Review Project

Participants also have the option of conducting and writing a literature review addressing a teaching and learning topic, in lieu of the research project. Literature reviews should focus on a specific topic area within teaching and learning, and may potentially be submitted for inclusion in

the POD/NTLF TEACHING & LEARNING ONLINE RESOURCE CENTER. To that extent, literature reviews should follow a specific format, and topics should be approved by Dr. Evans.

The POD/NTLF Format:

- Topic, Author Information
- Topic Overview -- 500-1,500 words short essay describing key issues, history of practice, practice variations, beneficial attributes, controversial aspects
- An annotated bibliography of the most influential, current, and useful resources, 50-150 words per resource (no more than 10-12 items)
- Additional Resources --- Citations of additional print, web, or video resources, without annotation.

Sample literature reviews, a writing template, and a list of suggested topics, are available on Blackboard.

Resources

Useful texts:

Angelo, T.A., & Cross, P.K. (1993). Classroom assessment techniques: A handbook for college teachers, 2nd ed. San Francisco: Jossey-Bass.

Cross, K.P & Steadman, M.H. (1996). Classroom research: Implementing the scholarship of teaching. San Francisco: Jossey-Bass.

Useful websites:

http://www.dean.usma.edu/centers/cte/
http://www.evergreen.edu/washcenter/resources/acl/c1.html
http://www.accessexcellence.org/LC/TL/AR/
http://www.prodait.org/research/index.php

Keyword List – use to stimulate ideas on what you might investigate for your classroom research.

Active Learning	Classroom Participation	Cooperative Learning	Case Studies
Discovery Learning	Experiential Learning	Problem-Based Learning	Questioning Techniques
Student Presentations	Advising	Assessment of Learning	Methods
Cheating	Grading	Testing Formats	Assessment of Teaching
Classroom Observations	Lesson Planning	Teaching Portfolios	Course Development
Course Goals and Objectives	Student Course Evaluations	Distance Education	Computer Assisted Instruction
Cognitive Mapping	Intellectual Development	Problem Solving Skills	Ethics in Teaching
Evaluation of Teaching	Student Evaluations	Peer Reviews	Teaching Portfolios
Humor in Teaching	Interdisciplinary Teaching	Team Teaching	Instructional Technology
First Class Meeting	Electronic Media	Films and Videotapes	Laboratory Instruction
Mentoring Junior Faculty Members	Writing Across the Curriculum	Psychological Foundations of Teaching and Learning	Student Motivation
Learning Styles	Teaching Styles	Student Epistemology	Teacher Epistemology
Teaching Strategies	Lecturing	Debates	Demonstrations
Discussions	Games and Role Playing	Independent Study	Seminars
Simulations	Student Projects	Study Groups	Studio Instruction
Tutoring	Written Assignments	Philosophies of Teaching	Texts and Readings
Course Packs	Handouts	Individual Consultations	Group Consultations
Evaluation of Teaching	Student Evaluations	Peer Reviews	Teaching Portfolios
Classroom Observations	Learning Styles	Podcasting	Blogs

ABSTRACTS

BEHAVIORAL SCIENCES & LEADERSHIP

MAJ Robert Meine

Title: *Evaluation of Teaching: Teaching Portfolios (*Literature Review)

Abstract: This article reviews the structure and function of teaching portfolios in their various forms, as well as their application in advancing the art of teaching. Portfolios are useful tools in developing teachers and courses, assessing professional growth and contributing to fellow professionals' improvement. Controversial aspects and recommendations are discussed, and related readings are provided.

CHEMISTRY & LIFE SCIENCE

MAJ Melissa R. Eslinger

Title: *Chemical Equilibrium, Which direction shall we favor? An Instructor Guide to Teaching Using the Systematic Method*

***Introduction*:** There are traditional methods for teaching chemical equilibrium, generally understood and accepted by the scientific community. However, the normal approach requires assumptions regarding the minimal variation from initial concentration in order to simplify mathematical procedures and arrive at approximate answers. The Department of Chemistry & Life Science is in the second year of a cohort study where an alternative educational style is presented in select sections of the core course, general chemistry, CH102. The alternative approach to chemical equilibrium, the Systematic approach, is being compared to the traditional method--RIC/RICE, in order to determine the more effective method to teach equilibrium and promote understanding of what occurs in solution at the molecular level. This brief overview will address the current teaching methods, the proposed systematic alternative, and observations regarding instruction in both.

MAJ Marc Franciszkowicz

***Title*:** *Video based Instruction to Enhance an Active Learning Environment for General Chemistry*

***Abstract*:** "Podcasting" and "Vodcasting" have received particular attention as a way to send or push subject-matter content to students. These techniques show promise, but arguably can create a more passive learning environment. Our program methodologies seek to utilize current technologies to facilitate the development of self learners in an active learning environment. Using screen capture software, we created Video-based Additional Instruction (VAI) for a General Chemistry course to foster problem solving skills and conceptual understanding of course material. The supplemental resource was linked to an online syllabus which required students to seek and pull content as needed. We used surveys and website hit counter data to determine when and why students used the resource and surveys to determine its perceived benefit. We also conducted limited efficacy testing between users and non-users. Initial self surveys show overwhelming use of the resource for both pre-class preparation and pre-test review with nearly 80% utilizing at least 50% of the videos available. Students agreed that it improved their conceptual understanding and their problem solving skills. Students who used VAI prior to class (30% to 40%) showed increased participation and performed statistically better on all beginning-of-class quizzes. Moreover, students wanted other departments to use VAI in their classes and courses. The initial data suggests that videos in a pull content show great potential in supporting an active learning environment as well as providing additional on demand support outside of normal office hours.

MAJ Andrew Morgan

Title: *Use of Placement Tests in College Classes(*Literature Review)

Introduction: Many colleges use some sort of a placement system to determine if incoming students are required to take remedial level courses or place students in a class that focuses the teaching to their level of expertise. While this practice is widespread and continuing throughout America, what is the impact on the students and the courses they are taking? Have we designed the test for the specific purpose in mind, assessed the method, and validated the methods? This paper is designed to look at

the literature behind the reasons why placement exams are given, the results, the uses, and suggestions for improvements.

MAJ Chi Nguyen
Title: *Student Motivation and Learning (*Literature Review)
Abstract: Everything students do is underlined by some sort of motivation. This includes students and their motivation to learn. Motivation is essential to learning since it is the driving force for students' to complete tasks that build knowledge. There are many factors that potentially influence motivation, which makes research on this topic as it relates to learning diverse and abundant. However, motivational considerations can be summed up as being either task or ego-oriented. The purpose of this paper is to review research conducted on student motivation as it applies to learning, and in the process, identify teaching techniques that support motivating students to learn.

CIVIL & MECHANICAL ENGINEERING

MAJ Jakob Bruhl
Title: *Learnin Style Preferences for an On Demand Learning Resource*
Abstract: An on-demand learning resource was evaluated based on students preferred learning styles. During the Spring semester of 2007, I created short video tutorials for various topics in the introductory engineering class, Fundamentals of Engineering Mechanics and Design. The original implementation was highly successful so the concept was expanded for the following term and feedback (both grades and perceptions) was gathered. Learning style preferences (using Felder's Learning Styles Inventory) of the students in the course were assessed and compared to trends in usage of the on-demand videos. The author hypothesized that it would be more likely to be used by visual, sequential learners. Surprisingly, no specific learning style preference exhibited a greater tendency to make use of the videos. This paper suggests that well-organized, short, instructional videos appeal across the entire spectrum of learning styles. In addition, students at all levels of academic performance utilized the video tutorials. This pedagogically sound on-demand resource potentially helps all students.

MAJ Tim Johnson
Title: *Time Management Practices in Undergraduate Students* (Literature Review)
Abstract: I believe most undergraduate college professors would expect their students to come prepared both for class and prepared to manage their lives outside of the class. I would postulate that most professors take this for granted. I know I did, especially here at West Point, where if you don't manage your time properly you suffer. Students should (and probably need to) possess the ability to manage their resources and time effectively as they enter college. What I have learned, through my short time teaching, and the research supports it—is that those who learn to manage their time effectively have a higher rate of success while those who fail to manage their time fall behind.

The transition for most high school students to higher education and the increased workload is often unmanageable and can lead to high levels of stress and anxiety which can directly impact student performance. The question becomes what can be done to mitigate these stress levels and who should be responsible. Should the Math 101 professor be responsible for taking some of his class time to teach time-management skills? Is it an institutional responsibility? Is it a student responsibility?

MAJ Yvonne Miller
Title: *Battle Buddies: A Cooperative Learning Technique for Reducing Anxiety and Increasing Motivation*
Introduction: Anxiety often influences how well students perform on tests. This anxiety can be compounded by the daily demands of college life, especially at a military academy such as West Point. The intent of this study is to assess whether anxiety is an issue among cadets in the daily

preparation for class and looks at one method to reduce the anxiety and improve learning and performance on evaluations such as daily quizzes while encouraging better class preparation.

One main issue associated with student learning in a required course that is outside the student's interests is a lack of cadet preparation for daily participation. This is reflected in poor performance on daily quizzes and evaluations. The goal of this research is to assess whether team testing on quizzes will improve learning and motivation. Team quizzes presents a low threat environment, allowing the instructor to gauge the students' understanding of the lesson readings and promoting more active learning. Taking quizzes as a team would promote cooperation, and students could share their ideas with another cadet without feeling pressured since they are not presenting their ideas to the entire class.

Dr. John Rogers
Title: *Teaching Computer Aided Drafting and Design (CADD) to Undergraduates* (Literature Review)
Authors: *Dr. John Rogers and MAJ Jason A. Evers*
Introduction: Maintaining proficiency in one's profession can be a challenge as an educator, especially in regard to rapidly changing technology. In the realm of engineering, developments in Computer Aided Drafting & Design (CADD) over the past two decades have increased the speed and effectiveness of design through the use of modeling, analysis, and visualization tools embedded in software packages. Engineering graphics instructors have attempted to adapt their courses to keep pace with the rapid changes but instruction on higher-end, industry-standard CADD packages continues to increase in complexity, often causing courses to focus on the intricate series of commands that results in the creation of the model or drawing. The traditional engineering graphics courses tended to focus instead on projections, views, and other more basic visualization concepts. The argument then arises over how much time should be spent on the traditional graphics instruction versus the CADD package specific training such that students are experts in both visualization and modeling. The future of these types of courses looks increasing more complex as the abilities of various software packages increases into the realms of four- (time) and five- (money) dimensional models and CADD begins to morph into Virtual Design and Construction (VDC). This future necessitates a thorough review of current and past practice, which this paper seeks to do; and a look to the future to define the knowledge that our students need to have to succeed.

MAJ Jason A. Evers
/_collaborated – see joint entry under Dr. John Rogers_

MAJ Steve Bert
Title: *Using Peer Design Review as an Undergraduate Engineering Education Tool*
Authors: *MAJ Steve Bert and MAJ Aaron Hill*
Background: The ultimate goal of any teacher is to inspire their students toward lifelong learning. Many people, by nature, are accustomed to learning by doing. It is an active process. There are very few things people master by simply hearing or seeing only once. In fact, when considering the fundamental everyday tasks in life such as tying one's shoe, reading a book and driving a car, it is clear that each was mastered through practice. Just as world class athletes perfect their jump shot, split-fingered fastball or golf swing through practice, students become proficient through active learning and repetition. It is no surprise then, that within the engineering discipline, most successful instructors require their students to learn by doing. In fact, by definition, engineering is "the creative APPLICATION of scientific principles to design or develop structures…" The instructor may write or lecture in the classroom to convey ideas, but it's up to the student to apply the ideas in order to learn it. This active learning has proven to be a successful technique to foster student learning.

MAJ Aaron Hill
***/collaborated – see joint entry under MAJ Steve Bert*

MAJ Brian Novoselich
Title:*ME350 Remote Education: Experiences Teaching Engineering to Non-Engineering Majors Studying Abroad*
Authors: *MAJ Brian Novoselich, COL Grant Crawford, and Dr. Erica Young (Math)*
Abstract: This paper examines the development and implementation of a remote, asynchronous mechanical engineering course taught to seven non-engineering majors. The students studied abroad in five countries on three continents and in four different time zones. The content of the course includes topics in the areas of Fluid Mechanics, Thermodynamics, and Heat Transfer. Particular emphasis is placed on how the approach used to teach ME350 via remote education affects resource allocation, student performance, and student perception of the learning experience. Because course content between the resident and remote formats was nearly identical, a meaningful comparison of student time spent per lesson is addressed, showing that overall, students spent similar amounts of time on the course, regardless of the venue. A significant issue for remote students was reliable communications with the host institution. Internet connectivity varied widely based on student location and could not be adequately assessed prior to implementation of the program. Key learning points associated with this experience are addressed. The course director conducted a personal time survey which revealed that approximately two hours were spent in development of remote course content for every hour of student utilization. Anonymous student time surveys also indicate that both resident and remote students devote a comparable amount of their time to the course.

Regardless of venue, all students took the same final examination at the host institution under controlled conditions. Remote students performed better than local students on the final examination, but, overall course grades were comparable. Statistical evaluation of performance on the final examination and overall course performance showed no statistical significance between the two groups. Exit survey results indicate that remote students completed the course with a more positive perception of their learning experience when compared to their counterparts. A concise list of lessons learned that has been shared with the United States Military Academy Center for Teaching Excellence and International Affairs Office is included.

CENTER FOR TEACHING EXCELLENCE

Dr. Kimberlee Bonura
Title: *Classroom Relationships* (Literature Review)
Introduction: "One looks back with appreciate to the brilliant teachers, but with gratitude to those who touched our human feelings. The curriculum is so much necessary raw material, but warmth is the vital element for the growing plant and for the soul of the child." – Carl Jung

When students believe that their peers and teachers like and respect them, they are more likely to achieve academic success (Goodenow, 1993; Ladd, 1990; Ryan & Patrick, 2001). "Research is clear on this point: Effective teachers are warm, caring individuals who, through a variety of statements and actions, communicate a respect for their students, an acceptance of them as they are, and a genuine concern about their well-being," (Ormrod, 2003, p. 482). There are many benefits for developing positive relationships with students – students who feel cared for by their teachers and in their learning environments experience higher self-efficacy for learning, enjoy learning more, are more likely to request needed help, less likely to cheat, and more likely to achieve at high levels (Hayes, Ryan, & Zseller, 1994; Kim, Solomon, & Roberts, 1995; Murdock, Hale, Weber, Tucker, & Briggs, 1999; Osterman, 2000; Ryan & Patrick, 2001; Ryan, Pintrich, & Midgley, 2001; Wentzel & Wigfield, 1998). Further, Gorham and Millette (1997) indicate that students attribute demotivation (i.e., loss of motivation for academic performance) to teacher behavior, including lack of enthusiasm.

Classroom relationships matter in both the traditional classroom and in the modified classroom of an online learning community, where technology strategies need to be developed in ways that support the development of classroom relationships (Bennett, 1999).

DEPARTMENT OF FOREIGN LANGUAGES

LTC Scott Womack

Title: *Authentic Artifacts in the Classroom and Student Development: A Case Study of their Relationship in the Affective and Cognitive Domains for Basic French Students at the US Military Academy*

Abstract: This study explored the relationship between the use of authentic artifacts in the classroom and student performance and attitudes in LF203, Introduction to Basic French at the United States Military Academy. It employed an exploratory case study methodology with quantitative and qualitative techniques in the author's two LF203 sections in the first semester of academic term 081. Analysis of the study's results indicated a positive relationship between the use of authentic artifacts in the classroom and student development in the areas of language proficiency, cross-cultural competence, and regional knowledge in the cognitive and affective domains.

DEPARTMENT OF MILITARY INSTRUCTION

MAJ Justin Perusek

Title: *Student Epistemology/Teacher Epistemology: Different Dichotomies (*Literature Review)

Introduction: (After reading through several articles within the Master Teacher Program curriculum over the past 2 years and instructing/interacting with Cadets, I became more interested in the dichotomy of beliefs about knowledge and learning between teachers and students. In our environment, Cadets often think differently from their Instructors and vise-versa. After having a discussion with a Plebe earlier in the academic year about his traffic ticket, I was convinced that there is a difference. This Plebe could not understand why he was singled out of a group of six cars (all speeding) and received a speeding ticket while the others did not get stopped. His rationale was that everyone else was speeding rather than the fact that he was breaking the speed limit law. His beliefs were different from mine. Coupled with reading several articles from the Master Teaching Program curriculum, I was led to the Student and Teacher epistemology study subject. It is a vast, abstract, and complex realm. Little did I know that I was attempting to "boil the ocean" on this topic.) The challenge is for teachers to adjust their pedagogy based on their epistemological perspective to best educate the student with their own epistemology.

DEPARTMENT OF PHYSICAL EDUCATION

MAJ Mark Rea

Title: *Portable Fitness: Enhancing Learning through Technologies in a USMA Fitness Course*

Purpose: The purpose of this research project was to evaluate potential enhancements of student learning experiences through the use of podcasts, portable media consumption, and web cameras in a USMA fitness course. The course, PE350 Army Fitness Development, is a 19 lesson course which provides students knowledge and skills necessary for them to prepare, implement, and assess scientifically-based Army unit level physical training plans. My research was conducted during Term 1 Round 1 2008. My goal was to engage students with new technologies to provide the following specific enhancements:

1) More in class time to engage in deeper/meaningful dialog
2) Fun with technology/additional forms of media
3) Introduce students to commercial podcasts; inspire them to use podcasts for a lifetime
4) Better assessment of learning (video quizzes)

MAJ Julia Wilson

Title: *Effective Teaching in Physical Education: IMPACT BEHAVIOR BARRIERS AND FACILITATORS TO LEARNING* (Literature Review)
Topic Overview: Teacher behaviors that either influence or set barriers to learning are affected by many factors. Instructional tasks, managerial tasks, teacher expectations, feedback, as well as teaching style and enthusiasm, all create a concept in the physical education environment known as the "ecology of the gym." This paper describes some impact behavior barriers and facilitators to learning that teachers might consider prior to entering the classroom.

ELECTRICAL ENGINEERING & COMPUTER SCIENCE

MAJ David Chang
Title: *Educating Generation in Robotics*
Introduction: Today, a majority of students in the classrooms of colleges and universities across the country were born after 1981 as generation Y or the MTV generation. An unprecedented number of these young people lived in households where both parents work or in single parent households where the single parent is employed. Generation Y belongs to a generation in which daycares, babysitters, televisions and peers serve as surrogate parents [1]. Because many of them have grown up with computers, a majority of youth in this generation are technologically literate. In fact, intrinsic to the proliferation of technology, modern tools of communication such as the internet, beepers and cell phones are social lifelines for this generation. Consequently, youth of today are more independent, resourceful and peer dependent [2]. They also tend to be inventive and are self-sufficient problem solvers. They often desire support and feedback, but detest authoritative control. Accustomed to immediate gratification, youth in these generations are responsive. They crave stimulation and expect immediate answers and feedback [3]. Recently National Academy of Engineering, Committee on the Engineer of 2020 published Educating the Engineer of 2020: Adapting Engineering Education to the New Century that offers recommendations on how to enrich and broaden engineering education so graduates are better prepared to work in a constantly changing global economy. This addressed how students learn as well as what they learn in order to ensure that student learning outcomes focus on the performance characteristics needed in future engineers. If the United States is to maintain its economic leadership and be able to sustain its share of high-technology jobs, it must prepare for this wave of change [4].

Today's college students are typically very comfortable with technology, have shorter attention spans, a low threshold for boredom, resist memorization and busy work and prefer action to observation [9]. Learning styles of these generations are more active and visual rather than verbal. Given the distinguishing attributes of these new generations, including a highly visual imagination, educators are obliged to explore different and innovative teaching strategies that effectively address students in terms that they easily recognize and comprehend. For effective instruction to occur, the educator should traverse the world of the learner. Brown [3] suggested that authentic learning requires the learner to communicate detailed understanding of a problem or issue rather than memorize sets of isolated facts, and must result in achievements that have relevance beyond the classroom. This paper presents a successful teaching/learning strategy applying robotics in the classroom at the United States Military Academy, which is directed geared towards Generation Y.

MAJ Matthew Dunlop
Title: *The State of Gender Equity in Science Classrooms* (Literature Review)
Abstract: Much has been done to improve gender equity in the science classroom, but research shows there is still a need for improvement. Teachers have attempted to improve female performance by employing such techniques as giving both genders equal feedback or assigning roles in group work. There has been an improvement in female performance and an increase in females in the science fields, but it is still open to debate as to whether teachers' strategies in the classroom have contributed

to this improvement. Most research points toward the positive effect of teacher influence and suggests we should continue our effort to improve equity.

MAJ Kirk Ingold
Title: *Faculty Development (*Literature Review)
Introduction: Faculty development is a fluid system that is continuously changing to meet the needs of the students and the teachers. Institutes that have successful faculty development programs develop those to meet the specific needs of their students. Some key topics noted in faculty development models are goal-oriented teachers, social systems, and a learning-centered model. Faculty development models possessing these attributes have the potential to be very successful in producing excellent teachers with successful students.

MAJ Christopher Korpela
Title: *Assessing the EE Program Outcome Assessment Process, Case Study: EE401 Senior Design Capstone Project Course*
Abstract: Program outcome assessment is an integral part of systematic curriculum review and improvement. Accrediting commissions expect each student to achieve program outcomes by the time of graduation. Programs undergoing accreditation must have an assessment process that demonstrates program outcome achievement. Documenting and assessing just how graduates are meeting program outcomes can become a tedious and data intensive process. We report on our "assessment" of our assessment process that resulted in more streamlined procedures by targeting performance indicators. Our methodology included the development of a learn, practice and demonstrate model for each outcome that focuses performance indicators at the appropriate point in development. We target actual outcome achievement during the "demonstrate" phase with rubrics to detail the level of mastery on a modified Likert scale. We originally used seventy-eight embedded performance indicators spread throughout the curriculum. We reduced to thirty indicators using a mixture of internal and external measures such as individual classroom events and fundamentals of engineering exam topical area results. We also emplaced guidelines targeting a single outcome measurement per indicator. For example, in our capstone senior design course, virtually every assignment was being reviewed by one of our outcome monitors. By targeting performance indicators at specific sub-events and looking at those which had to be assessed during the course versus indicators assessed by advisors or senior faculty, we were able to reduce the embedded performance indicators by a factor of three. We applied similar techniques to reduce individual course director workload. We have found that by streamlining the outcome process and using a rubric approach applied across multiple outcomes, we can greatly reduce the number of performance indicators yet preserve our ability to accurately assess our program. Reduced workload assessing the program has enabled us to place more effort into improving the program.

Dr. Peggy Leonowich-Graham
Title: *Programming to Music*
Abstract: Do college freshman perform better listening to music of their choice during graded computer programming labs? Previous studies of workplace productivity indicate an increase of about 5% after background music systems have been installed. Music seems to boost enthusiasm, increase relaxation and lessen nervousness and as a result, the elevated mood contributes to higher productivity[6]. Can music have this same effect in the classroom? A study was conducted on college freshman to determine the effects music had on learning Java programming. The hypothesis of the study was that students who listened to music of their choice would perform better on graded programming labs than those that did not listen to music. The findings of the study indicated that students did not perform well while listening to music. This is important as educators consider music in the classroom.

Dr. Michael Miller
Title: *Interdisciplinary Courses* (Literature Review)
Introduction: Curriculum integration is teaching about topics that reach across multiple disciplines. One approach to such integration is through interdisciplinary courses which incorporate topics from across multiple disciplines into a cohesive narration (Vars 1991). This review looks at course development through interdisciplinary approaches in respect to the goals to be achieved, course development, and continuing challenges. In addition to interdisciplinary there also exist cross-disciplinarity and multidisciplinarity. Cross-disciplinarity is the use of one discipline to examine another discipline. Multidisciplinarity is the understanding that disparate academic disciplines exist and students should be aware of those disciplines. Of the three, only interdisciplinary involves the understanding that a set of topics from disparate disciplines are related and might be taught under the umbrella of a single course. In examining interdisciplinary courses we start from first premises and see what has been said about the goals in teaching an interdisciplinary course. Next we look at what the current thinking is on developing the ideal interdisciplinary course. Finally, we look at the current state of interdisciplinary courses.

LTC Tim Schmoyer
Title: *Leveraging Rhetoric and Logic in Classroom to teach Math, Science and Engineering* (Literature Review)
Introduction: Teaching is a form of human communication. As such, understanding to communicate more effectively using rhetoric and logic can be applied to the development of curriculum and to improve teaching technique in the classroom. In math, science and engineering curriculum, the "language" of communication normally includes spoken and written words familiar to the teacher and student, as well as Greek letters, mathematical functions, graphs, and interactive software and hardware that may not be familiar to the student at the beginning of a course. The student must learn the symbols and the concepts they signify within the context of the course and the technical discipline of the wider profession. The literature on how we learn what signifiers mean is extensive, multidisciplinary, and dates back over thousands of years. This paper introduces a few concepts from that literature and their application to teaching math, science and engineering.

ENGLISH

MAJ Ramit Ring
Title: *Humor tin Teaching* (Literature Review)
Introduction: As recently as the 1990s, structured use of humor in…classrooms was elusive at best, and flat out dissuaded by administrators at worst (Lovorn, 2008). And, while the use of humor to facilitate learning is not a new concept, it is seeing an emergence today as more teachers and educators look for methods to better communicate and help students learn. Humor can be represented as jokes, puns, riddles, sarcasm, physical antics, nonverbal behaviors, cartoons, and one-liners (Wanzer et al., 2006). Additionally, when employed as a conversation starter, tension-breaker or therapeutic intervention, laughter is a highly effective way to stimulate communication (Lovorn, 2008). Other factors that influence the effectiveness of humor in the classroom include humor appropriate for the audience, targeted to the topic, and placed in the context of the learning experience (Garner, 2005). However, even those who champion using humor in the classroom admit that there are dangers to the student-educator roles if the humor is allowed to get out of hand or is misconstrued by students. There is a fine line between the competent use of humor in the classroom and inappropriate humor in the classroom.

HISTORY

MAJ Michael Bonura
Title: *First Impressions May Not Be All That Lasting: The Importance of Multiple Introductions in Small Classes*

Introduction: Due to the small classroom sizes (12-19) and the profession that my students will enter upon graduation (officers in the United States Army), class participation plays an extremely important role in the history classroom at the United States Military Academy (USMA). In my first semester teaching a military history survey course at USMA, I made a deliberate effort to increase the classroom participation of my students. It seemed as though the class took almost 25% of the course before they warmed up to me as an instructor, each other as fellow students, and the material itself, so that by the end of the course the class was energetic and enjoyable for the majority. However, when taking attendance on the penultimate lesson of the course, I made a surprising discovery. When asked who was absent, the cadet sitting next to the empty chair replied, "the guy who sits next to me with the funny hair." I realized that after almost forty lessons of instruction, my students did not know their classmates' names, much less anything about each other. I then decided to conduct a classroom experiment to determine if numerous introductions would not only increase their knowledge of each other, but also bond the class together more rapidly and improve classroom participation from the start.

This experiment in introductions as a way to motivate classroom participation and discussion is really an effort to improve teacher-student relations. As such, there is a large body of research that makes a direct linkage between an effective teacher-student relationship and improvements in student performance. At their very basic level, teacher-student relations are a strong motivator and indicator of learning. Taking this assertion as a starting point, there are a number of specific attributes of this relationship that impacts learning in the classroom. Some believe that "a notion of trust between the teacher and student … is a fundamental and necessary condition for the realization of a particular pedagogy of higher learning." (Curzon-Hobson, 2002) While other researchers discovered that the important benefit of the relationship is the construction of a safe and nurturing environment that facilitates the students' ability to create and trust their knowledge (Raider-Roth, 2005). Still another links this relationship directly with student participation and discussion stating that, "student's enthusiasm, involvement, and willingness to participate affect the quality of class discussion as an opportunity for learning." (Davis, 1993) This author also includes classroom introductions as a method to inspire and develop student enthusiasm. This experiment in introductions seeks to determine the most effective use of introductions over an extended period in order to improve teacher-student relations.

LAW

CPT Christopher Ford

Title: *The Socratic Method.* (Literature Review)

Introduction and History For many non-lawyers (and a good many lawyers), law school conjures up images of large lecture halls packed with students being instructed by an overbearing, authoritarian professor relentlessly posing a series of questions to the hapless students caught in the line of fire. As vividly perfected by the fictitious Professor Kingsfield in The Paper Chase, the pedagogy is commonly known as the "Socratic Method."

In a loose sense, the term "Socratic method" has its foundations in Plato's dialogue the Meno. In the classical sense, both Platonic and Socratic dialogues were dialectic – that is, the truth of the point of discussion was unknown to either the questioner or questioned. However, the modern understanding of the term "Socratic method" bears little resemblance to these classical dialogues. Jeffrey D. Jackson defines it as such: "the heart of the Socratic method lies in professor-student interaction. In the most traditional sense, the professor calls upon a student and engages that student in a colloquy, either about a case or about some other problem. As the student answers, the professor poses other questions in an attempt to get the student to delve into the problem in more detail."

The introduction of the Socratic method in U.S. law schools came in 1870 when Christopher Columbus Landell became Dean of Harvard Law School and immediately set about reworking the nature of legal education. Before Langdell, legal instruction was conducted through the lecture and textbook models – memorizing texts and having professors lecture on the material – and, apprenticeships. Langdell sought to make the whole process more "scientific".

MATH

MAJ Randy Boucher
Title: Student Selection for the Advanced Mathematics Program at the US Military Academy
Abstract: Every year the U.S. Military Academy is faced with selecting highly qualified students to fill the seats in its Advanced Mathematics Program. Traditionally, selection has been accomplished using a tiered performance system; qualified students are placed within five tiers related to chosen performance criteria. These tiers form the basis for student selection. In this paper we will present a new approach to student placement. Using historical student performance and final grade data as well as statistical tools such as multi-regression analysis, mathematical models were created to predict student performance. It will be shown that these models do a very good job of predicting final course grades in the Program. We will also examine results from a program culminating survey and determine that students are fully benefiting from the Program's curriculum and selection process.

LTC Robert Burks
Title: *The Student Mathematics Portfolio: Value Added to Class Preparation?*
Abstract: This paper describes key elements for teachers to successfully implement a student portfolio in their undergraduate course. This paper offers practical experience in implementing a student mathematics portfolio for a freshman Precalculus course and looks at the potential value added to daily class preparation and traditional classroom assessments of the portfolio. The paper provides strong anecdotal and student self-confidence evidence that student portfolios provide increased performance in the course.

Dr. Elisha Peterson
Title: *Using a Wiki to Enhance Cooperative Learning in a Real Analysis Course*
Introduction: For decades, educators have become increasingly convinced of the importance of cooperative learning in the classroom, and have sought out new strategies to accomplish this goal. It is widely believed that cooperative learning increases the ability of students to work together, keeps them more engaged in the process, and better reinforces the material being learned. In this paper we investigate the efficacy of a wiki as a tool for collaborative learning and enhancing students ability to communicate in an undergraduate mathematics course. A wiki is a website which is constructed primarily for the purposes of online authoring and collaboration [8]. The prototypical example is Wikipedia, the online encyclopedia constructed with the help of tens of thousands of users. But wikis also exist on much smaller scales. There are thousands of wiki sites on the web, allowing groups of individuals to collaborate around shared interests such as an employer, video games, or mathematics. Sometimes wikis are created for use by a single person. (This paper was written on the author's personal wiki.) There are several features which attract users to wikis.

MAJ Charles Sulewski
Title: *Does the Prerequisite Differential Calculus Core Course Offered at the United States Military Academy Adequately Prepare Students for the Follow on Mandatory Calculus-Based Introductory Physics Program?*
Authors: *MAJ Charles Sulewski and MAJ Michael Schock*
Abstract: Students at the United States Military Academy are mandated to take differential calculus and a calculus-based physics course as part of their graduation requirement. PH201 is the first course of a two-semester, calculus-based physics sequence. This course consists of an introduction to nuclear

physics and a comprehensive study of classical mechanics, which is designed to promote scientific literacy and to develop the use of scientific modes of thought to solve complex problems. This paper discusses the findings of a qualitative analysis derived from student survey data dovetailed with student performance on graded examinations to measure the adequacy in the MA104 Differential Calculus course in preparing students for their future physics PH201 course.

MAJ Michael Schock
*/*collaborated – see joint entry under MAJ Charles Sulewski*

MAJ Robyn Wood
Title: *Demonstrating "What Right Looks Like" and Increasing Confidence in Mate-Averse Students*
Introduction: As a math instructor of a mandatory calculus course, I see a wide variety of student performance throughout the semester. I was struck by the wide variety of attitudes held by the students, particularly the ones who struggled with calculus. Many of the lower performing students often expressed their feelings that they "never get math" and lacked the ability to succeed in a calculus course. I also noticed that these students typically had extremely poor mathematical knowledge base, which manifested itself poor test performances.

In this classroom research study, I sought to see if I could somehow impact both of these characteristics of the lower-performing students. This particular group took my calculus course on the "off cycle;" that is, they were a semester behind their peers in their year group. Most of the students were behind because they lacked the fundamental skills necessary to begin the USMA Mathematics core course sequence, and were subsequently place in a class that reviewed the basic skills they would need to succeed mandatory 4- course sequence. I wanted to see if I gave them more examples of "what right looks like" in a manner other than their textbook (which these students typically so ardently avoid), that they would be able to pick up and emulate the "correct" notation, and therefore be able to focus on truly understanding the deeper concepts in each lesson, instead of getting caught up in the notation and giving up. Likewise, if they were availed of a number of written solutions to problems on a regular basis, and they were able to compare and contrast their own work against these solutions, and find correctness in their work, their confidence in their abilities might increase. Is it possible to break the downward spiral of poor performance and subsequent low confidence in their abilities?

PHYSICS

MAJ Jonathan Campbell
Title: *Encouraging Class Preparation through Reading Quizzes*
Introduction: Who among us would not want to see students change their behavior and start preparing adequately for class? I embraced reading quizzes (RQs) and became an early fan based on comments like the one above, but just how effective are they at encouraging classroom preparation, and how can I execute a RQ program most effectively?

Peer Instruction (PI), pioneered by Dr. Eric Mazur, Professor of Physics at Harvard University, seeks to increase student understanding of concepts by increasing classroom interaction between students. Rather than focusing on numerical problem-solving, it reorients emphasis onto fundamentally understanding the concepts of science. The immediate critique that students' problem-solving skills would suffer has been repeatedly shown to be incorrect. In fact, by better understanding what is happening conceptually in a problem, students' ability to solve numerical problems actually increases. As an alternative to classroom lecture with prepared notes that often mimicks the textbook, in which students sit as passive observers of progress through the syllabus, PI seeks to force students to understand and discuss a focused, but non-numeric, problem. Using an automated response system, also known as "clickers," students commit anonymously to an answer and can see how the

class as a whole voted. Based on the level of student understanding, the teacher can proceed in various directions. If results are good enough (generally, greater than 90% correct), discussion can move onto another topic after a student explains how and why they chose their response. If results show a certain group of students understand the problem (generally between 50% and 90% correct responses), students have the opportunity to discuss among themselves and convince their neighbors why their response is correct or listen to the reasoning of their partners. If results are poor enough (generally less than 50% correct responses), the teacher can choose to provide a mini-lecture on the topic, before allowing students to deal with the concept problem again.

MAJ William Viar
Title: *Tracking and Ability Grouping* (Literature Review)
Introduction: Tracking or ability grouping is one of the most controversial topics in education today. Literally thousands of papers have been written arguing both for and against the practice of tracking. This paper will present an overview of tracking, consider the advantages and disadvantages of tracking, and finally review some of the most prominent research done on the topic today.

SYSTEMS ENGINEERING

MAJ Stephen Gauthier
Title: *Thunder Run in the Classroom-Simulation Entity Detail in Education*
Abstract: In April of 2003 the American Army launched an attack into the heart of Baghdad called the Thunder Run. The 3rd Infantry Division saw most of the fighting against sizable force of moderately well armed Iraqi Army soldiers. This paper provides an in depth look into utilizing the Thunder Run scenario in conjunction with Joint Conflict and Tactical Simulation (JCATS) software and the Systems Decision Process (SDP). The comparison between two semesters will be made in order to determine if a difference in simulation entity utilization impacts the cadets' abilities to learn and benefit from the course material. JCATS is an advanced military simulation program and the SDP is a methodology developed by the Systems Engineering Department in order to formalize the decision making process. With these tools cadets explore the world of modeling and simulation and utilize analytical processes in the form of a semester long project by which to recommend to a decision maker a new armored vehicle design for the United States Army. The SDP utilizes problem definition, solution design, decision making, and solution implementation processes by which cadets through a serious of in progress reviews, simulation runs, factorial design analysis, and a final paper work through all the steps necessary to recommend a new armored vehicle design.

MAJ Ken Gilliam
Title: *Assessing Partial Knowledge Using Innovative Scoring Rules*
Authors: *MAJ Ken Gilliam and MAJ Robert Dees*
Abstract: Strictly proper scoring rules are used to elicit a person's true probability beliefs about an uncertain outcome. The application of strictly proper scoring rules to grading in an academic environment is not new and is typically restricted to classes centered on Decision Analysis. For the purpose of explanation, a typical application of strictly proper scoring rules in academic grading would be as follows: assume that a multiple choice question with four possible answers has correct answer "D" and is worth one point. The traditional technique requires students to select one right answer, so if a student answers "D", the student receives a 1 or a 0 for all other answers. Conversely, a strictly proper scoring rule requires the student assign probabilities that each possible answer is correct, say A=0.1, B=0.2, C=0.05, D=0.65. The student's score depends on the scoring rule applied. Under the logarithmic scoring rule, the student would receive ln(0.65) points or -0.43. The scores are obviously bounded by $(-\infty, 0]$. Usually, the instructor rank orders students' scores and then assigns final grades. This situation can be extremely punitive for students who assign a low probability to a correct answer, and only slightly rewarding for those who submit their true understanding of the problem. Alternatively, the quadratic scoring rule allows a range of scores for the "correct" answer

but is bounded between -1 and 1 allowing the instructor to similarly rank the scores. We discuss a modification of the quadratic rule applied at the United States Military Academy in our Decision Analysis course. In our approach, we are restricted to an absolute grading requirement - the grade a student earns is not curved in any way. We explore the trade off between information gained about the students' true beliefs and points awarded. We examine initial student feedback and compare probabilistic grades to the hypothetical traditional multiple choice grades. Finally, we explore options for integrating strictly proper scoring rules into other engineering courses.

MAJ Robert Dees
***/*collaborated – see joint entry under MAJ Ken Gilliam*

SOCIAL SCIENCE

MAJ Eric Bjorklund
Title: *Reviewing Student Evaluations of Teaching* (Literature Review)
Introduction: Although the formal process of students evaluating their professors has existed since the early 1920's, the process continues to stir up debate, controversy, and the need for further research. The University of Washington pioneered this process by first asking their students to fill out questionnaires on their professors almost eighty-five years ago. However, the expansion in the use of student feedback to evaluate teachers has only recently blossomed. In fact evidence shows that only 28% of universities asked for student feedback for teacher evaluations in 1973. The data by 1993, however, showed an increase to 86%. With this clear trend in recognizing the perceived value of such student evaluations of teaching (SETs), the literature on the topic clearly shows that there is no agreement on the scope and limit of that value. This literature review will focus on three areas that are at the core of the current debate. First, the discussion of the possible utility of student feedback on instructors is summarized. Next, the validity argument of these SETs (whether or not they measure what they intend to measure) is discussed. Finally, this review will conclude with some of the main themes that currently find a large amount of scholarly consensus as well as some of the areas where further research is requested.

MAJ Jonathan Dunn
Title: *Assessing and Improving Student Motivation* (Literature Review)
Introduction: Motivating students has consistently been a concern of educators. In 1987, Howard Hendricks claimed that "the number one problem in education today is the failure to motivate students…..to get them off the dime and into action." A decade later, a survey of elementary school principals found that ninety-seven percent identified motivating students as either an important or very important issue in their schools. Motivation is defined as "the process whereby goal-directed activity is instigated and sustained" (Pintrich and Schunk 1996). In the realm of higher education, student motivation can be thought of as the overall drive of the student to succeed in the classroom – learning is the goal-directed activity. It is not uncommon for teachers to blame students for lacking motivation when they do not achieve at the level their teachers would expect them to. However, the literature on student motivation indicates that teachers can have an extraordinary impact on their students drive to achieve and succeed in their classes. Most research on student motivation focuses either on student characteristics or teacher traits that impact, positively or negatively, students' motivation to learn.

MAJ Matthew Sheiffer
Title: *Simulation Use in the Undergraduate Classroom*
Abstract: The use of simulation exercises in undergraduate international relations courses is not new. Yet, many instructors faced with large classes full of students with little experience in the subject matter avoid this tool in favor of more traditional classroom techniques. This paper reports on the results following the introduction of a simulation exercise into a large, introductory undergraduate

course in international relations in order to explore the validity of views that simulations are inappropriate tools for large undergraduate courses.

MAJ William Skimmyhorn
Title: *Measuring the Effect of Aplia on Cadet Perfromance in the Principles of Economics*
Author: *MAJ William Skimmyhorn and MAJ Mike Shekleton*
Abstract: This paper looks at the impact of using an online homework software solution, Aplia, on cadet performance during in-class graded events and on instructor satisfaction with teaching SS201. While we don't have a causal argument, we find that an increase in Aplia homework performance by 1 percentage point results in an increase in in-class graded performance on the multiple choice portion of an exam from 0.161 percentage points (Microeconomics WPR) to 0.211 percentage points (Macroeconomics WPR). For the non-multiple choice portion of an exam, an increase in Aplia homework performance by 1 percentage point results in an increase in in-class performance from 0.036 percentage points (TEE) to 0.105 percentage points (Macroeconomics WPR). This indicates that the increase in in-class graded exam performance may simply be a test-taking effect, since the practical significance of the impact on multiple choice performance is better. Future research that is on-going will utilize a treatment and a control group to allow the authors to ascertain a causal link between use of an online homework software solution and in-class graded examination performance. Lastly, while this paper focuses on the impact on cadet performance, instructors should also consider how the use of an online homework software solution frees up their resources, mainly time. To assess these effects and to gain greater insight into how best to use technology in the economics classroom, surveys were administered to all of the instructors teaching SS201 in AY08-02. Our future work will also include surveys of all cadets enrolled in SS201 in order to determine their receptiveness to Aplia as a teaching tool and to solicit their feedback on better incorporation of technology as part of the teaching of economics.

MAJ Mike Shekleton
**/Collaborated – see joint entry under MAJ William Skimmyhorn*

MAJ Scott Taylor
Title: *Educating Children with Down Syndrome* (Literature Review)
Introduction: Confusion abounds in our society about what a learning disability is and how to educate individuals that have one. In the education community we are charged with educating students in order to prepare them for the rest of their lives. Yet some of these students that are entrusted in our care may have a learning disability. How do we reach them? How do we also educate the greater student population on learning disabilities to encourage the inclusion of individuals with disabilities into the greater society?

USMA COMMUNITY

MRS Dian Roginski
Title: *Unlocking the Power of the Brain: The Next Great Educational Paradigm Shift* (Lit. Review)
Author: *MRS. Dian Roginski*
Introduction: In the past decade there has been significant inquiry into the quality of undergraduate education. More specifically, faculty responsibility for effective teaching at this level has been under review. At many universities, instructors place primary importance on research pursuits, leaving minimal time or concern for use of effective practices and student learning (Umbach & Wawrzynski, 2005). This review will highlight current issues regarding effective strategies for lifelong learning and diversity in intelligence. Current research in the areas of education and neuropsychology propose a reconsideration of the traditional role of teachers with respect to content delivery and environment in the classroom. Several proposals have been made in the educational arena, including a paradigm shift from the traditional instructor-centered model of knowledge dissemination to a more student-

centered process of syllabus construction, rate of learning and social environment (August, Hurtado, Wimsatt & Dey, 2002). A related technique addressed by Collins (2004), is based on the theory of adult learning as described by Dr. Malcolm Knowles. This concept also puts increased focus on the learner as a respected counterpart with shared responsibility for course design and content. Finally, research in cognitive neuroscience is being more positively regarded as improvement in physical evidence of findings is disclosed, examining the educational techniques favorable for brain-based learning (Phillips, 2005).

FULL-TEXT MODELS

Literature Review

The State of Gender Equity in Science Classrooms

Major Matthew W. Dunlop, EE&CS

Abstract

Much has been done to improve gender equity in the science classroom, but research shows there is still a need for improvement. Teachers have attempted to improve female performance by employing such techniques as giving both genders equal feedback or assigning roles in group work. There has been an improvement in female performance and an increase in females in the science fields, but it is still open to debate as to whether teachers' strategies in the classroom have contributed to this improvement. Most research points toward the positive effect of teacher influence and suggests we should continue our effort to improve equity.

Introduction

Achieving gender equity in the science classroom has the potential to improve female performance in the classroom and, ultimately, increase the number of female scholars who pursue science careers. The performance gap between males and females in the science classroom has gotten smaller over the past few decades (Gender Equity in Science Education, 2005), but the gap is still prevalent. In this literature review, we will review current research aimed at improving female performance in the science classroom. We begin by describing past and present classroom practices regarding gender equity. We then explore some benefits of achieving gender equity in the classroom. Finally, we will address the debate on whether teacher influence in the classroom can actually affect female performance.

Classroom Practices

Most instructors do not think much about why the percentage of male students in the classroom is much higher than the percentage of female students. It has come to be expected. It is common to believe that females leave the sciences or do not get into the sciences based on lack of ability. Research has shown this is not always the case (Seymour 1992, 284). The culture of how sciences are taught contributes greatly to this trend (Achieving Gender Equity in Science Classrooms, 2005).

A key cultural shift has to do with classroom participation. Nearly all research discusses how males and females communicate differently. Males tend to be more aggressive and quick to respond while females tend to be more reflective and deliberate (Achieving Gender Equity in Science Classrooms, 2005. Gender Equity in Science Education, 2005. Gondek, 2000). Males tend to shout out the answer before females have a chance to respond causing females to feel shut out. A technique to help overcome this is to prohibit students from calling out answers. By calling on students, the instructor can be sure that a proportionate number of females are called upon (Gender Equity in Science Education, 2005). The instructor should also mentally divide the classroom into quadrants. By shifting focus to quiet quadrants, the instructor notices when students are not participating (ECPI, 2005). Finally, when a question is asked, the instructor should wait at least three seconds (Campbell, 2007. ECPI, 2005). This delay will allow female students time to reflect on the question and formulate an answer.

Increasing collaboration is also a topic most research points toward. Some introductory science courses get labeled as "weed out" courses. In these courses, the high level of competition causes many students to leave science majors. Allowing students to form small groups to solve the problems takes much of the anxiety from the course and allows many students to learn more effectively (Achieving Gender Equity in Science Classrooms, 2005. Gender Equity in Science Education, 2005.

Campbell, 2007). In computer science courses this is called pair programming. In pair programming, a pair of students works together on solving a computing problem. Research has even shown pair programming to produce better overall student solutions (Barker and Cohoon, 2007).

There are a number of other suggestions researchers have made to improve the classroom environment. We highlight a few of them here in no particular order.

- Focus more on thought-provoking problems than on single answer questions (Gender Equity in Science Education, 2005).
- Challenge students to bring real-life examples of scientific applications. When students are able to get personally involved, they tend to derive more satisfaction (Achieving Gender Equity in Science Classrooms, 2005. Gender Equity in Science Education, 2005).
- Assign females to leadership roles in lab activities (Achieving Gender Equity in Science Classrooms, 2005. Gender Equity in Science Education, 2005).
- Invite public speakers from diverse backgrounds (Achieving Gender Equity in Science Classrooms, 2005).
- When teaching assistants (TAs) are available, consider using female TAs (Achieving Gender Equity in Science Classrooms, 2005. Gender Equity in Science Education, 2005).
- Praise correct answers. Make sure to praise both males and females equally (Achieving Gender Equity in Science Classrooms, 2005. Campbell, 2007. Gender Equity in Science Education, 2005).

Benefits

The benefits of achieving gender equity go beyond the classroom. The most prominent advantage is the new ideas and perspectives brought by females. One student that was interviewed said, "If half of society is discouraged from being a part of it [computer science field], then we're missing out on a lot of great ideas." (Blum and Frieze, 2005). In addition to the fresh ideas that women can bring to the field, there are many talented, intelligent women that can contribute to the workforce (Cuny and Aspray, 2000).

The benefits are not just limited to the workforce. Encouraging females to study science opens up opportunities for the individual as well (Cuny and Aspray, 2000). There are many women who would thrive in the sciences, and may find themselves more professionally satisfied in those occupations. Additionally, by gaining access to science, women are given the "power to see" the world from a different perspective (Sinnes, 2006).

Instructor Influence

Most articles discuss the positive effect having a close relationship with students has on performance. It is suggested to encourage students to attend office-hours (Gondek, 2000) and even to require students to schedule a visit (Achieving Gender Equity in Science Classrooms, 2005). It is also recommended for instructors to exude a warm demeanor in class so that students feel valued (Gondek, 2000). The Center for Teaching and Learning at the University of North Carolina at Chapel Hill claims that some female students abandon their science majors due to a lack of instructor encouragement (Gender and your classroom, 2001). It is worth noting that there is no supporting evidence presented to back up any of these claims.

One article by Varma et al. does not agree that teacher immediacy has a significant impact on performance. The authors arrived at their conclusions through analysis of data gathered from extensive interviews with students from four different universities in either their second or third year. They found no significant relationship with regard to teacher immediacy (Varma and LaFever, 2007).

There is also controversy as to the benefit of instructors modifying their curriculum to match differing learning styles. From 1995-1999 a study was conducted, known as the Margolis-Fisher study, that concluding men are more programming oriented and women are more application oriented (Margolis, and Fisher, 2002). Subsequent research proposed modifying curriculum to account for the female application-driven learning style (Achieving Gender Equity in Science Classrooms, 2005. Gender Equity in Science Education, 2005. EPCI, 2005). Other research believes changing curriculum as a means to achieve gender equity reinforces stereotypes. This perceived disparity is a product of how we educate females not an intrinsic difference (Blum and Frieze, 2005).

Conclusion

Gender equity in the science classroom is important, and although progress has been made, there is still room for improvement. We discussed some popular classroom practices to help draw and retain females in the sciences. Two practices most researchers agree on are incorporating more group work and adding time for reflection between questions and answers. We then looked at the benefit of gender equity on women and on society. The new perspective females can bring to science is a major advantage. Finally, we showed differing points of view on how much impact instructor interaction has on gender equity. Many researchers believe that teachers have a great deal of influence while a smaller number have not seen any significant benefit.

Annotated Bibliography

Barker, Lecia J. and Cohoon, J. McGrath. "Pair Programming. Retaining women through collaborative learning." National Center for Women and Information Technology. http://ncwit.org/pdf/PairProgramming_RetainingWomenCollaborativeLearning_Practice.pdf, 2007.
This article discusses how pair programming helps retain women in the computing sciences. Pair programming is the concept of having students work on programming assignments as a pair. Research has shown that students who participate in pair programming during introductory computer classes gain more confidence that they would if they worked alone. Women who participate in pair programming are more likely to stay in computer science and are more capable than their non-paired peers. Additionally, pair programming led to a higher percentage of women who declared computer science as a major.

Blum, Lenore, and Frieze, Carol. 2005. The Evolving Culture of Computing: Similarity Is the Difference. Journal of Women's Studies 26: 110-126.
This paper revisits the work done by the Margolis-Fisher study three years later. The three years targets the next group of females students in Carnegie Mellon's School of Computer Science. The authors applaud the work done in the Margolis-Fisher study, but disagree with some of the findings. They believe that modifying curriculum to accommodate female students reinforces stereotypes. They suggest that in a gender balanced teaching environment, gender differences dissolve.

Campbell, Patricia. "What Can I Do? Making Engineering Classrooms More Effective for Women (and Men) Students." Engineering Equality Extension Service. 2007.
This article covers a list of eight different classroom techniques to make learning more effective. First, relate teaching to real-world applications. Second, allow students time to reflect on questions before asking for responses. Third, use praise wisely. Fourth, encourage collaboration. Fifth, create a warm teaching environment. Sixth, seek outside research opportunities. Seventh, work out opportunities for students to transfer into engineering fields. Eighth, improve teaching skills.

Equitable Classroom Practices Institute (ECPI). "Best Practices for Achieving Gender Equity in the Classroom." http://www-bioc.rice.edu/precollege/ei/best_practices.html, April 6, 2005.

This is a summary of ideas developed throughout the course of the Equitable Classroom Practices Institute. The material is split between classroom practices and equity resources. Classroom practices is further broken down into student/teacher interaction, lesson planning, classroom management, and curriculum content.

"Gender Equity in Science Education." West Virginia University. http://www.as.wvu.edu/~equity/gender.html, April 25, 2005.
This article is used by West Virginia University to address the gender gap in math and science. It gives some background to the problem and then provides checklists of strategies for improving different areas. These areas are avoiding bias, classroom strategies, discussion and interaction, extracurricular activities, experiential strategies, institutional, use of equity materials, parents, personal, and stereotypes. The article is well-organized and easy to pick out topic-specific ideas.

Gondek, Rebecca. 2000. "Promoting Gender Equity in the Science Classroom. A Practical Guide to Accessing and Implementing Gender-Fair Strategies," http://www2.edc.org/WomensEquity/pdffiles/sciguide.pdf.
This paper is aimed at educating middle school teachers to gender equity in science and math. What makes this paper good is the way it is written in outline form with topics divided into sections. The author points out that this approach was used to allow instructors to choose sections to work on. Different sections can be applies as the instructor's classroom evolves.

Margolis, Jane, and Fisher, Alan. 2002. Unlocking the Clubhouse: Women in Computing. Cambridge, MA: MIT Press.
This book examines the lack of female enrollment in the School of Computer Science at Carnegie Mellon University (CMU). One of the key components of this book is the famous Margolis-Fisher study conducted from 1995-1999. This study tracked the progress of female students through the computer science program at CMU. The goal of their study was to increase female enrollment in computer science. One of their discoveries was that females did not get exposed to computers in high school. In an attempt to solve this problem, they conducted training sessions with high school teachers from around North America. The result was an increase of enrollment from 7% to 42%.

New England Consortium for Undergraduate Science Education. 2005. Achieving Gender Equity in Science Classrooms. Brown University, http://www.brown.edu/Student_Services/WiSE/gender.html.
This article is used by faculty at Brown University to offer techniques for improving gender equity in the classroom. The idea for this article stemmed from a group of undergraduate student concerned with the underrepresentation of females in science. The article presents a series of problems that affect gender equity in science classrooms. For each problem, multiple suggestions to overcome it are offered.

Sinnes, Astrid. 2006. Three Approaches to Gender Equity in Science Ed.. Nordina 3: 72-83.
This article takes a look at increasing gender equity from three different approaches. The first approach is based on the belief that there is no difference between how males and females approach science. The second approach considers males and females to approach science differently. The third approach argues that males and females cannot all be grouped into a specific category.

Gender and your classroom. 2001. In Teaching for inclusion. Center for Teaching and Learning at the University of North Carolina at Chapel Hill, http://ctl.unc.edu/tfi3.html.
This chapter's goal is to describe the characteristics female students typically exhibit. The chapter begins with a discussion of differing communication to include classroom participation and group

dynamics. It then explains learning styles and provides ideas for modifying curriculum. It ends with an explanation of how factors outside of the classroom can affect female performance.

Varma, R., and LaFever, M. 2007. Importance of gender homophily in the computer science classroom, IEEE Technology and Society Magazine 26, no. 2: 43-47.
This paper uses data collected from students within computer science (CS) programs at four different universities to draw conclusions about satisfaction with the CS program. Specifically, the authors consider the impact of teacher immediacy, peer immediacy, and gender homophily on satisfaction. The authors are able to conclude that there is a tie between gender, climate, and satisfaction. They also conclude that peers have an impact on satisfaction. They were not able to establish a tie between teacher immediacy and satisfaction.

Additional Resources

Cuny, Janice, and Aspray, William. 2000. Recruitment and Retention of Women Graduate Students in Computer Science and Engineering. ACM SIGCSE Bulletin 34, no. 2: 168-174.

Seymour, Elaine. 1992. Undergraduate Problems with Teaching and Advising in SME Majors: Explaining Gender Differences in Attrition Rates. Journal of College Science Teaching. February: 284-292.

Literature Review

Student Motivation and Learning

MAJ Chi Nguyen, Dept. of Chemistry

Abstract: Everything students do is underlined by some sort of motivation. This includes students and their motivation to learn. Motivation is essential to learning since it is the driving force for students' to complete tasks that build knowledge. There are many factors that potentially influence motivation, which makes research on this topic as it relates to learning diverse and abundant. However, motivational considerations can be summed up as being either task or ego-oriented. The purpose of this paper is to review research conducted on student motivation as it applies to learning, and in the process, identify teaching techniques that support motivating students to learn.

Teaching Techniques that Motivate

Motivation is the determining factor in learning, since students who do not want to learn will not learn regardless of the caliber of the instructor, and students who do want to learn will. However, students' motivations may change, such that even those who do not want to learn will change their minds upon exposure to stimulating environments that capture their attention. To keep students engaged, students need to maintain a task-oriented outlook on learning, which is associated with deep-level learning and learning for the sole gratification of acquiring knowledge. In comparison, those who are surface learners, gravitate towards ego-oriented learning, and rely on how others perceive them as a source of motivation. To facilitate task-oriented learning, Ward and Bodner (1993) recommend that teachers evaluate student performance based on an absolute scale rather than on a scale that compares student performance against each other, emphasize student participation and self-improvement in learning, and incorporate test questions that require explanations and justifications rather than memorized material.

More specific techniques to engage students in learning involve taking what they know from current pop culture and using the concept in the classroom. For instance, Jeopardy, as an active learning alternate to lecture for knowledge based material. For engineering, science and math courses that require problem solving, the reality television show Survivor may be more useful. In Survivor, students are divided into tribes to solve problems to earn immunity. Although Newall (2005) uses different terms to describe the different types of motivation, the concept is the same. Students who are intrinsically motivated (task-oriented) gladly participate in the activity for the challenge of solving the next problem, students who are socially motivated worked on the problems to not let their team, students who were achievement-oriented wanted to win, and students who are instrumentally motivated wanted the bonus points from winning the game to improve their grade in the course. Even students who are voted off the tribes continue to participate by coming up with problems for the next round.

Another technique is through the use of scenarios based on literary work that are interdisciplinary in nature. Waddell and Rybolt (2004) presented scientific problems in a mystery story format based on characters of Sherlock Holmes and Dr. Watson. After every story there is a break to allow students and opportunity to solve the problem before providing the solution.

Woodburn (1977) shares a technique that has had lasting value. His technique emphasizes the contributions of the discipline as it relates to current day activities. Students are motivated by knowing that what they are learning has a greater purpose. They want to know that what they learn in the classroom has relevance and significance to their daily lives. Along a similar concept is what Holme (1994) proposes by starting off a course with students engaged in learning about current research topics in a particular discipline as it relates to the course. Holme's concept dedicates a number of lessons to current research before moving into the actual required lesson material. The

advantage of this technique is that it grabs students' attention and allows them to explore their interests in directions that excite them. This technique does however require preparation by the instructor to research the most newsworthy findings and to prepare supplemental information in support of the current research.

Psychological Aspects of Motivation and Learning

In a study conducted by Moore (2007), motivation is deemed self-perpetuating. Students who are motivated conduct themselves in ways that maximize learning and success in academia. Motivated students attend classes on a regular basis without a need for external rewards, they seek additional help when needed, and they turn in quality work on time. On the other hand, unmotivated students minimize the effort they exert, which result in continued poor performance.

So the issue then is how to encourage students to think positively about learning so that they are motivated to learn. One notion has to do with how students perceive intelligence. According to Dweck (2008), students who believe intelligence is fixed tend to shy away from tasks that challenge them. Their belief is that if they are challenged, they are not smart enough to complete the task, so why bother; whereas students who believe in a growth mindset thrive on opportunities to learn. Growth mindset students understand the concept of hard work and how through hard work your abilities grow and further develop. A technique is to explain and show students that the brain is a muscle that can get stronger with use.

Another aspect of motivation is the concept of motivation as it relates to psychological needs. As leaders in modern motivation theory, Ryan and Deci (2000) formulated the self-determination theory that relates motivation to social development and well-being. They believe that humans are active and engaged based on their social condition in terms of competence, autonomy, and well-being. The same concept applies to students in their development and motivation for learning. Based on this concept, students are motivated to learn if they perceive having adequate support from their social environment, a positive environment to master skills and tasks, and an environment where there needs are met.

Social Factors of Motivation and Learning

In looking at motivation, social factors are also relevant. In a special issue of the Journal of Experimental Education, Anderman and Kaplan (2008) look at various types of social motivational factors, from classroom settings, social motives, and the role of culture, to interpersonal and relational factors in student interaction. Classroom social environment and student-teacher interaction play a significant role in student motivation. Ryan and Patrick (2001) report that when students feel a sense of relatedness or belonging they are motivated to learn and perform well in school. Students feel this sense of belonging if they believe teachers are supportive of social aspects in the classroom, such as promoting interaction and respect among students. Teachers report that students are motivated to perform well if they believe their teachers care for their social, as well as academic needs.

On a more personal level, student emotions relate directly to social factors in the form of interpersonal relationships with peers, parents, and teachers. Ainley (2006) shows that emotions play an important role in motivation and cognition as these three factors relate to learning. Interest in learning raises alertness and attention, which facilitates a desire and motivation to learn.

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Ryan, A. M., & Patrick, H. (2001) The classroom social environment and changes in adolescents' motivation and engagement during middle school. American Educational Research Journal, 38(2), 437-460.
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Annotated Readings:

Bigge, M. L. (1982) (4th ed.) Learning theories for teachers. New York, NY: Harper & Row. This book was written with the intent of serving as a resource on learning theory and educational psychology. The book is comprehensive in addressing modern theories of learning in an understandable manner without oversimplifying the concepts, which would detract from the full meaning of the theories. The author also compares and contrasts the differences and similarities between the different theories, which assist readers in thinking critically about the theories and formulating their own views. This pedagogical foundation will serve educators well as they formulate plans of action in curriculum development and application of the curriculum in the classroom.

Bransford, J. D., Brown, A. L., Cocking, R. R., Donovan, M. S., & Pellegrino, J. W. (eds.) (2000) How people learn: Brain, mind, experience, and school. Washington, D.C.: National Academy Press. This book provides insight on education and related psychological aspects of learning. The intent is to explore the connection between research in education and learning, and its application in the classroom. This requires bringing together current research on the mind, the brain, and learning processes, to address curriculum development, teaching techniques and assessment methods, which is the concept behind this publication.

Claxton, C., & Murrell, P. H. (1987) Learning styles: Implications for improving educational practices. Washington, D.C.: Association for the Study of Higher Education-Clearing House on Higher Education. This publication serves to inform readers of the different learning styles so that those involved in education have a better understanding of the kind of students they are working with. With the trend in improving the education system, educators and administrators need to be well informed of how students learn to make the necessary changes and improvements. In looking at learning styles, the authors incorporate personality, information-processing, social-interaction and instruction-preference models.

Deci, E. L., & Ryan, R. M. (2000). The "what" and "why" of goal pursuits: Human needs and the self-determination of behavior. Psychological Inquiry, 11, 227-268. Self-determination theory was developed by the authors over 30 years ago. The theory addresses human motivation as it pertains to

psychological needs. This paper addresses psychological needs as it relates to factors such as development, integrity, and well-being. The authors hypothesize that the pursuit of goals is directly affected by the need for well-being, and that different goals have different affect on a person's behavior and sense of well-being. The authors develop this discussion through the relationship between needs being met and its direct correlation to growth and motivation.

Fries, S., & Dietz, F. (2007) Learning in the face of temptation: The case of motivational interference. The Journal of Experimental Education, 76(1), 93-112. This purpose of this research paper was to report the findings on the performance of students as it pertains to consequences of temptation in ongoing learning, and when does an alternate activity to learning because a temptation that becomes detrimental to learning. The hypothesis is that temptation lowers motivation for learning, which results in negative learning experiences, less time spent on learning, and poor learning quality. The hypothesis was proven correct. The implication is that researchers who study learning and motivation need to consider distracters and alternate activities that may compete with learning.

Gagne, R. M., & Driscoll, M. P. (1988) (2nd ed.) Essentials of learning for instruction. Englewood Cliffs, NJ: Prentice-Hall. This book on learning is written for teachers as a professional development tool to assist them in designing and conducting classroom instruction. In discussing learning, the authors rely on the information-processing model, which is based on the concept of internal learning processes requiring the activation, support, and sustainment from external factors. The authors believe that external factors play a significant role on internal information-processing, hence, learning.

Grippin, P. C., & Peters, S. C. (1984) Learning theory and learning outcomes. Lanham, MD: University Press of America. This book was written for students of educational psychology and education with the intent of showing students the relevance of theory in their area of study as it relates to education. The book is laid out in such a way that it presents the reader with learning outcomes and then works toward explaining and discussing the theory that leads to the particular outcome. The learning outcomes used are based on Gagne's taxonomy.

Hardre, P. L., Crowson, H. M., DeBacker, T. K., & White, D. (2007) Predicting the academic motivation of rural high school students. The Journal of Experimental Education, 75(4), 247-269. In conducting this research, the authors were interested in determining whether motivation in students can be predicted. The authors hypothesized that perceived importance can predict learning goals and performance-approach goals. This means that a student is motivated to learn if there is a perceived importance in mastering a skill, information or performance standard. The hypothesis was proven by the data collected.

Kytle, J. (2004) To want to learn: Insights and provocations for engaged learning. New York, NY: Palgrave MacMillan. The author argues that the current conventional curriculum is based on a flawed model of how students think. In the book, the author uses the latest research on neurobiology, psychology, and cognition to address the issue of motivation and learning. He does this by addressing educators, the reality of the situation, the concept of being engaged in life, the psychological and neurobiological role of learning, and the motivation factors.

Nelson, R. M., & DeBacker, T. K. (2008) Achievement motivation in adolescents: The role of peer climate and best friends. The Journal of Experimental Education, 76(2), 170-189. Applying Maehr's theory of personal investment, the authors looked at students' performance based on how the students perceived the peer environment in their classroom and how their friends' behavior and achievement

values affected their goals and achievements. The findings showed that students who felt valued and respected by their classmates were motivated to perform well. Having quality friendships and friends who valued achievement also supported the students' motivation to achieve and perform well academically.

Patrick, H., Mantzicopoulos, P., Samarapungavan, A., & French, B. (2008) Patterns of young children's motivation for science and teacher-child relationships. The Journal of Experimental Education, 76(2), 121-144. Given the limited research on the motivation of young children in learning and motivation, the authors set out to study children of kindergarten age to determine their motivation for learning. In looking at motivation, the researchers looked at demographics, competence, relationships with the teacher, and the curriculum. Teacher-child relationship played a significant role in students' motivation. Positive teacher-child relationship tended to result in high motivation.

Pintrich, P. R., & Schunk, D. H. (1996) Motivation in education: Theory, research, and applications. Englewood Cliffs, NJ: Prentice-Hall. The intent of this book is to provide students with a resource that encompasses theoretical and empirical information on motivation in education. More specifically, the authors focus on the major motivation theories, principles, and research results. The authors also use the information in the text to describe and explain how research in motivation can be applied in the classroom.

Additional Resources:

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Literature Review

Humor in Teaching
By MAJ Ramit Ring, D/English

As recently as the 1990s, structured use of humor in…classrooms was elusive at best, and flat out dissuaded by administrators at worst (Lovorn, 2008). And, while the use of humor to facilitate learning is not a new concept, it is seeing an emergence today as more teachers and educators look for methods to better communicate and help students learn. Humor can be represented as jokes, puns, riddles, sarcasm, physical antics, nonverbal behaviors, cartoons, and one-liners (Wanzer et al., 2006). Additionally, when employed as a conversation starter, tension-breaker or therapeutic intervention, laughter is a highly effective way to stimulate communication (Lovorn, 2008). Other factors that influence the effectiveness of humor in the classroom include humor appropriate for the audience, targeted to the topic, and placed in the context of the learning experience (Garner, 2005). However, even those who champion using humor in the classroom admit that there are dangers to the student-educator roles if the humor is allowed to get out of hand or is misconstrued by students. There is a fine line between the competent use of humor in the classroom and inappropriate humor in the classroom.

For those who desire a more relaxed atmosphere in their classrooms, the use of humor as a pedagogical tool has been shown to reduce classroom anxiety, create a more positive atmosphere, as well as facilitate the learning process (Berk, 1996, 1998; Garner, 2003; Pollio & Humphreys, 1996). Research also supports the idea that humor facilitates retention of novel information, increases learning speed, improves problem solving, relieves stress, reduces text anxiety, and increases perceptions of teacher credibility (Torok, et. al., 2004). Additionally, Joseph Lowman (1994) found that effective college teachers were often described by their students as 'enthusiastic' and those who use humor in their instruction were rated more highly. And Tom Tatum, a high school English teacher, claims that using [humor] enhances lesson plans, compels students to pay closer attention, and gives many students a chance to display creative thinking skills (Tatum, 1999).

In 2006, Melissa Wanzer placed appropriate teacher humor into four different categories labeled: "related humor," "humor unrelated to course material," self-disparaging humor," and "unintentional humor" (Wanzer, et al., 2006, 184). Another way to view these four categories is by labeling them as "high-risk humor," "low-risk humor," "offensive humor," and "self-effacing humor" (Berk, 2003).

Ronald Berk, who advocates using humor as a systematic teaching or assessment tools, suggests using what he describes as a humor trifecta, in which all three elements are required for maximum winnings. The trifecta consists of 1) expected – serious set-up with commonly understood situation or content; 2) expected – build-up of tension; and 3) unexpected twist – the punchline (Berk, 2002). There has to be an element of surprise, which is often difficult to incorporate in these days of political correctness, when speakers are so fearful of making a mistake that they run every witticism through internal censors, causing spontaneity to disappear (Nilson, 1994). Regardless of the material taught or the method of presentation, Berk stresses confidence in one's material and the ability to deliver.

Some examples of competent humor include satire, puns, hyperbole, absurdity, and irony; taken too far, they can be a weapon, but used well, can connect students' world to the classroom material, and give them a vehicle for understanding their paradoxical lives (Davis, 1999). For instructors so inclined, pedagogical use of humor in the classroom, as with any type of educational approach, can enhance learning and retention, but it must have a high degree of resonance for the listener. Students

must be able to recognize the meaning that is being conveyed and its relevance to the issue at hand (Garner, 2005). Alleen Nilson, Professor of English at Arizona State University, and instrumental in founding the International Society for Humor Studies, suggests, when using humorous incidents or jokes, that the instructor keep four characteristics in mind: 1) the subject, 2) the tone, 3) the intent, and 4) the situation, including the teller and the audience (Nilson, 1994).

This is not to say that all educators who employ humor in the classroom will necessarily be viewed as good or even adequate instructors. In fact, several detractors of this pedagogy argue that there is a fine line between joking and disrupting a proper classroom tone essential if any learning is to take place (Sudol, 1981). As David Sudol, a high school teacher, says, if used unnecessarily or allowed to get out of hand, "the classroom becomes a playroom, a circus, or – at worst – a zoo" (26). Also, students are more likely to view teacher humor as inappropriate when it is perceived as offensive and when it demeans students, either as a group or individually (Frymier, et. al., 2008).

Inappropriate humor behavior is placed into four different categories: "disparaging humor: targeting students," "disparaging humor: targeting others," "offensive humor," and "self-disparaging humor" (Wanzer, et al., 2006, 185). Wanzer also specifies that the group labeled "others" clearly refers to nonstudent populations, such as with general stereotypes (Wanzer, et. al., 2006). Tatum cautions against allowing humorous word play and creativity to get out of hand, which can sometimes lead to socially unacceptable, racially or ethnically charged overtones (Tatum, 1999). Another caution is that allowing students to become too sarcastic, or too absurd, detracts from the course-related material and meaning of the class (Sudol, 1981).

And, rules about appropriate humor are increasingly more difficult to enforce considering that virtually all forms of contemporary entertainment incorporate vitriolic and sadistic attempts at humor (Lovorn, 2008). Michael Lovorn, an Assistant Professor at California State University, argues that there are inopportune situations when humor is inappropriate. Those situations include humor that is hurtful or demeaning, cynical, sarcastic or sardonic in nature, type of humor that reinforces stereotypes, biases or secual or cultural misconceptions, and humor directed at someone who does not wish to participate (Lovorn, 2008).

A measure for determining when humor needs to stay out of the learning environment is when it is deemed offensive, based on an individual, subjective interpretation. To minimize the chance of offending a student or students, an instructor needs to either share or understand the values and principles of his/her students (Berk, 2002). Wanzer, et. al., conducted a study which listed types of disparaging humor students found inappropriate. Groups of students disparaged based on their intelligence, gender or appearance. Individual students singled out by an instructed and disparaged on the basis of their intelligence, personal opinions, appearance, gender, or religion (Wanzer, et. al., 2006).

When students deem a comment or joke as insensitive or offensive, they react in a variety of ways which hinder the learning process and relaxed atmosphere. Reactions can include tightening up, withdrawal, resentment, anger, tension, anxiety, and turning off or tuning out (Berk, 2002). Because the use of inappropriate or disparaging humor often attacks students' self concept, we might describe it as a form of verbal aggression (Wanzer, et. al., 2006). Yet, incidents where humor offends someone need to be discussed because that's where learning will occur and where tensions will be released (Nilson, 1994).

A final note on the use of humor in the classroom: Humor can be used as a systematic teaching or assessment tool in your classroom and course Web site. It can shock students to attention and bring

deadly, boring course content to life. Since some students have the attention span of goat cheese, we need to find creative online and offline techniques to hook them, engage their emotions, and focus their minds and eyeballs on learning (Berk, 2002).

Recommendations

The following are recommendations for competent use of humor in the classroom (Wanzer, et. al., 2006):

- Humor related to material (tactic not specific).
- Humor related to course material using different types of media or external props to enhance learning.
- Jokes related to course material.
- Humorous examples to illustrate course concepts.
- Humorous stories to illustrate course concepts or reinforce learning.
- Critical/cynical about course material in an effort to be humorous.
- Humor attempts related to course material and targeting stereotypical college behaviors.
- Humor attempts related to the material and, at the same time directed towards students.
- Humor attempts related to class material that involve some type of animated performance.
- Humor attempts related to course material that involve student role play or activities.
- Humor attempts related to course material that involve creative language or word play.

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Bacay, S. C. (2006). "Humour in the Classroom – A Dose of Laughter Won't Hurt." Centre for Development of Teaching and Learning Link. 28 April 2008 <http://www.cdtl.nus.edu/sg/link/mar2006/tm3.htm>.

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Berk, R. A. (2003). Professors are from Mars, Students are from Snickers: How to Write and Deliver Humor in the Classroom and in Professional Presentations. Sterling, Virginia: Stylus Publishing, LLC, 2003.

Davis, J. (1999). "Speaking My Mind: On Humor." The English Journal, Vol. 88, No. 4, 14-5.

Frymier, A. B., Wanzer, M. B., & Wojtaszczyk, A.M. (2008). "Assessing Students' Perceptions of Inappropriate and Appropriate Teacher Humor." Communication Education, Vol. 57, No. 2, 266-288.

Garner, R. (2005). "Humor, Analogy, and Metaphor: H.A.M. it up in Teaching." Radical Pedagogy, Vol. 6, No. 2.

Johnston, J. (2001) "James Johnston uses imagination and humor." University of Pittsburgh Teaching Times, Vol. VI, No. 2, 2001.

Lovorn, M. G. (2008). "Humor in the Home and in the Classroom: The Benefits of Laughing While We Learn." Journal of Education and Human Development, Vol. 2, No. 1, 1-12.

McMahon, M. (1999). "Are We Having Fun Yet? Humor in the English Class." The English Journal, Vol. 88, No. 4, 70-72.

Nilson, A. P. (1994). "In Defense of Humor." College English, Vol. 56, No. 8, 928-933.

Sudol, D. (1981). "Dangers of Classroom Humor." The English Journal, Vol. 70, No. 6, 26-28.

Tatum, T. (1999). "Cruel and Unusual PUNishment (LOW Humor is Better Than NO Humor)." The English Journal, Vol. 88, No. 4, 62-64.

Torok, S. E., McMorris, R. F., & Lin, W. C. (2004). "Is humor an appreciated teaching tool? Perceptions of professors' teaching styles and use of humor." College Teaching, Vol. 52, No.1, 14-20.

Wanzer, M. B., Frymier, A. B., Wojtaszczyk, A. M., & Smith, T. (2006). "Appropriate and Inappropriate Uses of Humor by Teachers." Communication Education, Vol. 55, No. 2, 178-196.

Annotated Readings:

Berk, R. A. (1996). "Student ratings of ten strategies for using humor in college teaching." Journal on Excellence in College Teaching, Vol. 7, No. 3, 71-92.

I think this source would have been extremely useful to my research efforts, as many of my references – Garner, Berk 2003, Lovorn, Wanzer, et. al., etc. – cited this article, but I could not find it.

Bradford, A. L. (1964). "The Place of Humor in Teaching." Peabody Journal of Education, Vol. 42, No. 2, 67-70.

This article argues that humor has a high place in teaching because teaching must have realism. "Reality is often incongruous, situationally absurd. It is never logical for long" (68). There are broad, sweeping generalizations, but Bradford argues that without humor, the mind suffers, and a humorless individual, lacking in personality, is crippled. Therefore, this education filled with humor allows for a more well-rounded individual, capable of handling life and civilization with hope and a sense of humor for the ever-changing realities.

Frymier, A. B., & Houser, M. L. (2000). "The teacher-student relationship as an interpersonal relationship." Communication Education, Vol. 49, No. 3, 207-219.

While this article does not really discuss humor in the relationship between teachers and students, it does examine communication skills in the teacher-student relationship. Findings include: students reported referential skill, ego support, and conflict management as being most important to effective teaching; and that referential skill, ego support, and immediacy have a strong relationship with student learning and motivation. The implied finding is that a more relaxed relationship leads to better conflict management and more effective teaching, and is then followed by the assumption that one of the methods of achieving this relationship is through appropriate humor.

Frymier, A. B. & Weser, B. (2001). "The role of student predispositions on student expectations for instructor communication behavior." Communication Education, Vol. 50, No. 4, 314-326.

This article looks at three students and the relationship of their expectations for instructor communication behavior to their class dispositions. Examines students' communication apprehension, grade and learning orientation, and humor orientation in relation to students' expectations for teachers' use of verbal and nonverbal immediacy behaviors, clarity behaviors, and humor behaviors. Finds that student learning/grade orientation was related to expectations for instructor communication behavior.

Garner, R. (2006). "Humor in pedagogy: How ha-ha can lead to aha!" College Teaching, Vol. 54, No. 1, 177-180.

This article references several studies examining the pedagogical implications and cautions concerning the use of humor in teaching. It lists many positive physiological and psychological effects. One of the arguments Garner promotes is that educators who use humor in their instruction

are more positively rated by their peers and their students, while pointing out further studies which have suggested that humor may enhance learning. While the studies Garner cites are interesting, they are purely anecdotal, and needs further credible studies in order to be used as concrete evidence for the use of humor in the classroom. Finally, this article discusses the appropriate use of humor in a classroom setting and cautions against tendentious humor.

Glasgow, N. A. & Hicks, C. D. (2002). What Successful Teachers Do: 91 Research-based Classroom Strategies for New and Veteran Teachers. Thousand Oaks, CA: Corwin Press, 2002.

While the majority of this book is about techniques for teaching, interacting with students, parents, and colleagues, "Chapter 1: Interacting and Collaborating with Students" does present various ways to alleviate student test anxiety and suggests using humor to improve student interactions. Glasgow and Hicks combine theory, research, and employable suggests. The chapters in the book cover curriculum and pedagogy, discipline and classroom management, interacting and collaborating with students, managing classroom organization and discipline, lesson plans and instructional delivery, using student assessment and feedback to improve instructional effectiveness, working with special needs students, embracing and celebrating diversity, integrating technology into the classroom, enhancing teacher self-assessment and reflection, developing a professional identity, time management and organization.

Godfrey, W. P. (1953). "The Teacher as Humorist." The Journal of Higher Education, Vol. 24, No. 5, 227-229.

Godfrey argues that humor is a valuable adjunct to the many skills involved in teaching, which he likens to an art. He discusses the tension created by a mentality of "transmitting of knowledge from an older to a younger robot" (227), and the presumed superiority instructors tend to exude in the classroom. While this article is very much out of date, it adds to the history of the debate about the use of history in the classroom, and allows the reader to understand that there is a difference between comedy and humor/wit.

Gurtler, L. (2002). "Humor in Educational Contexts." Chicago: Paper presented at the 110th Annual Meeting of the American Psychological Association. ERIC Document Reproduction No. ED470407, 2002.

This article mentions the use of humor in the classroom, but only as a lead-up to its main focus – the enhancement of social climate through humor. Gurtler explores personal mental meodels associated with humor, and presents a framework of humors models. The elements of this framework are "action theory, humanistic psychology, and Vipassana mediation technique to give guidance in the development of the preconditions of humor." After Gurtler begins expounded on his psychological theory, I found the article to not have much relevance to the discussion of humor in the classroom.

Jennings, B. & Zillman, D. (1989). "Using Humor to Promote Learning in the Classroom." Journal of Children in Contemporary Society, Vol. 20, No. 1, 49-78.

This article was not used in the essay, but it does back up Wanzer, et. al., assertions that there are certain normative patters of teachers' humor which can be employed competently and to further promote discourse and learning in the classroom. Questions such as "Should teachers avoid certain types of humor?" and "Does teaching with humor enhance students' attention?" are discussed, and guidelines for using humor in the classroom are offered.

Kher, N., Molstad, S., & Donahue, R. (1999). "Using humor in the college classroom to enhance teaching effectiveness in 'dread courses.'" College Student Journal, Vol. 33, No. 3, 400-406.

This article identifies opportunities for humor in the classroom, discusses how humor affects learning outcomes, and presents guidelines for the appropriate use of humor, particularly in the 'dread courses.' The article identifies 'dread courses' as ones that "students sometimes avoid due to a lack of self-confidence, perceived difficulty of the material, or a previous negative experience in a content are such as mathematics" (1). Presents ideas on incorporating humor into the classroom, linking humor and course learning outcomes, and guidelines for incorporating humor into the classroom.

Lowman, J. (1994). "Professors as performers and motivators." College Teaching, Vol. 42, No. 4,137-141.

This article argues that intellectual excitement and interpersonal rapport are important qualities that influence teaching effectiveness. It proposes a model of effective college teaching based on these qualities that utilizes a 39-item checklist evaluation form. The form was tested with students at the University of North Carolina at Chapel Hill and appears to show promising validity.

Martin, R. A. (2007). The Psychology of Humor: An Integrative Approach. Burlington, MA: Elsevier Academic Press, 2007.

Martin presents research on humor in psychology, including the cognitive (What makes something funny?), developmental (when do we develop a sense of humor?), and social (how is humor used in social interactions?). The article presents a summary of information researchers might wish to know about research into the psychology of humor. The material is scholarly, but any undergraduate or graduate level student is able to read and understand the presentation of the material.

Pollio, H. & Humphreys, W. (1996). "What award-winning lecturers say about their teaching: It's all about connection." College Teaching, 44, 101-106.

I think this source would have been extremely useful to my research efforts, as many of my references – Garner, Berk 2003, Kher, et. al., Wanzer, et. al., etc. – cited this article, but I could not find it.

Wanzer, M. B. (2002). "Use of humor in the classroom: The good, the bad, and the not-so-funny things that teachers say and do." In J. L. Chesebro & McCroskey (Eds.), Communication for Teachers (pp. 116-125). Boston: Allyn & Bacon.

The book synthesizes research on teacher communication, focusing on applying the theories to practical classroom situations and student-teacher interactions. It is divided into three sections, with this article falling into the second section. Wanzer focuses on teaching behavior, such as nonverbal immediacy and use of humor, in order to better communicate with students from other cultures or in a distance learning setting.

Classroom Research Project

Learning Style Preferences for an On-Demand Learning Resource

MAJ Jakob C. Bruhl, C&ME

Abstract

An on-demand learning resource was evaluated based on students preferred learning styles. During the Spring semester of 2007, I created short video tutorials for various topics in the introductory engineering class, Fundamentals of Engineering Mechanics and Design. The original implementation was highly successful so the concept was expanded for the following term and feedback (both grades and perceptions) was gathered. Learning style preferences (using Felder's Learning Styles Inventory) of the students in the course were assessed and compared to trends in usage of the on-demand videos. The author hypothesized that it would be more likely to be used by visual, sequential learners. Surprisingly, no specific learning style preference exhibited a greater tendency to make use of the videos. This paper suggests that well-organized, short, instructional videos appeal across the entire spectrum of learning styles. In addition, students at all levels of academic performance utilized the video tutorials. This pedagogically sound on-demand resource potentially helps all students.

Introduction

This paper is part of a larger, continuing study examining the impact of the short tutorial videos. In papers presented at the 2008 American Society of Engineering Education, Bruhl et. al. demonstrated the impact on academic performance seen by students who make use of this resource. In this paper, I examine how likely students are to watch the video tutorials based on their learning style preferences.

The recent increases in computer technology, internet availability and connection speeds are changing the face of education. Until recently, distance education consisted of a student completing course requirements with a textbook, course notes, and perhaps some video tapes of lectures at a location somewhere other than the classroom. Students completed assignments and mailed them to the professor. With the advent of the internet, student access to instructors and course material improved in distance education. Course materials are now accessed through internet portals and conversations take place via e-mail and/or chat rooms. Video-teleconferencing technology further improved capabilities by enabling real-time interaction between student and teacher.

Outside of the classroom, the same technologies that improved distance education have caused a significant shift in the way we access information. We can now get news, watch television shows, and even watch complete movies all through the internet. Individuals have the freedom to get information and entertainment they want, when they want it, and where they want to be when they get it.

Harnessing the capability of these technological changes in traditional courses has been a bit slower than in distance education and much slower than in other aspects of our lives. Yet, today's generation of students wants to have more control over their education, much as they do over information in other aspects of their lives. Prensky refers to students today as "digital natives" – they have literally grown up with ubiquitous technological devices. These "natives" use the internet regularly to maintain social contact, obtain news, and for entertainment. They carry iPods® for music, handheld video devices for gaming and movie watching, and cellular phones often for more than simply making a phone call. Because of this, many students desire more use of technology in other aspects of their lives – such as education.

Most teachers, Prensky states, are "digital immigrants," having to gradually integrate the technology that their students take for granted. Students today are increasingly "bewildered", "disappointed", and even "disillusioned and dispirited" in the way that these digital immigrant teachers attempt (or, in many cases, do not attempt) to integrate technology into coursework. This finding is strongly corroborated by recent research by the Pew Internet and American Life Project. The question all teachers should be asking, however, is: Can we make use of technological advances to improve our courses? A secondary question is: How can we ensure that the technological advances appeal to our students and improve their learning?

Background

In Fundamentals of Engineering Mechanics and Design (CE300), we recently created a "pull" resource: short (5-10 minutes), instructor-made, instructional videos (each on a specific topic). We used a Tablet PC and Camtasia screen capture software to create these videos and call this resource "Video AI" since they provide another avenue of "additional instruction" for our students. The videos are not intended to replace any of the classroom instruction; the intent is to augment instruction. The videos are posted on the course Blackboard page for access by students at a time and place of their choosing. Unlike copies of problem solutions, these videos allow the student to see the solution unfold bit-by-bit similar to what they see in class. By making the problems in these videos different from those worked in class and providing some videos focused on concepts rather than direct application, the students have a resource at their fingertips to augment their traditional preparation for class and study for exams and which supplements what they get during class without replacing the need for classroom instruction. In addition to their textbook and course notes they can now supplement their studying with a few videos. Over the course of the last three semesters, the number of videos available for cadets enrolled in CE300 has grown from four to eleven with plans to continue creating videos on problem areas as they arise in the midst of the semester.

Choi and Johnson concluded in a recent study that "video-based instruction can effectively be used to motivate learners by attracting their attention" when the instruction is well-organized and prepared based on effective pedagogy. We created videos that would maintain their attention by keeping each video less than ten-minutes in length. This ensured the video remained focused on important details and was accessible by our students without being burdensome. By having different videos available on a variety of topics and organized by major topics, students are able to quickly find a video to address a concept with which they need assistance. Baggett suggests that videos are effective for learning because they contain both auditory and visual information. When used as a supplemental study resource, videos clearly have some potential benefits over the "old standards" of a textbook and handwritten notes – the student can hear and see the information rather than simply see it.

Determining the benefit of this new resource on our students learning is critically important. In order to decide if it is worth the time required to create new resources, the impact on academic performance (i.e. grades) as well as student attitudes towards it was assessed. We showed that not only do students appreciate having Video AI available, but those that used the videos when studying performed better than those who did not use the resource .

With the impact established – these videos definitely help students learn – this paper examines the likelihood of students to use a "pull" resource in an otherwise traditional course. We found that while students with lower incoming GPAs were more likely to use the resource, even those with high academic records made use of and benefited from it. The question addressed in this paper is: Are students more likely to make use of the instructional videos based on their learning style preferences?

Researchers have investigated the influence of learning styles on preferences of instructional material organization and delivery mode. The focus of the majority of this research is on-line courses (i.e. distance education). A 2002 study found students enrolled in a traditional course and those enrolled in an on-line version of the course performed equally and that no specific learning style exhibited a strong preference for either form of instruction. The researchers concluded that their results are due in large measure to the quality of instruction presented online and the way in which it was organized.

A 1992 study conducted in the United Kingdom examined the impact of the organization and presentation of online instruction. The researchers prepared three versions of a lesson with varying structure, organization, verbal emphasis and use of diagrams and other images. Results showed that students with an Analytic-Imager learning style (that is, they tend to think in parts rather than the whole and they prefer visual to verbal learning) performed poorest on the version in which the information was presented primarily verbally with simple line diagrams. Not surprisingly, Analytic-Verbalisers performed least well when the information was presented in small chunks of verbal content with a reliance on diagrams and pictures. However, when the lesson was presented with a quick overview, small summaries throughout, and a combination of diagrams and verbal presentation all students performed equally well regardless of learning style. This version of presentation was effective across learning styles by appealing to all learning styles.

The study reported in this paper used the learning styles described by Felder and Solomon and examines the influence of learning styles on preferences using an on-line resource in an otherwise traditionally presented course. Felder and Solomon identify four learning style dimensions: Sensing/Intuitive, Visual/Verbal, Active/Reflective, and Global/Sequential.

The Sensing/Intiutive dimension describes the student's preferred way to perceive information. Sensing people exhibit a preference to learn through observation and gathering of data while an Intuitive student uses more indirect perceptions such as speculation.

The Visual/Verbal dimension describes how the student prefers to receive information. As the terms imply, Visual learners learn most effectively through what they see – diagrams, images, demonstrations – while Verbal learners remember more of what they hear and say.

The Active/Reflective dimension describes how a student tends to process information. Reflective learners tend to work best by themselves and do best after they have had some time to think about what they have recently learned. Active learners tend to be more effective when they are able to experiment and do not perform as well in passive classroom environments.

The Sequential/Global dimension describes the student's preferred way to understand information. Global learners do best when they have been exposed to the "big picture" before learning details. Sequential learners, on the other hand, tend to prefer to learn details (or "pieces") first and then see how it all connects.

It is important to note that most people are not clearly at one end or the other of each dimensional spectrum but, may exhibit a preference (moderately or strongly) for one end of each dimension. Many people are "balanced"; that is, they do not exhibit a strong preference but can effectively perceive, receive, process, and understand information in a variety of ways.

Method

Procedure. For each student enrolled in CE300 during the Fall 2008 semester, I compiled their learning style preferences (gathered as part of a homework assignment) and Video AI use history (using tracking statistics in Blackboard). Learning style preferences were compared to Video AI use. The two populations compared were: "Used Video AI" – these students watched at least one Video AI during the semester – and "Did not use Video AI". Comparisons were also conducted based on the regularity of Video AI use. Using the learning styles data I determined the distribution of learning style preferences for each of the two populations. This enabled observations to be made and conclusions drawn.

Sample. This study was conducted in a course with an enrollment of 183 students during the Fall 2008 semester. I chose not to create control groups since it was hypothesized that the videos would only improve performance, not harm it, and we wanted all student to be afforded the opportunity to use the resource. In practice, the students created two groups: 113 students (62%) used the videos to supplement their study at least once during the semester, 70 students (38%) did not once make use of the resource during the semester.

Of the students who watched the videos, most watched five or six of the eleven videos available (see Figure 1), many of them watching the videos multiple times (see Figure 2). As seen in Figure 3, the most popular videos were those covering course content that was applied throughout the semester (forces, moments, and 2-dimensional equilibrium).

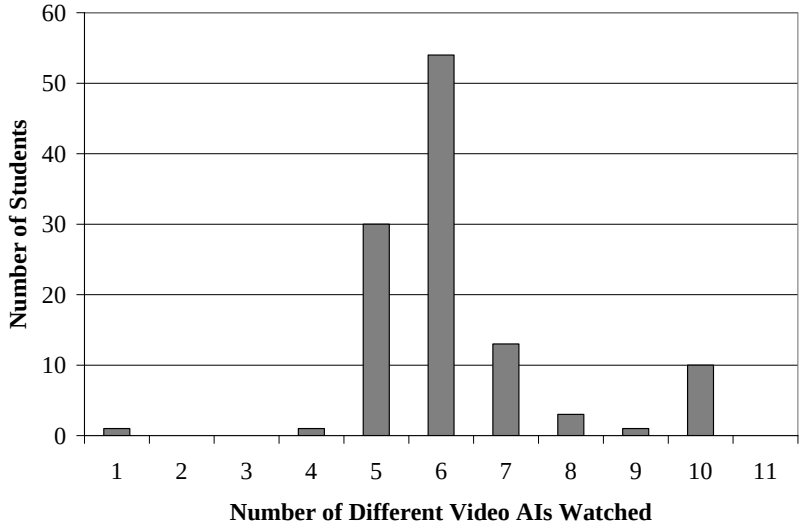

Figure 1 Distribution of Number of Different Video AIs Watched

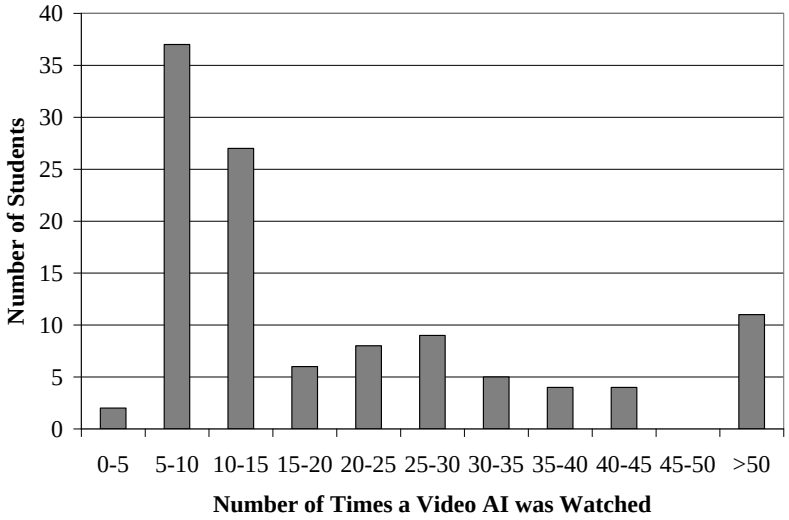

Figure 2 Distribution of Number of Total Number of Video AIs Watched

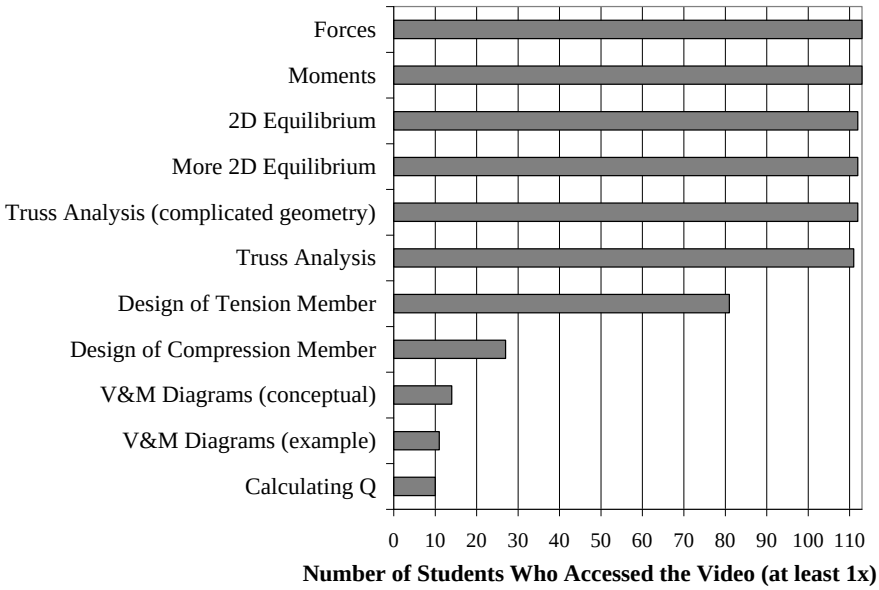

Figure 3 Number of Students Who Watched Each Specific Video AI
(NOTE: The horizontal scale is truncated at 113 – the total number of students who watched at least one video)

The students in the course spanned the range of learning style preferences (as shown in Table 1) but the majority of our students were: Sensing, Visual, Active, and Sequential learners. These preferences mirror what Felder discovered: "most engineering students are visual, sensing, active, and sequential learners." As seen in Figure 4 through Figure 7, many of the students in our sample exhibited balanced learning styles. Eight (4%) students were balanced in all four dimensions, 30 (17%) were balanced in three dimensions, and 65 (36%) were balanced in two. The dimensions in which our students were most likely to be balanced were Sequential/Global and Active/Reflective. Interestingly, 74 students (41%) were strong Visual learners, while only one student exhibited a strong Verbal preference.

Table 1 Learning Style Preferences of Sample

	Percentage of students exhibiting a preference in each category (n=179)
Sensing/Intuitive	72% / 28%
Visual/Verbal	89% / 11%
Active/Reflective	64% / 36%
Global/Sequential	34% / 66%

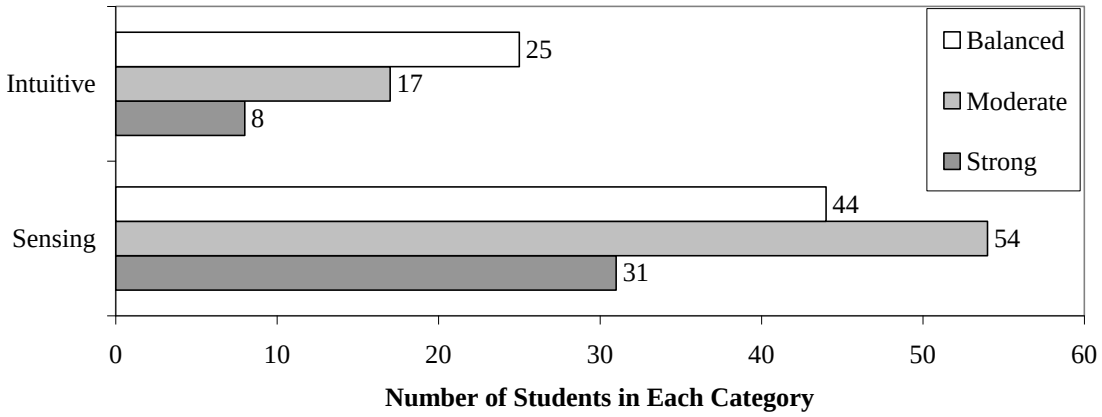

Figure 4 Distribution of Strength of Learning Style Preference (Sensing / Intuitive)

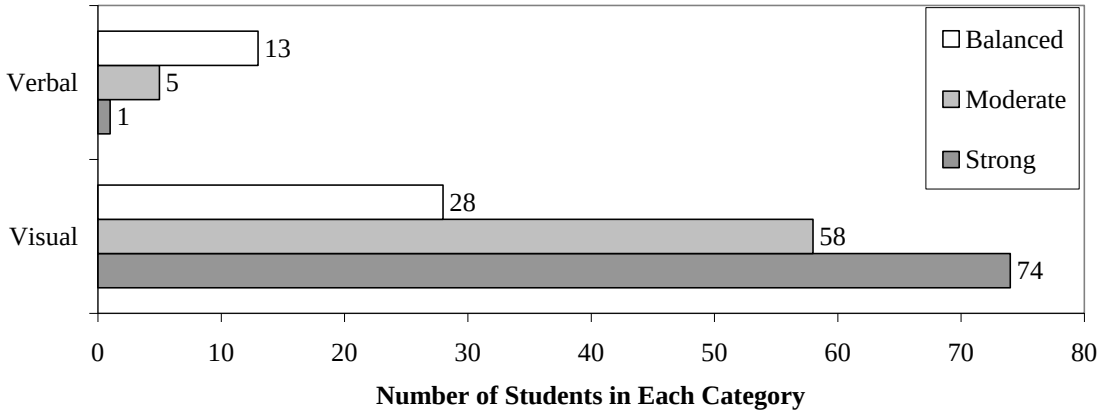

Figure 5 Distribution of Strength of Learning Style Preference (Verbal / Visual)

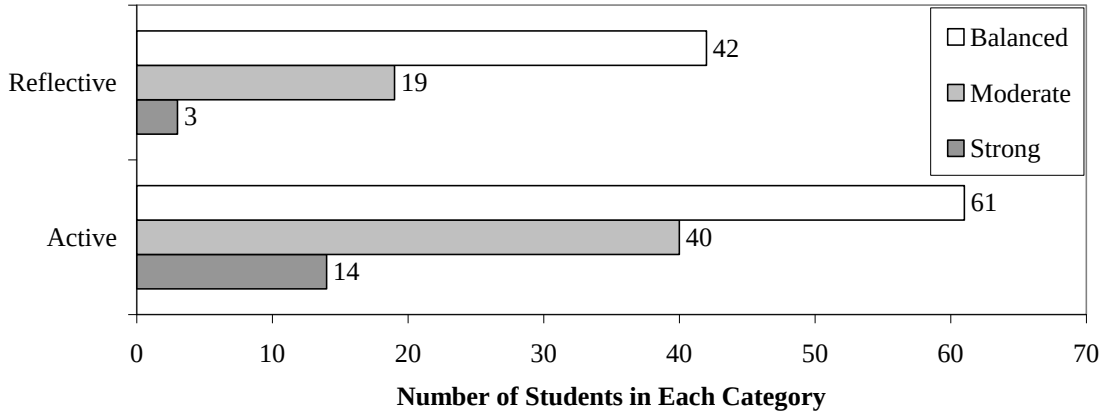

Figure 6 Distribution of Strength of Learning Style Preference (Reflective / Active)

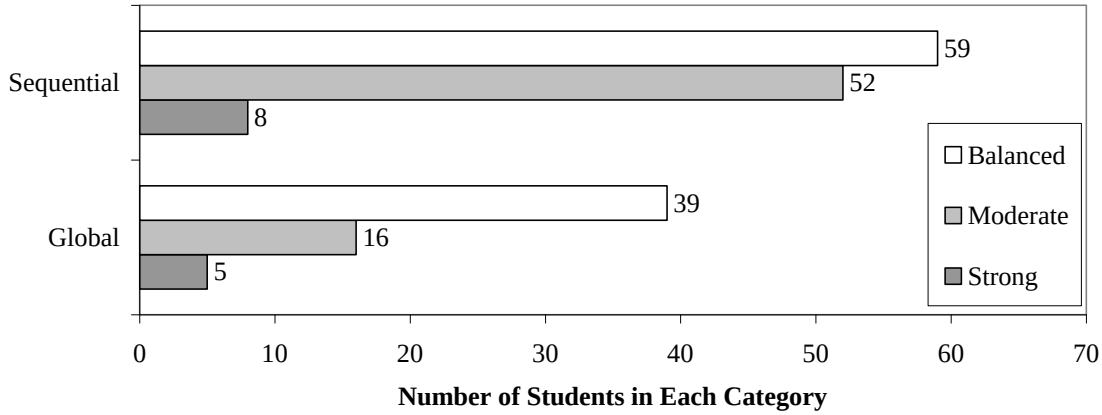

Figure 7 Distribution of Strength of Learning Style Preference (Global / Sequential)

Materials. All course materials were made available to all students enrolled. Felder and Solomon's Learning Style Inventory (LSI) was completed online by 179 of the 183 students as part of a homework assignment.

Findings

Students across the learning style spectrum made use of Video AI. Examining each learning style individually (Figure 8 through Figure 11) shows that there was reasonably close usage of the on-demand learning resource across the spectrum.

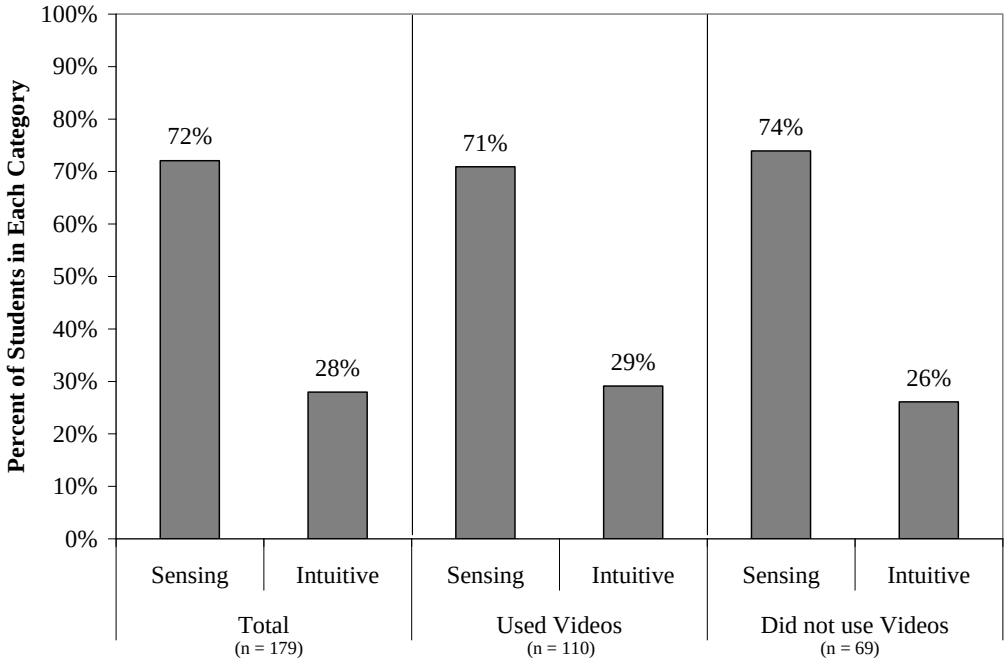

Figure 8 Distribution of Learning Style Preference for Video AI Usage (Sensing / Intuitive)

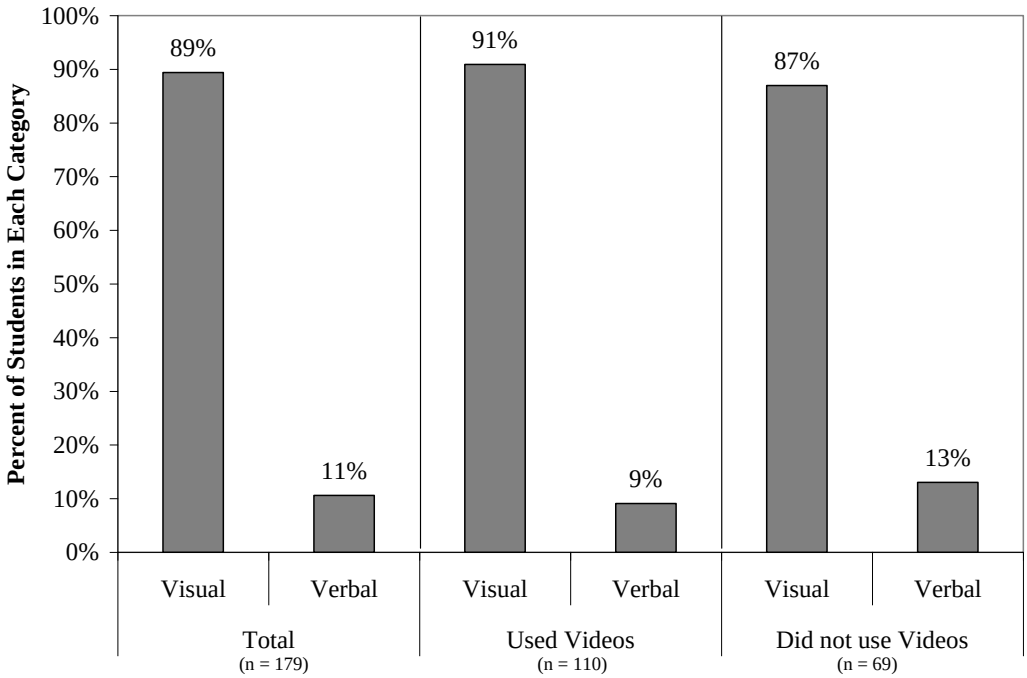

Figure 9 Distribution of Learning Style Preference for Video AI Usage (Visual / Verbal)

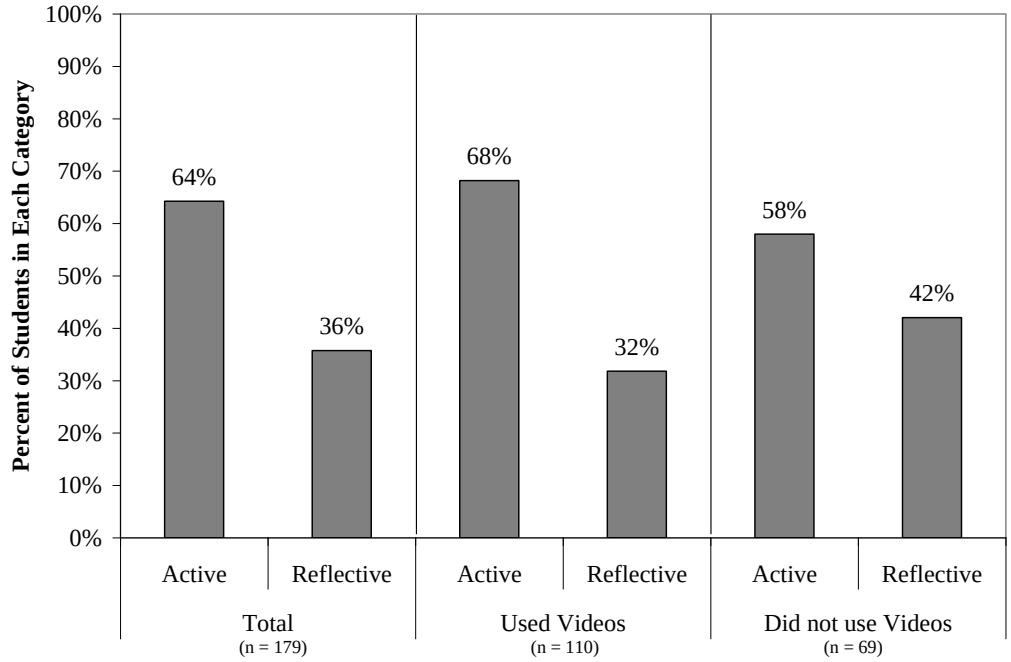

Figure 10 Distribution of Learning Style Preference for Video AI Usage (Active / Reflective)

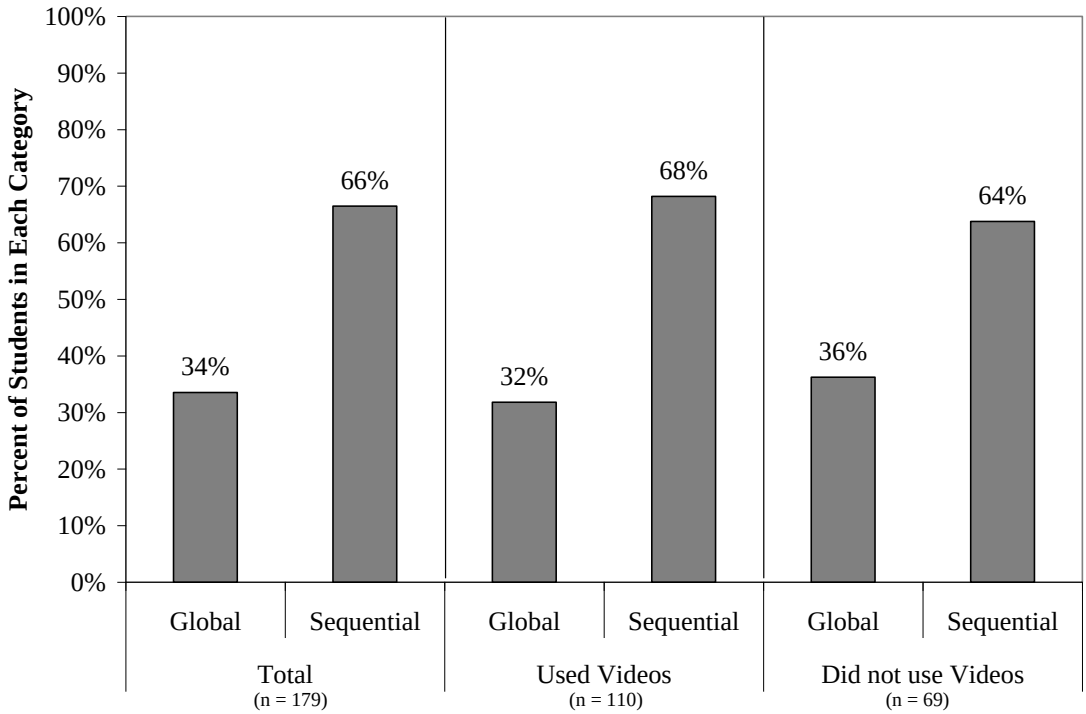

Figure 11 Distribution of Learning Style Preference for Video AI Usage (Global / Sequential)

Since students exhibit learning style preferences in varying degrees (balanced, moderate, and strong using the computer-based learning styles inventory), it is important to consider the impact of the

strength of their preference on the likelihood that they made use of the on-demand resource. This comparison is accomplished by examining the use of Video AI by those exhibiting a moderate or strong preference for each learning style (Figure 12 through Figure 15).

From Figure 12 we see that those exhibiting a strong preference for Intuitive learning were more likely to use the videos. Data in Figure 13 shows that visual and verbal learners were essentially equally likely to make use of the videos regardless of the degree of preference. As shown in Figure 14, those with moderate or strong preference for active or reflective are equally likely to make use of the videos, although when those with balanced preferences are included (as in Figure 10), active learners in aggregate appear to be more likely to use Video AI. Finally, students with a strong preference for sequential learning appear to be more likely to use Video AI as seen in the data in Figure 15.

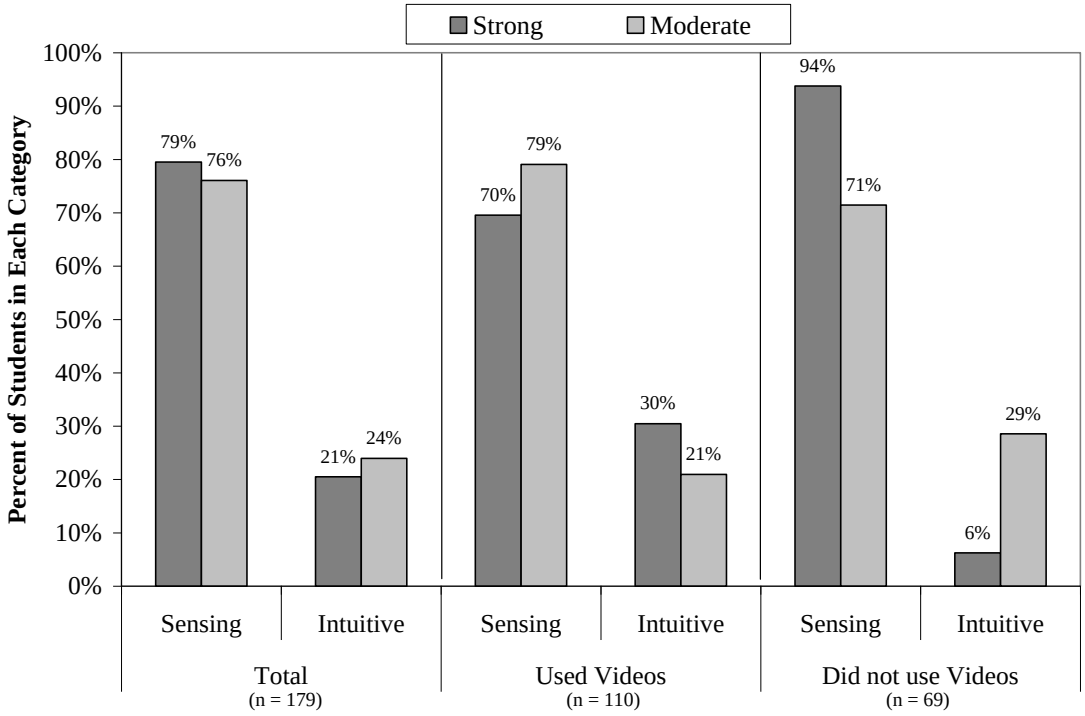

Figure 12 Impact of Degree of Sensing / Intuitive Preference on Likelihood of Using Video AI

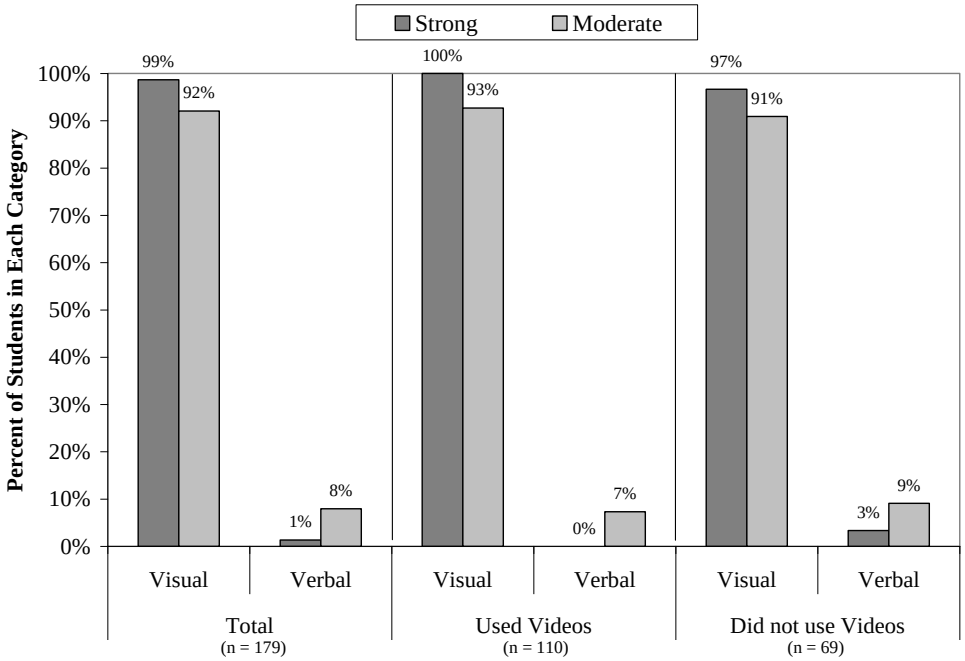

Figure 13 Impact of Degree of Visual / Verbal Preference on Likelihood of Using Video AI

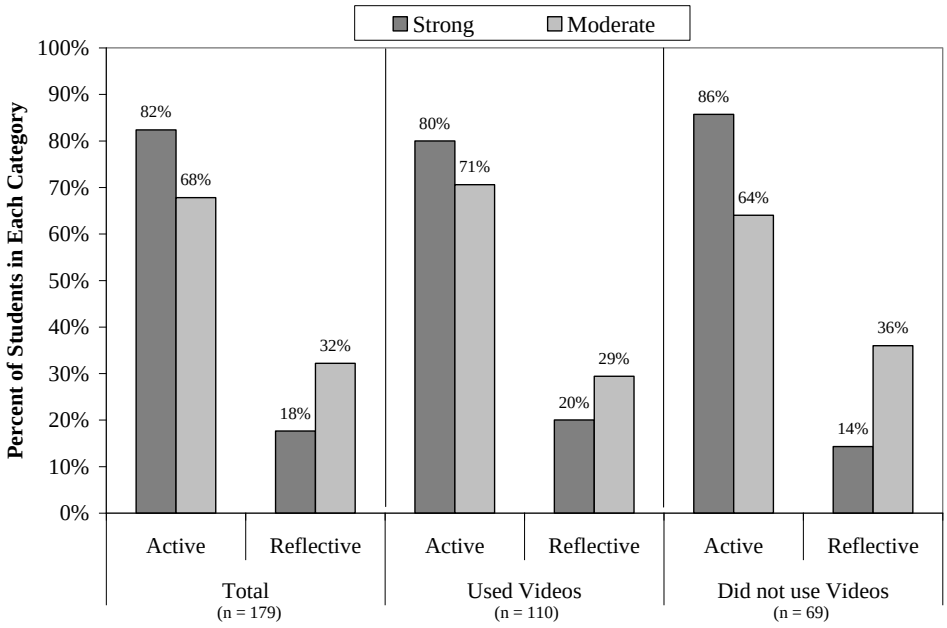

Figure 14 Impact of Degree of Active / Reflective Preference on Likelihood of Using Video AI

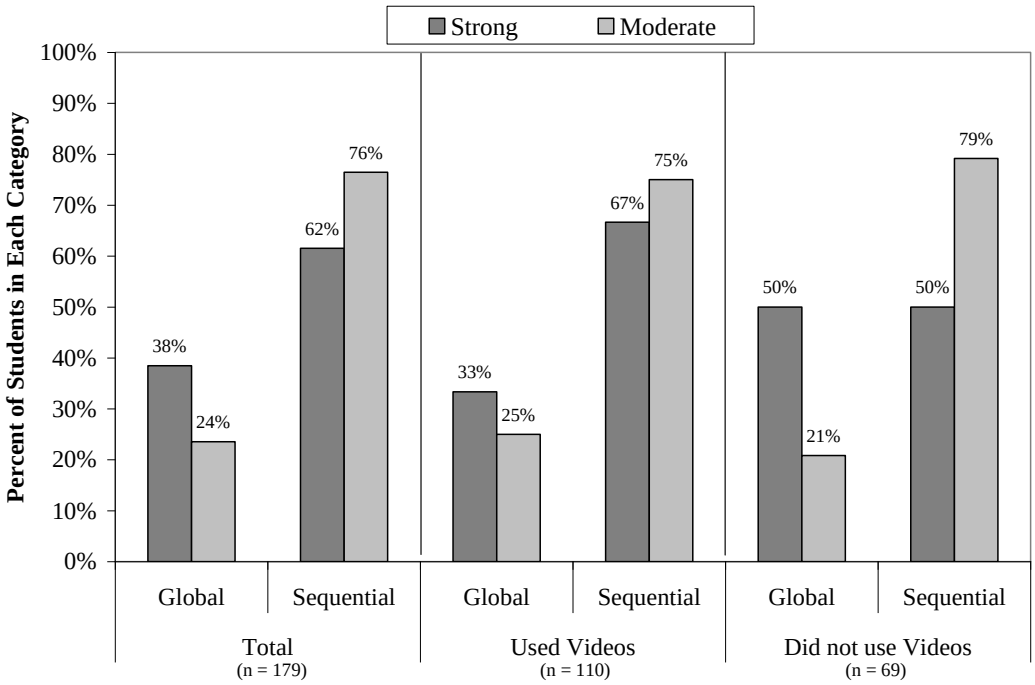

Figure 15 Impact of Degree of Global / Sequential Preference on Likelihood of Using Video AI

It is also worth considering the influence of combinations of learning styles. Since Visual and Sequential learners were the most likely to watch the videos when considered individually, I examined how likely those who were both Visual and Sequential were to watch the videos. As seen in Figure 16, when considered in aggregate, those students who exhibited preferences for both Visual and Sequential learning appear to be slightly more likely to access the on-demand resource. Conversely, we see that those who are the opposite (exhibiting a preference for both Verbal and Global learning) were less likely to use the videos. From Figure 16, several other observations can be made. When considering the strength of a student's preference for Visual and Sequential learning, we see a slight increase in the likelihood of accessing the videos. When a preference for Active learning is included along with a preference for Visual and Sequential learning, we again observe a slight increase in likelihood. Students with a strong or moderate preference for all three learning styles have an even greater likelihood of using the video resource.

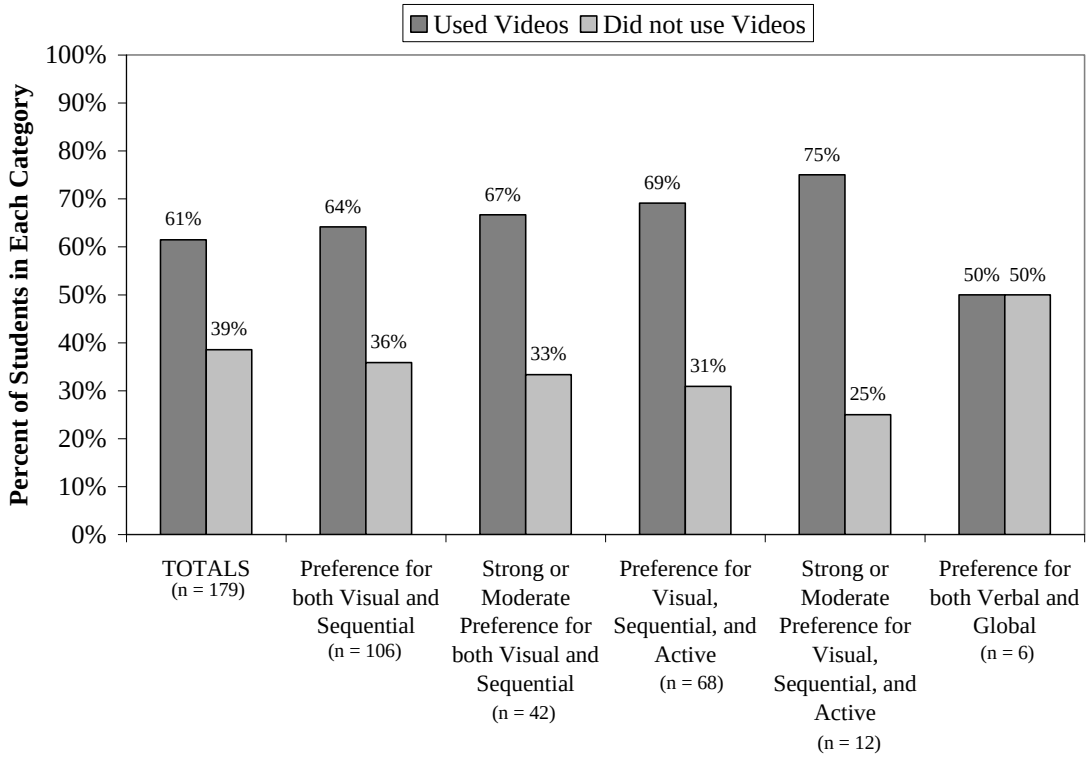

Figure 16 Influence of Combination of Learning Styles on Likelihood of Using Video AI

Those students who were balanced in three or four of the learning style dimensions appear to be slightly more likely to use the videos to supplement their studying (see Figure 17). Those balanced in only two, however, were neither more nor less likely. This is most likely due to the fact that a large number of students balanced in two dimensions and those who were represented the full spectrum of other learning styles.

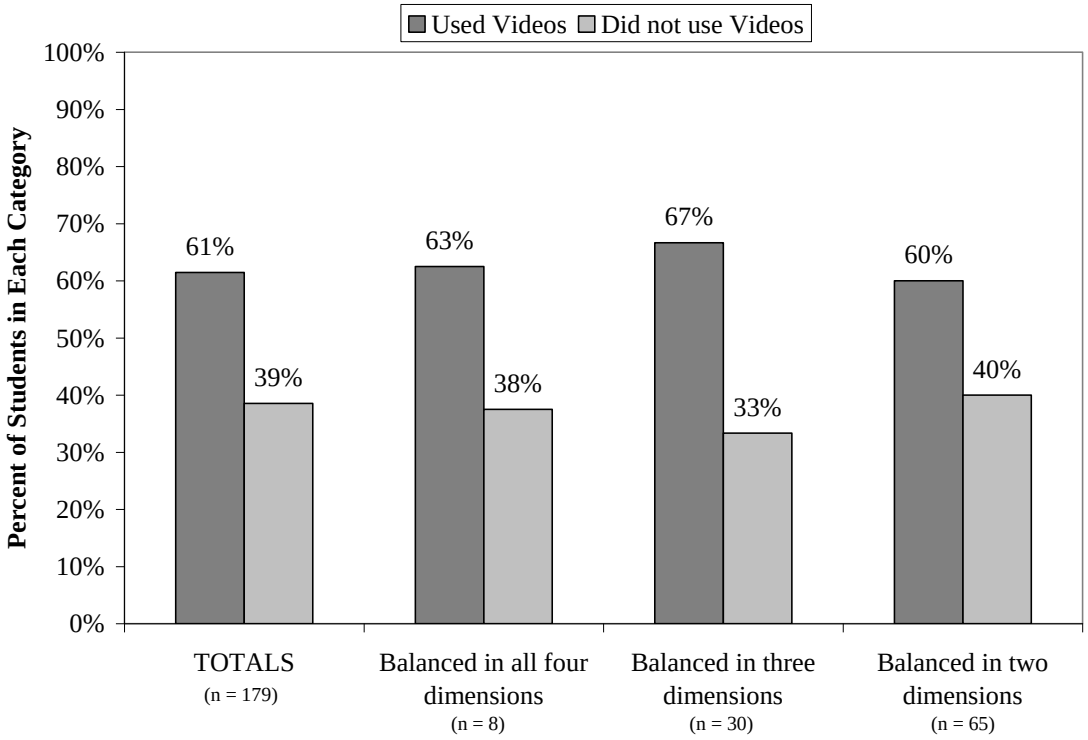

Figure 17 Influence of Combination of Learning Styles on Likelihood of Using Video AI

Conclusion

Today's students use technology to "pull" information in most aspects of their lives yet traditional courses, in general, have not integrated "pull" type of resources. In education, we owe it to our students to develop ways to appeal to all learning styles – since all types are represented in our courses – both in our traditional instruction in the classroom and in additional resources we provide. This led us to the idea of Video AI and this paper examined this resource and its appeal to various learning styles.

These videos appealed across the spectrum of learning styles. Verbal learners made use of them as did Global learners. Similarly, Reflective and Intuitive learners watched the videos to supplement their learning. While students exhibiting preference for visual, active, and sequential learning were slightly more likely to use an on-demand resource the increase in likelihood was most evident for those students who exhibited a strong preference. Because of the rather small size of the samples, none of these variations in use are statistically significant. I have been gathering the same data for this current semester (168 students) and the same trends appear to be continuing. At the conclusion of this semester, I will combine the data from 08-1 and 08-2 and again conduct a statistical analysis to determine if, with a larger sample, the likelihood of various learning styles to use the video resource is statistically significant.

As long as the resources are designed using proven pedagogy (for example: focused, well-organized, and clearly explained instruction) the on-demand video resource appeals to most students regardless of learning style preference.

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Classroom Research Project

The Student Mathematics Portfolio: Value Added to Class Preparation?

By LTC Robert Burks, Department of Mathematical Sciences

Abstract

This paper describes key elements for teachers to successfully implement a student portfolio in their undergraduate course. This paper offers practical experience in implementing a student mathematics portfolio for a freshman Precalculus course and looks at the potential value added to daily class preparation and traditional classroom assessments of the portfolio. The paper provides strong anecdotal and student self-confidence evidence that student portfolios provide increased performance in the course.

Keywords: Portfolio, mathematics portfolio, mathematics instruction, pedagogy

I. Introduction

After teaching freshman mathematics for a year and based on my own undergraduate education experience, I noticed that those students that were more organized throughout the semester tended to do better academically both in terms of grades and understanding of the course content. As an instructor, I tried to verbally share my organizational insights with my students but to no apparent avail. Consequently, this year I decided to require my students to maintain a mathematics portfolio that I would collect and assess throughout the semester. As an additional incentive, I decided that the portfolio would represent three percent (30 points) of their semester course grade. However, deciding to implement something in the course and fully realizing all that was really entailed in the exercise is another matter. Throughout the semester, I struggled with how to take full advantage of using a portfolio in the classroom and discovered that like most things this is a growing process.

Traditional mathematics education, at all levels, has relied heavily on homework and tests to evaluate student progress but these tools do not always yield sufficient or suitable information concerning a student's growth. Educators are constantly in search of new or revised assessment techniques are to address these shortcomings and a mathematics portfolio has become more popular as a potentially effective assessment tool [Stenmark 1989, Clarke and Clarke 1990, Grace 1992]. The growth of the mathematics portfolio is linked directly to the National Council of Teachers of Mathematics (NCTM) Curriculum of Standards' [NCTM 1989, 1991] which requires all students to: (1) learn the value of mathematics, (2) develop mathematical confidence, (3) become problem solvers, (4) learn how to communicate mathematically, and (5) learn how to reason mathematically.

So, what is a mathematics portfolio? Why should a mathematics teacher use a portfolio? How should a teacher organize, implement and assess a mathematics portfolio? This paper will address each of these questions and present insights from a specific application of a mathematics portfolio for a freshman undergraduate pre-calculus course.

II. What is a Mathematics Portfolio?

Portfolios have long been used successfully by educators to evaluate a student's work in both the arts and humanities. Since publication of the NCTM guidelines and standards [NCTM 1989, 1991], portfolios have become a popular assessment mechanism for grade school mathematics teachers. Much like an art portfolio, a mathematics portfolio represents a collection of a student's work intended to provide evidence of their understanding, and if collected over a period of time their growth in the subject [Crowley, 1993, Stix 1994]. A properly developed portfolio serves to facilitate

both communication between student and teacher and provide additional information concerning the student's progress and needs.
What actually goes in a mathematics portfolio is open to some debate and discussion. The literature suggests that mathematics' portfolio should include representations of student problem solving applications, projects, mathematical investigations, writing examples, reflections and completed tasks, categorized across three broad categories: problem solving, reflective writing and teacher selected work [Lambdin 1994, Ferguson 1992, Crowley, 1993, Crowley & Dunn 1995]. Most of the literature concerning mathematics portfolios is directed at the K-12 grade levels. There is very little literature that discusses implementation of a mathematics portfolio at the undergraduate level but a review of the objectives established by the NCTM and success experienced by K-12 mathematics teachers suggests that there is no reason not to expect success in an undergraduate mathematics course.

III. Why Use a Mathematics Portfolio

Portfolios provide an opportunity for students to take an active role in their own assessment and progress toward the course objectives. I had several objectives for implementing the portfolio in my course. First, I was looking for a method that stressed the importance of organization, daily preparation and the development of effective study habits in the course. Second, I wanted something to foster an attitude of the necessity of completing suggested homework problems, in-class board problems and a personal reassessment (reflection) of quizzes and exams. The last objective was for something to serve as an assessment tool of student progress through the course other than fixed grades in time.
A mathematics portfolio provides the mechanism to get at each of the above identified objectives [Lambdin 1994, Kuhs 1994]. However, in retrospect, I realized early that I did not know exactly what a good portfolio looked like or how I would eventually assess it. What follows includes insights into how I eventually organized, implemented and assessed the mathematics portfolio in the course.

IV. Organization, Implementation and Assessment of a Mathematics Portfolio

As mentioned earlier, the organization and implementation of the portfolio was a learning process throughout as my attitude of what to expect changed during the semester. The final implementations are not all original concepts but were effective techniques gleaned from the literature, modified and updated to fit my situation.

4.1 *Portfolios are not the same as Notebooks*

At the beginning of the semester, I initially equated a portfolio with a standard student course notebook, after all a notebook captures most of my objectives of stressing completion of assigned work and organization. However, a true portfolio requires reflection, writing and self-critiquing to present a full assessment of learning and to fully realize all of my stated objectives. There was nothing more valuable for the student who did not do well on the first WPR than to critique their own notebook while looking at the graded test questions and the incomplete concept pages in their own notebook. This individual reflection and self-critiquing exercise provides more growth than a semester of my stories about how important organization is to success in academics.
What was missing from this first implementation is more opportunity for student reflection. Students were required to write a short statement at the beginning of the semester addressing what they hoped to get from the course and what I, as their instructor, could do to help them achieve their objectives. I missed the opportunity to have the student update their initial statement throughout the semester. I believe this additional reflection provides one additional opportunity to capture evidence of student growth during the course. Future implementations will incorporate more of these elements into the portfolio.

4.2 *Create a Portfolio Culture in the Classroom*

It is critical to ensure that portfolios become an integral component of day to day operations in the classroom. The portfolio losses its effectiveness if it is perceived by the students as a project assigned at the beginning of the semester to be collected and assessed at the end of the semester. This perception allows students to procrastinate and attempt to bring the portfolio together in time for submission. Effective implementation requires student acceptance of a portfolio's importance early in the course. The following implementation techniques were developed and updated throughout the semester to ensure that my students were encouraged to maintain their portfolios.

- **Establish a clear purpose for the portfolio** – students need to understand the links between a portfolio and success in the course. Educators need to know in advance exactly what they expect from the portfolios and communicate this information to their students. The requirement to maintain a portfolio is outlined in the student course guide issued to each student. I also introduced the portfolio requirement on the 2nd day of the course and discussed the value of maintaining it throughout the semester and mentioned its weight in the course evaluation. This introduction included the advantages of organization, self assessment and eventual Term End Exam (TEE) preparation.
- **Establish clear assessment criteria** – provide your students a rubric early in the semester. Students need to understand how you plan to assess their work. Do you plan to assess their collection of quizzes and tests or do you have additional elements (e.g., written reflections) that you plan to assess. Each student was provided with a rubric (appendix A) at the beginning of the semester that outlined how I planned to assess their portfolios and I referred to it several times throughout the course as a reminder of the requirement. I established at the beginning of the semester that each student would turn-in their portfolios as they turned in their completed Written Partial Review (WPR). This requirement forces students to put something together for use during the exam.
- **Use portfolios on a daily basis if possible** – An incomplete notebook provides little value to daily class preparation. Throughout, the semester I stressed the importance of completing homework, daily board sheets and making corrections to any returned assessments. Students were provided access to worked solutions for all assigned material to assist in completing any missed work and making corrections. As added emphasis, students were authorized to use their notes on each of the nine mini-quizzes given during the semester. The objective was to have students maintain their portfolios and gain their own insight into the value of an organized and complete portfolio.
- **Make students responsible for maintaining an up to date and organized portfolio** – The rubric clearly articulated the requirement to maintain the order of all daily assignments and reassessments (corrections to missed problems). This point was stressed by allowing students to use their portfolio throughout the semester.
- **Provide multiple opportunities for feedback on the portfolio** – The portfolio was reviewed twice formally by me and once informally by the student. After the first WPR, I reviewed each student portfolio and provided written feedback on their portfolio and a score between 1 – 5 points. The second formal assessment occurred after the second WPR where each student once again received written feedback and a score between 1 – 25 points. Students were provided a third optional formal assessment at the conclusion of the third WPR to gain back any of the points they might have lost during the second formal assessment. Each student also performed an informal assessment of their own after I returned their portfolios and graded first WPR. The objective was to write a short paragraph of how (or why didn't) their portfolio helped them on the WPR.

4.3 *Implementation in the Classroom*

All students at the United States Military Academy (USMA) are required to complete a challenging four sequence mathematics program that includes discrete analysis, single and variable calculus, probability and statistics. Most students arrive at West point with at least an introduction to calculus. However, every year there are a handful of students who are admitted with a weaker mathematics

background or an unusually long break since their last mathematics course in high school. These students are required to take a fifth sequence of mathematics are enrolled in a Precalculus course to increase their mathematics skills. My research addressed the merits of a mathematics portfolio during a freshman first semester course in Precalculus.
Historical analysis of grades shows that this particular group of students struggle academically their first year. Hopefully, the implementation of a course portfolio will improve the overall experience for these students. The course initially consisted of 50 students divided between two instructors across four sections. I shared teaching responsibility with a second instructor who would serve as the control group (non-portfolio group) for the implementation. All sections used the same course wide assessments, term end exams (TEE) and projects. The major difference in course assessment was the inclusion of the evaluated portfolio for my two sections worth of students (portfolio group).
In addition to this course, all students are enrolled in a student success course (RS101) at the institution's center for enhanced performance (CEP). The objective of this course is to help these students with organization, time management and academic skills to improve importance.

I discussed the major aspects of the portfolio requirement as outlined in section 4.3 with my students. My counterpart did not emphasis the notebook during the course but did check daily homework for the first ten lessons to emphasis daily preparation. He also collected his student's notebooks at the conclusion of the first WPR and provided informal feedback the notebooks.

I coordinated for one of the student's CEP instructors to sit through all of my lessons. This instructor worked side by side with the students completing all of the daily work and taking every assessment as a student. This provided invaluable insight during the cadet's RS101 class since their instructor set through the same material and new what belonged in the course portfolio and updated it daily.

4.4 *Assessment*

The assessment mechanism developed for this research attempted to target success or failure of the portfolio's contribution in achieving the stated objectives of organization, daily preparation and effective study habits. The assessment comes in three forms: a statistical analysis of course grades, an assessment of the portfolios themselves and student survey results.

4.4.1 Statistical Analysis

The initial goal was to determine if there were any statistical significant differences in academic performances between the two groups of students. Since course end grades include different instructor point assessments, I was concerned about the ability to isolate the effect of course portfolio versus other confounding factors if I used course grades. In response, I considered student performances in three areas. The first assessed area consisted of a combined score that covered each of the three major exams (WPR) and the TEE. This provided a broader range of assessments to capture any potential growth during the semester. Since the exams were all open note assessments, the expectation is that those individuals that were organized in thoughts and
notes would score higher. The second performance assessment consisted solely of the TEE grade. This exam, more than any other event, was graded in tandem to ensure equity in the evaluation and should have removed many of the potentially confounding factors. The final assessment consisted of all shared experiences by both groups in the course. These experiences included all of the exams, projects, graded homework and represented approximately 85 percent of a student's course grade. The inclusion of graded homework should provide the effect of routine day to day preparation. Figure 1 provides the descriptive statistics of the two groups (portfolio and non-portfolio) for the three assessed areas.

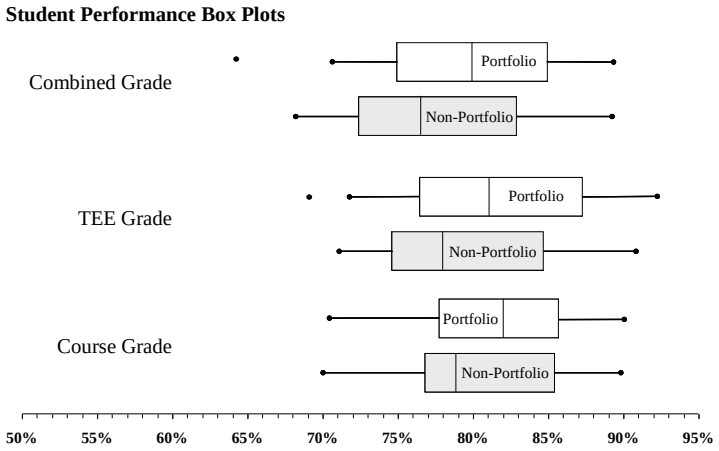

Figure 1 Student Performance

A review of the box plots seems to suggest that the students with increased emphasis on the portfolio tended to perform better on each of the three assessed areas. To confirm this observation, I conducted an Analysis of Variance (ANOVA) statistical calculation with Minitab to determine the actual strength or presence of any statistical significance between the means of the three groups. Unfortunately, the statistical output (p-values) suggests that there is not a statistical difference between the two groups of students. This finding suggests that there may be some other unaccounted for confounding issue that is attributing to the differences. One such confounding issue might have been that all students were enrolled in RS101. This course provided external emphasis throughout the semester on organization and maintaining a notebook for the non-portfolio group that may be a contributing factor.

One stated objective was to gain an increase in student daily class preparation with a corresponding increase in completion of suggested homework problems and board sheets. This objective was informally assessed through weekly in class surveys and the tracking student visits to the math clinic. During the first four weeks of the course leading up to the first exam, students were asked to submit (using the muddiest point format) the average amount of time they spent studying and preparing for the next day's class. Figure 2 tracks this performance for both instructors during this period. A review of Figure 2 provides no clear indication of an increased amount of study time for the portfolio students. However, the responses did confirm expectations that students typically spend a little less than an hour each night preparing for the next day's lesson. This snapshot seems to support the

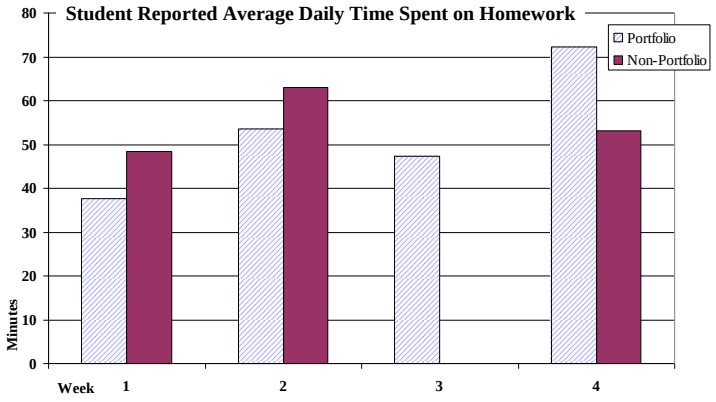

Figure 2 Student Reported Average Daily Study Time

statistical analysis of no difference between the group's average performances. There may have been a problem with stopping the survey after only four weeks. My first assessment of student portfolios was returned in the fifth week. This assessment and performance on the first exam might have translated into an increase in study time.

Each student in the portfolio group was expected to complete all board sheets and make corrections to any missed quiz and exam problems. This expectation in theory should translate to more time spent preparing for the lesson or more time examining the course solution book. Figure 3 tracks the number of students who signed in to the math department's clinic to use the solution manual. The solution manual was updated every day and included worked solutions for all assigned work. Figure 3, as with time spent on homework, shows no increased trend among the portfolio students. The fact that on average only 9.2% of the students, enrolled in the course ever used the solution book is a surprising and disappointing result. One of the metrics identified in the portfolio rubric was the requirement to complete all board sheets and to make corrections to quizzes and exams. The tracking of so few students signing in to the clinic served as an early indication of what to expect when I received the individual portfolios.

Descriptively there appears to be a slight increase in test scores among the portfolio group versus the non-portfolio group but other confounding factors prevent any references to the portfolio as the single

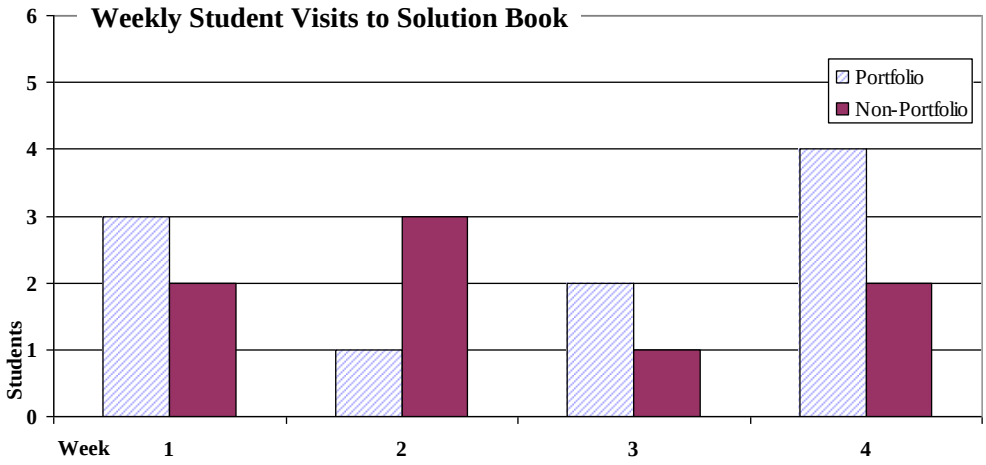

Figure 3 Number of Students Signing in to the Math Clinic

source of the increased performance. The following section examines student performance on the portfolio itself.

4.4.2 Portfolio Results

I evaluated the portfolios twice during the semester using the rubric provided in Appendix A. The first evaluation occurred at the conclusion of the first exam, four weeks into the course and the second evaluation was at the conclusion of the second exam, approximately 12 weeks into the semester. The portfolios ran the gambit from very well organized and maintained to the obvious no thought given to even maintaining notes.

The major portion of the assessment beyond organization, neatness and completeness covered five areas; suggested problems, graded homework, mini-quizzes, board sheets, and exams. Students were expected to have all assigned items present in their portfolio and to have made corrections for any missed problems on the homework, quizzes and WPR. I examining the portfolios I paid

particular attention to two areas, corrections to missed work and board sheets. I emphasized throughout the semester that making corrections while the material was fresh would pay dividends later in the semester and especially on the TEE and I spot checked several examples in all groups. I paid more attention to the board sheets, examining most of them in each portfolio. Almost every lesson, students were provided a board sheet to reinforce important objectives of the lesson. These board sheets were usually double sided and built concepts from the front to the back of the sheet. Typically the final problem on the back of the sheet was representative of the type of problems a student might encounter on the exam. Generally, during the course of the class most students do not complete these problems. I repeatedly emphasize to the students the advantage of completing these problems on their own time and reminded them that worked solutions were located in the math clinic.

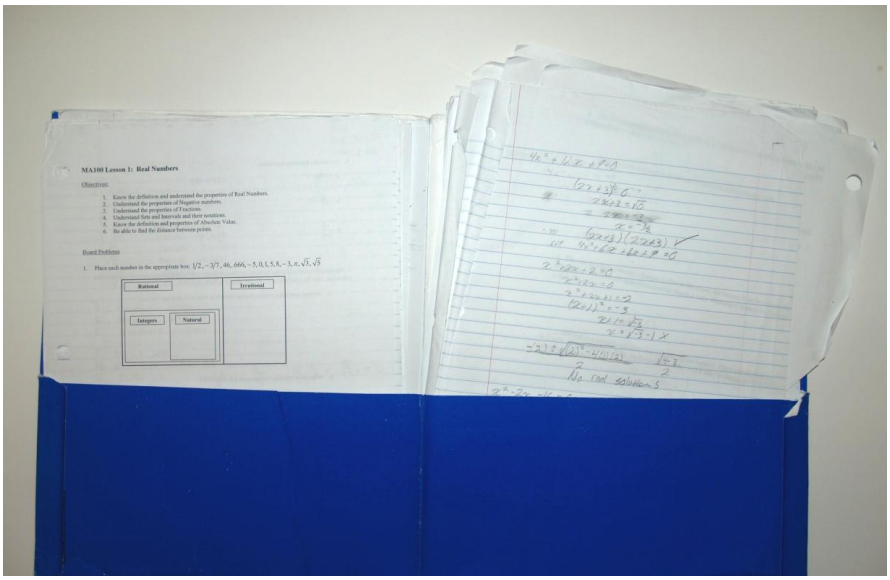

Figure 4 Sample Student Portfolio

The average portfolio grade was 75.31 percent with five of the 27 students receiving a failing grade. As mentioned earlier, the general organization of the portfolios ranged from excellent to poor. Figure 4 provides an example of one student's portfolio that was collected after the TEE. Despite repeated evaluations and an increased emphasis this represented the student's organizational effort. However, out of fairness there were two

other portfolios that were of equal quality as Figure 4 and the student received a C+ in the course. The student repeatedly stressed throughout the semester that he did not see a need for organization and that this system worked for him.

A review of overall performance in the five major areas shows that most students attempted all of the suggested problems which dovetails with the fact that students were doing some level of preparation for the next day's lesson. Three students actually completed all board sheets but only 29.63 percent of the students completed more that half of the board sheets. Each of these students received a B or higher in the course. A review of corrections shows that 48.14 percent of the students made corrections to more than half of the missed problems in the sample set of reviewed assessments. Approximately 84 percent of these students received a B- or higher in the course. There was only one student who corrected all missed work. It is interesting to note that student made all of the corrections without the benefit of the course solution book and she received an A- in the course.

Overall, there appears to be a strong correlation between a student's performance on their portfolio and their performance in the course.

Figure 5 plots student performance on their portfolio versus their final course grade. The chart clearly indicates a positive trend that as a student's portfolio grade increases there is a tendency for an increase in course grade.

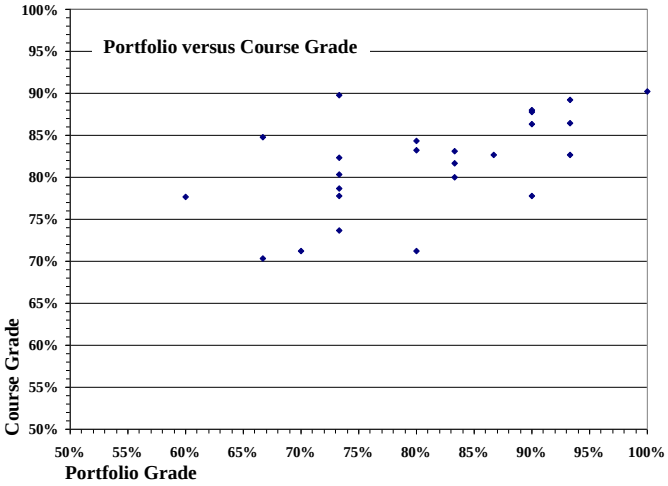

Figure 5 Portfolio Graded Versus Course Grade Correlation

There may not have been a statistical difference in performance between the portfolio and non-portfolio group but there appears to be strong anecdotal evidence that student's with a well maintained portfolio are doing better.

4.4.3 Student Survey Results

Most of the literature concerning the advantages of course portfolios focuses on theory, expert opinion and descriptions of successful implementations. There is little attention in the literature placed on gathering and understanding student opinion on maintaining a course portfolio. My goal was to determine from the student's perspective if they thought a portfolio notebook was beneficial in the course. I used a simple survey assessment tool in an attempt to capture individual student attitudes and perceived benefit of maintaining the course notebook. I implemented this survey in two phases. The first implementation was at the conclusion of the semester after the students had taken the term end exam (TEE) and the second implementation was 14 weeks into their follow on mathematics course after they had completed the second exam (WPR).

4.4.3.1 Survey I

The first survey targeted their attitudes after receiving my final assessment of their notebooks, the completion of their own assessment and then utilization on the TEE. This initial survey was not anonymous since I wanted to link individual attitudes with actual performance. I anticipated that this survey approach and their actual success in the course or on the TEE would likely color their perceived advantage of maintaining a portfolio. I was initially worried about receiving candid opinions but was pleasantly surprised with the range of responses. Survey I contained the following five questions with the additional instruction of commenting why or why not to prevent simple yes or no answers (note: Q5 was reserved for only portfolio students).

Q1. Do you believe that being required to maintain a course portfolio helped you prepare for the daily lessons?

Q2. Do you believe that your course portfolio helped you prepare for the WPR?
Q3. Do you believe that being allowed to use your course portfolio helped you during the WPR?
Q4. Did knowing that your instructor was collecting and reviewing your portfolio influence you to maintain the notebook throughout the semester?
Q5. Did knowing that your portfolio was worth 3% of your course grade influence you to maintain the portfolio throughout the semester? If not what might have been a better motivation?

Of the 56 students who took the course, 49 students attended the last day of class and completed the survey. The remaining seven students departed the academy prior to the TEE. Table 1 contains the binary (yes, no) responses to the survey. It is interesting to note that the non-portfolio group expressed the same level of support for the portfolios despite the reduced emphasis and evaluation throughout the semester.

The cadets' answers to the questions on the survey reflect the overall positive trend displayed in Table 1 regardless of instructor. The vast majority of the comments were favorable to the requirement of maintaining a course portfolio and its usage on exams regardless of instructor or final grade in the course. The comments below are taken from the survey and reflect the prevailing thought of most cadet responses.

	Portfolio		**Non-Portfolio**	
	Yes	**No**	**Yes**	**No**
Q1	22	5	17	5
Q2	24	3	21	1
Q3	25	2	20	2
Q4	23	4	20	2
Q5	20	7		

Table 1 Student Response to Survey I

Q1."I think that it helped a great deal, the course notebook helped me personally stay organized and be prepared for class."
Q2."It most definitely helped because our notes were easily accessible and the cumulative coursework was easier to follow with an orderly notebook."
Q3."I failed to maintain organization throughout the semester. If I had been more organized I believe it definitely would have helped though"
Q4."Yes, because I was organized everything was easier to find. I knew where to find all of the information for specific topics we discussed."
"When I studied I didn't have to look around for lesson assignments. They were all organized and ready for use."
Q5."Very much! I couldn't imagine moving at the pace we moved at and not being able to use our notes on the WPRs."
"I feel in some ways I put all my reliance on my notebook rather than what I actually learned. But if I didn't have my notebook or notes, I probably would have failed."
"It definitely helped on the WPR. Being organized was the key, and the fact that you checked it near the time of the WPR forced us to organize."

"The notebook did not help me personally during the test because I felt it would take too much time to flip through it for every problem so I did not use it at all."

Q6."Knowing That LTC Burks was collecting my notebook absolutely made me want to maintain it better. I didn't want him to think I was all ate up."

"To be honest, no. I would organize a couple nights in advance of the turn in date, but at least it was organized at the time of the WPR."

Q7."I looked at having my notebook organized as earning free points. I needed those points to help me pass the course."

"No, didn't realize that it was worth 3%."

Despite their performance in the course, many students felt in some fashion that maintaining a portfolio was beneficial. What is interesting is some of the negative comments I received. The comment from Q1 of "I failed to maintain organization throughout the semester …" was turned in by a student who received a B- in the course.

4.4.3.2 Survey II

The second set of survey questions followed after the students completed their second WPR during their follow-on course. The survey contained the following questions five questions with the additional instruction of commenting why or why not to prevent simple yes or no answers.

Q6. Given what you know from last semester and what you have observed this semester, describe any benefits/advantages of maintaining a course portfolio?

Q7. What personal attitudes or believes (if any) of yours concerning maintaining a course portfolio has changed in MA101 as compared to MA100?

Q8. Given your personal experience this semester do you believe it's a good idea for instructors to continue emphasizing maintaining a course portfolio in MA100?

Select the choice that best describes your opinion (comments are encouraged):

Excellent OK On the Fence Bad Idea See no Real Benefit

Q9. Given that one sheet of paper is the only authorized reference for all quizzes and exams in MA101, should instructors place more emphasis on maintaining a course portfolio in MA101?

Select the choice that best describes your opinion (comments are encouraged):

Excellent OK On the Fence Bad Idea See no Real Benefit

Figure 6 captures student responses to questions eight and nine of Survey II. It clearly demonstrates that after almost a semester the majority of students (79.59 percent) still believe that it's a good idea to emphasis maintaining a portfolio in both MA100 and MA101. The comments for question nine

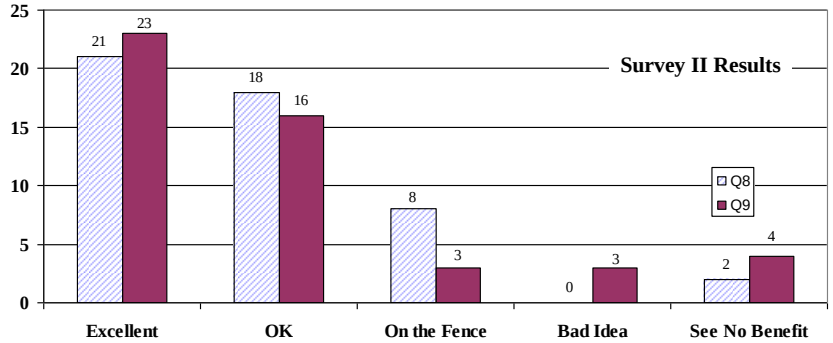

Figure 6 Student Responses to Survey II Questions 8 and 9.

stresses the importance organization has since students are only authorized one sheet of paper for all graded events in the course. The vast majority of the comments were favorable to the requirement of maintaining a course portfolio regardless of instructor or final grade in the course. The comments below are taken from the survey and reflect the prevailing thought of most cadet responses.

Q6. "It helps you study by keeping all of your information together."
"A portfolio is crucial for organization, study and success."
"Keeping a course portfolio is great! This semester we can use one sheet for reference of notes. As long as you keep your notebook up all you have to do before a WPR is skim your notes for important things."

Q7. "I try to keep my course portfolio organized still, even though it is not as emphasized. I think course portfolios are a great asset."
"My portfolio has not been as organized and I haven't been getting as good of grades. The material we are learning now is less familiar and it would help me if I had a better notebook."
"My attitude has not changes, I still feel that they are extremely beneficial and I have continued to keep one!"
"I love portfolios! I thought it was very helpful last semester, even more this semester. Staying organized is the only thing that has got me through this course alive."

In summary, the surveys show that the overwhelming majority of students perceive that their portfolios are beneficial and even crucial to success in the course. It is a wonder that so many actually failed to take full advantage of their portfolios by maintaining them throughout the semester.

V. Conclusion

This research has demonstrated that there is some strong quantitative and anecdotal assessment for the use of mathematics portfolios. Despite the lack of a statistical difference between the portfolio and non-portfolio groups, there does appear to be a strong correlation between an organized and complete portfolio and increased student performance at least in course assessments. I acknowledge that there was little to no indication of increased preparation for daily lessons but these may be a factor of the assessment tools. Despite any tangible results, the students strongly believe there is a benefit to be gained from maintaining a mathematics portfolio. This is a crucial first spark and it is incumbent upon us as educators to facilitate its growth into more of a burning desire to develop the portfolio. There were several missed opportunities during this initial implementation that might have provided a better learning experience for the students.

I also believe that there is much room for growth in the actual implementation of the mathematics portfolio. There was little emphasis placed on student reflection before, during and at the conclusion of the semester. I believe an increase in the reflection process will likely reap additional benefits. This first implementation did not provide an opportunity for the student to showcase any of their own work. Each of the assessed elements were what I thought were important to student success. However, to serve as a mechanism for charting student growth through the semester, I believe the student should be permitted to identify pieces that they believe demonstrate their growth.

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MA100 COURSE NOTEBOOK FEEDBACK	NOTEBOOK GRADE	/ 30
CADET		

GENERAL ORGANIZATION		*Letter Grade*	*COMMENTS*
1.	Notebook has an overall organized look to it.		
2.	**Neatness:** Your binder needs to be in order and neat. This means notes from September come before notes from October. This means that the pages should not be folded, crumpled, nor stained. This means that the pages should not be falling out of the binder. (Get reinforcements if you need them!)		
3.	**Completeness:** Your binder includes many suggested problems, board problems, graded homework, mini-quizzes, written partial reviews (WPR). In addition to being in order, these items should be fully completed (attempted). This should not be difficult if you have been keeping up with your assignments daily.		
4.	**Organization:** Generally open to interpretation but at a minimum should include some mechanism to separate all of the above information and a method to quickly find and retrieve information.		
SUGGESTED PROBLEMS			
1.	Suggested problems are completed (attempted) and in chronological order.		
GRADED HOMEWORKS			
1.	All seven (7) graded homeworks are present.		
2.	Corrections have been made to incorrect problems		
LESSON MINI-QUIZZES			
1.	All Mini-Quizzes are present		
2.	Corrections have been made to incorrect problems		
LESSON BOARD SHEETS			
1.	All Board Sheets are present		
2.	All problems have been completed (attempted)		
WRITTEN PARTIAL REVIEWS (WPR)			
1.	All WPRs are present		
2.	Corrections have been made to incorrect problems		

Battle Buddies: A Cooperative Learning Technique for Reducing Anxiety and Increasing Motivation

By MAJ Yvonne C. Miller, Department of Civil & Mechanical Engineering

Tests can be a major source of anxiety in a student's learning process. Team testing as a learning technique can decrease stress, increase motivation to learn and improve critical thinking skills. This study assessed students' performance in a team testing situation, with the intent to reduce anxiety and improve learning. Students were administered daily quizzes throughout a semester long course which they took with a partner. Their team performance was compared to individual scores and previous semester scores. Students were also given midterm and end-of-course surveys assessing the team testing. Results document that team testing reduced anxiety, enhanced understanding of the material, and increased motivation to prepare for class.

Introduction

Anxiety often influences how well students perform on tests. This anxiety can be compounded by the daily demands of college life, especially at a military academy such as West Point. The intent of this study is to assess whether anxiety is an issue among cadets in the daily preparation for class and looks at one method to reduce the anxiety and improve learning and performance on evaluations such as daily quizzes while encouraging better class preparation.

One main issue associated with student learning in a required course that is outside the student's interests is a lack of cadet preparation for daily participation. This is reflected in poor performance on daily quizzes and evaluations. The goal of this research is to assess whether team testing on quizzes will improve learning and motivation. Team quizzes presents a low threat environment, allowing the instructor to gauge the students' understanding of the lesson readings and promoting more active learning. Taking quizzes as a team would promote cooperation, and students could share their ideas with another cadet without feeling pressured since they are not presenting their ideas to the entire class.

Background

Cooperative learning is a form of active learning where students rely on their peers to help them learn the material. Cooperative learning may be formal or informal. One of the structured methods of cooperative learning is the jigsaw method, where the material is divided into parts and each student becomes the subject matter expert on different parts in order to teach the rest of the group. One method of informal cooperative learning is having students conduct discussions in pairs on specific lesson objectives during class. There are numerous methods for incorporating cooperative learning in the classroom. Whether structured or unstructured, cooperative learning should have five main components to be effective – positive interdependence, face-to-face promotive interaction, individual accountability, interpersonal skills, and group processing [4]. Researchers have proven the positive effects of cooperative learning. Specifically, collaborative testing has proven to be an effective technique in improving academic performance, reducing anxiety and fostering positive attitudes towards the course material.

Collaborative testing has proven to improve student performance on academic evaluations and overall course performance. Testing with a partner encourages critical thinking of the material with active processing of the information as students discuss their answers. Student performance on team-based examinations has proven to be superior to student performance on individual-based examinations [5, 6, 8, 9, 10]. This improvement may be attributed to the sharing of knowledge. Some may argue that team performance could actually decrease due to "social loafing", as students put less effort into their

studies, relying on their partner to learn the material [9]. The type of individual that would choose team testing over solo testing may also be an average student versus a high performer [10].

Team testing has been shown to reduce anxiety both in preparation for daily class and while taking examinations [3,5]. In a traditional educational environment, anxiety can plague students as they compete for grades or class rankings. Students with high levels of anxiety will typically score lower on examinations than students with lower levels of anxiety [1,2]. Many students also feel pressure from family, friends and peers. Although testing with a partner typically reduces anxiety, team testing can actually increase anxiety in students due to low self esteem or a sense of responsibility toward their partner [9]. Other studies have shown no changes in levels of anxiety while working in pairs [6].

Testing with a partner improves students' ability to communicate and cooperate, which is essential in most businesses [8]. Students have to present their own argument to back up their answer. Experience in presenting their ideas may help enhance self-esteem and make students more comfortable socially. Team testing gives an individual the opportunity to verbalize their thoughts which can improve recall of information [3]. It has been shown that students spend more time working on a collaborative test as they share their ideas [6], which can assist in learning the material.

Having a learning partner can also increase enjoyment of the course and the subject matter [3,10]. Difficult subjects, such as engineering, may seem easier to manage when discussed with another person. Students may become more motivated to study in order to support the team, and this method of testing enhances critical thinking [5]. Students typically show a strong preference for collaborative testing [6].

Collaborative testing is not for everyone. Whether a student prefers team testing or not greatly depends on the student's personality, such as their desire for control and sense of responsibility to the team [9]. Some individuals work better as individuals. Unarguably, the weaker student would benefit by teaming up with a stronger student. High performing students may feel as if they would not benefit from a team testing situation, although teaching a fellow student could assist in processing the material. "Social loafing" may also be a concern for some students, where one partner does not contribute to the group.

Although collective learning appears to have positive implications on most students' learning, team testing is a controversial topic, especially at the college level. Does team testing increase student motivation to learn and improve performance? Will students be more motivated to study because they feel a sense of responsibility toward their partner or will students be less motivated to study because they can rely on their partner to answer the questions? Will students learn more when taking an examination with a partner? These questions are addressed in this study. Most studies have looked at team testing on major graded assignments. This study narrows the impact of team testing on the student grades by using the team testing on daily quizzes versus major examinations.

Teamwork is an essential ingredient to success in military operations. It is bred into the military culture to take care of your fellow soldier. Soldiers are assigned a "battle buddy" during basic training and during most unit operations. This study capitalizes on the cadets' instinctual nature to take care of their comrade in order to assist in improving learning by assigning them an academic battle buddy.

Methodology

This study was conducted in an ME380 Engineering Materials course. The students were all Mechanical Engineering majors. This course is a required course for the major. There were 26 students in the course.

Students were initially given a test attitude survey at the beginning of the course to assess whether anxiety is a prevalent issue in this population of cadets. This survey was used to identify issues that may be affecting cadet performance on examinations. The survey was modeled after a Test Anxiety Inventory from the Educational Psychology and Measurement course at the University of Iowa [7]. The survey was a fifty item survey assessing whether students agree with statements about test taking.

The desks in the classroom were arranged in pairs, and cadets were informed during the first lesson that they would be taking quizzes with the cadet sitting next to them. Most of the students knew each other already since they were all among a small population of Mechanical Engineering majors. Although the students selected where they would be sitting, they did not realize they would be testing with the person sitting next to them when they choose their seat. Only one individual changed seats after the first quiz.

The quizzes were given at the beginning of every lesson at the start of the semester. For the first ten lessons, the students took the quizzes as individuals and then took the exact same quiz with a partner. A quarter of the way through the semester, the quizzes were only administered every other lesson, and the students only took the quizzes as a team. The quizzes were worth ten points each with 3 bonus points available on every quiz and were similar to historical daily quizzes administered in this course, consisting of short answer, true/false and multiple choice questions.

The five main components of cooperative learning as described by Johnson, Johnson and Smith [4] were used to frame the methodology of this study. Positive interdependence was established through shared grades on quizzes. The team members had to agree on an answer and develop strategies for success. The face-to-face promotive interaction occurred as the students assisted in teaching each other through discussion of each quiz question. Individuals were still accountable for their own learning since the quizzes were only a small fraction of their grade. Students were also given individual tests to compare to the team tests. The fourth element was the development of social skills as students explained their answers to each other and had to come to a consensus on the correct answer. Finally, the periodic surveys helped students assess the effectiveness of their team for group processing.

A mid-semester and end-of-semester survey was conducted to assess the cadets' feelings toward team testing. The midterm survey was nine Likert item questions and seven open-ended questions involving team testing. The end of course survey was five yes-no questions on statements involving team testing and two open-ended questions as to how the students would motivate students to prepare for class each day and how they would assess whether students had learned/retained the material for each lesson.

Results

Test Anxiety

A test attitude survey was given to the students in this course prior to the start of the semester in order to determine the level of anxiety that was prevalent in this group of students. The survey identified that anxiety is evident among cadets based on the statements that a majority of the cadets agreed reflected their test taking experience. The main sources of anxiety for cadets were concerns about how others would view them if they did poorly and concerns about how their performance would affect their future. The students' concerns about their future may be especially prevalent at West

Point because students' military branch and post are dependent on their class ranking. There were also significant concerns about how well prepared cadets felt for tests. This feeling of being unprepared may be a result of the demanding schedule that cadets follow. Figure 1 shows representative statements from the survey to which the majority of the cadets agreed reflected their own experience in test taking.

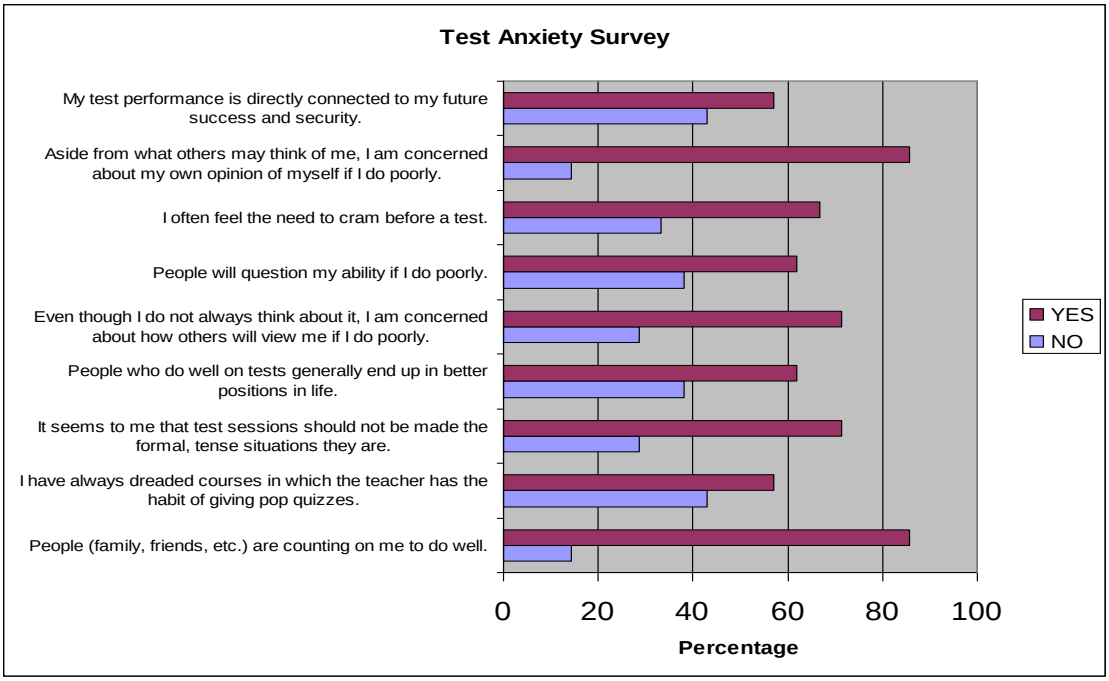

Figure 1: Representative questions from test attitude survey

The test attitude survey established that some level of anxiety was evident in the cadets. The midterm survey and the end-of-course survey showed that this anxiety was reduced by taking quizzes as a team. The results of these surveys are shown in Figures 2 and 3. 79% agreed that they felt less anxiety while taking the quizzes as a team, and 87% agreed that taking quizzes with a buddy reduced anxiety in preparing for class.

Improving Communication

Some students would prefer not to participate in class based on their personalities, even if they were knowledgeable about the material. By breaking the class down into teams of two, the cadets were forced to participate and voice their opinion to their partner. Cadets could share their responses with their partner without concerns of being incorrect in front of the entire class. Observations while the quizzes were being administered showed active participation by all cadets and lively discussions when there were disagreements as to the correct answer.

During the midterm survey, cadets were asked how well they communicated with their partner. Most responses stated that the team communicated well. Comments included:

- *We allow for both sides to be heard on a problem if neither side is 100% sure.*
- *We always talk before we put down a response.*
- *We share ideas when answering the questions.*

This method of testing forces students to talk about the lesson objectives with well-structured quizzes. This cooperative method of test taking helps prepare students to work as a team. Teamwork is

essential in the military and business settings. Members of a work force need to be able to communicate their ideas, defend their opinions and negotiate a final decision.

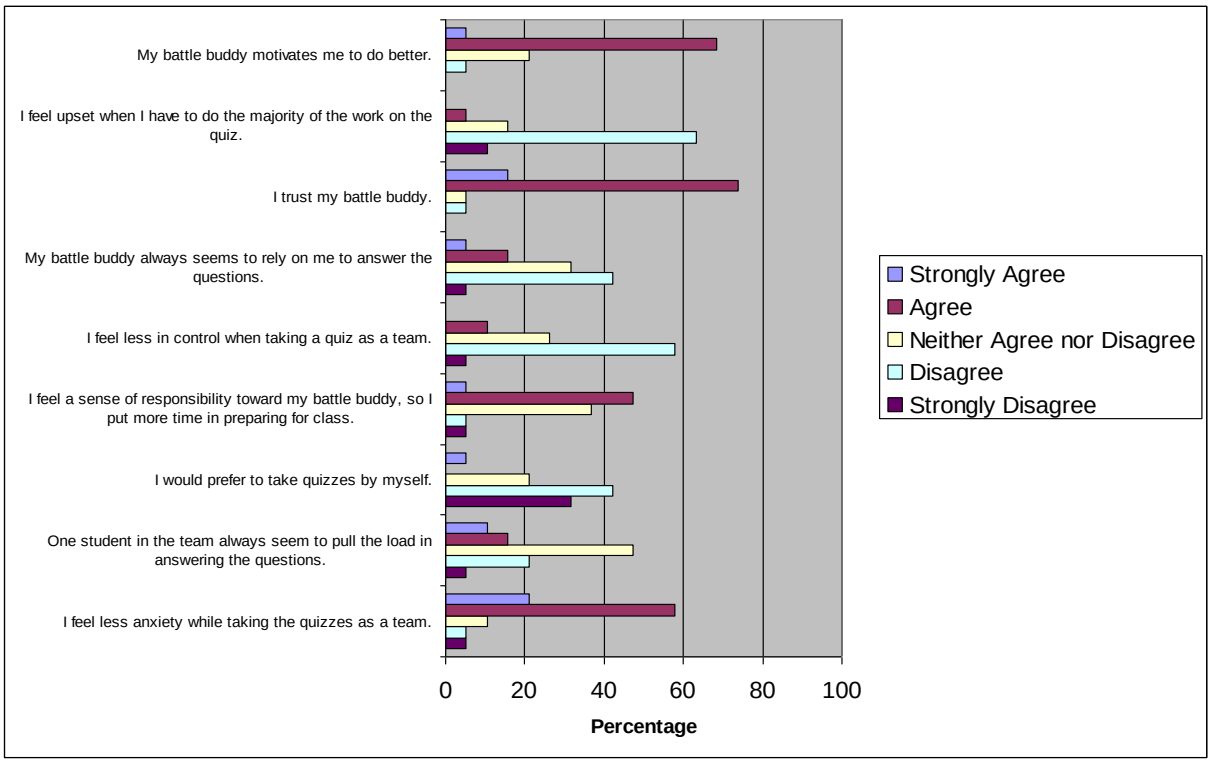

Figure 2: Midterm Course Survey

Contributing to Fellow Students Learning

Results on the standard United States Military Academy End of Course Survey showed a significant increase in the rating for the question – "My fellow students contributed to my learning in this course." The rating increased over last year from 4.11 to 4.68 on a five-point scale. This rating was also significantly higher when compared to the same term's USMA course average of 4.16. This question may have been affected by other group projects such as presentations and lab reports. However, these group requirements were the same as last year. The only change from last year in regards to group work in this course was the addition of team testing for the lesson quizzes.

During the midterm survey, students were asked open-ended questions on the conduct of the quizzes. Only one student provided negative responses due to lack of contributions from their partner. West Point may be an anomaly when determining the impact of social loafers due to the competitive nature of most cadets. Less than 6% of the students agreed that they felt upset when they had to do the majority of the work on the quiz and only 21% stated that their battle buddy always seemed to rely on them to answer the questions. 26% of the students agreed that one student always seems to pull the load in answering the questions. Team testing can turn testing into not just an evaluative process but also a learning process. However, all students need to participate and should vocalize their own response. The instructor should monitor the involvement of every individual to ensure all are contributing.

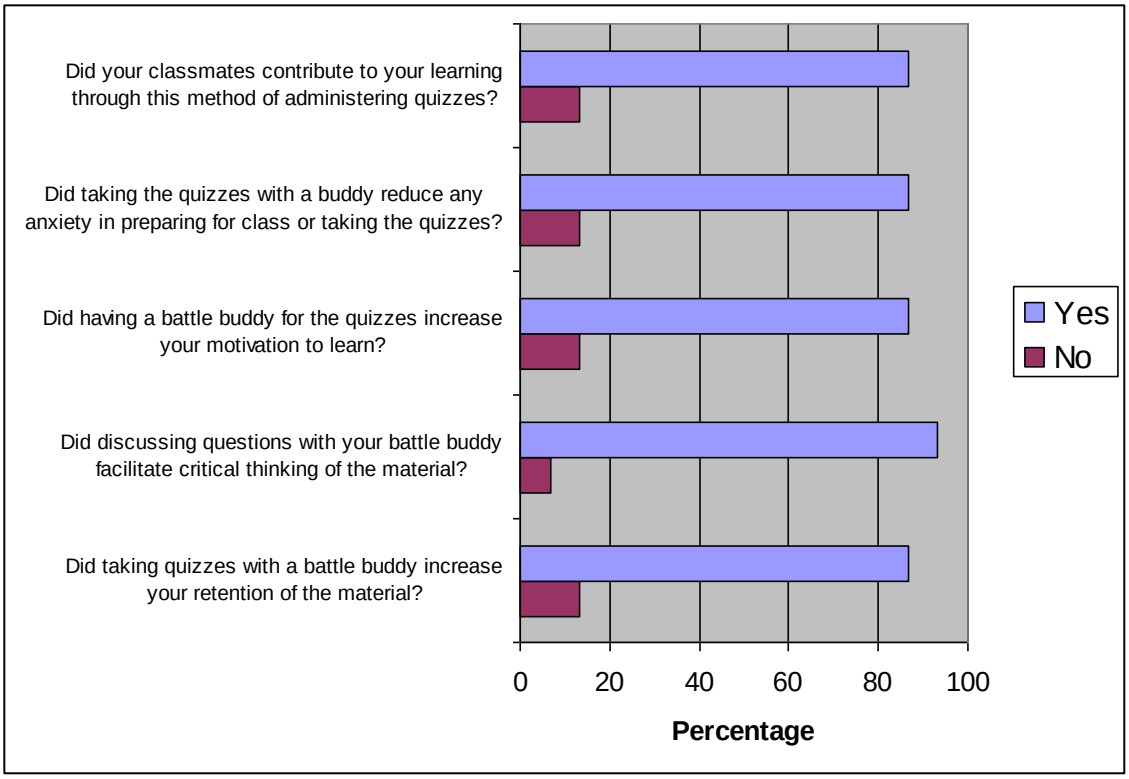

Figure 3: End of Term Survey

Motivation to Prepare for Class

In order to promote active learning, the students must be knowledgeable about the topic of discussion. For improved participation in class, students should prepare for class by reviewing the assigned readings. Due to a lack time or interest, most cadets do not read the assigned readings prior to each lesson. Administering a reading quiz in class makes the students accountable for doing the readings and recalling what they read. Based on the cadet's responses to the test attitude survey given at the beginning of the semester, cadets do not like pop quizzes. The approach taken in this study still made use of reading quizzes to hold students accountable for the readings, but lessened the anxiety by allowing the students to take the quizzes with their partner and by announcing when each quiz would be given. By taking the quiz as a team, each cadet's preparation for class affected not just their own grade, but also their teammate's grade.

The midterm survey asked the question "Knowing you will be taking quizzes as a team, does this increase or reduce the amount of class preparation time?". Over half the responses stated that this method of testing increased their preparation time because the cadets did not want to let their buddy down or because they did not want to be the team member that did not contribute anything. Only one cadet said that this method of team testing reduced the amount of preparation time. The rest of the responses stated that there was no impact because they would be doing the same amount of class preparation regardless of the method of evaluation. Their study time for the course depended on their priorities for the night. When asked about their performance as teams, one student commented "I am doing better in a team, because I am more motivated to prepare". During the midterm survey, 74% of students agreed that their battle buddy motivated them to do better. 52% of students agreed that they felt a sense of responsibility toward their battle buddy, so they put more time in preparing for class. The increased preparation time for class was reflected in the increased participation in class.

Student Preference

On the midterm survey, less than 6% of the students stated that they would prefer to take quizzes by themselves. On an open-ended question during the midterm survey, the majority of the students commented that they liked taking quizzes with a partner. Comments included:

- *I like the challenge of agreeing on answers in the short amount of time allotted.*
- *I do like team testing. It allows you to work with someone to improve your score, teamwork abilities, and to share the score with. I like the sense of being on a team, when we do well and when we do poorly, it is nice to have someone to be "in it with you".*
- *I like team testing, because it builds teamwork, increases material understanding, decreases quiz anxiety, and results in usually a better grade.*

There were some reservations about team testing from a few students. Some thought that team testing allows students to become dependent on each other and could cause stress in a team that does not get along. Comments included:

- *I think it makes people too reliant on their buddy.*

When using team testing, the instructor should ensure that everyone is participating and should ensure that students have other opportunities to demonstrate their own knowledge. Since the quizzes were less than 6% of the students' overall grade in this course, students were still required to demonstrate their own knowledge on other assignments and examinations.

The end of course survey also supported positive attitudes toward team testing, where students agreed that team testing helped in reducing anxiety, increasing motivation and enhancing retention of the material. One student commented that he has learned a lot from his "battle buddy", and they actually started socializing more outside of class as a result of the teamwork required in class.

Performance

When analyzing the individual versus team test scores for the quizzes administered during the first ten lessons, students scored higher on the team test greater than 61% of the time. Some students actually changed their answer from the correct answer to the wrong answer based on the influence of their partner. Over the first ten lessons, the difference in individual versus team scores was significant. The average individual quiz score was 7.18, and the average team quiz score was 8.34. Figure 4 shows the average individual and collective scores for the quizzes administered during the first ten lessons. One primary reason for improved scores may be that the teams took advantage of the combined knowledge of both partners. This supports the proposal that team testing can be used as an instructional tool.

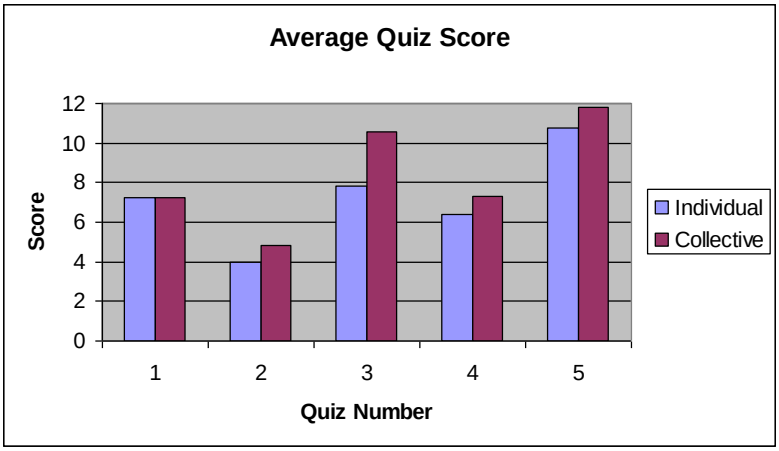

Figure 4: Comparison of average individual and collective quiz scores

The average quiz scores for this term, Term 08-1, were compared versus the average quiz scores for a previous term, Term 07-1. Both terms consisted of Mechanical Engineering majors that were in the first semester of their senior year. All sections were taught and graded by the same instructor. When comparing the students' average quiz scores versus the previous semester's score, there was no significant difference in the average score. Term 07-1 (no team testing) had an average score of 8.82 and Term 08-1 (team testing) had an average score of 8.78. These results may be a product of differences in the academic abilities of the students in the course or variations in the quizzes. The incoming grade point average of Term 07-1 was 3.22 and the incoming grade point average of Term 08-1 was 3.08. The outgoing course grade point average for Term 07-1 was 2.99 as compared to 3.33 for Term 08-1, which may support the position that team testing fostered improved overall performance in learning the course material. Figure 5 outlines the differences in the daily quiz scores and the overall course performance for Term 07-1 and Term 08-1. All factors need to be considered before comparing the two different terms.

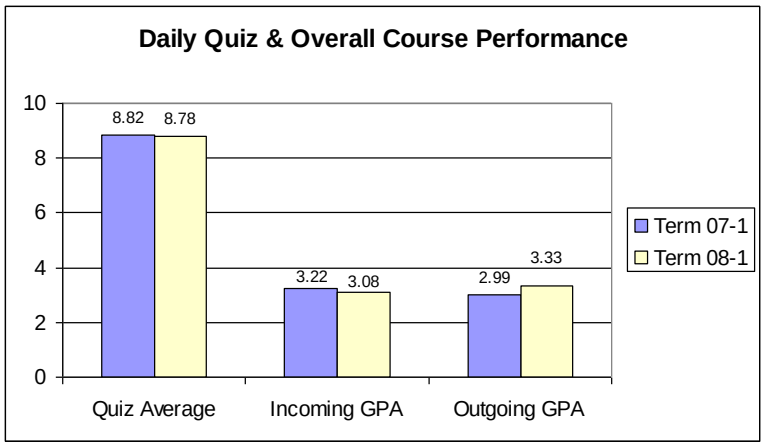

Figure 5: Daily quiz and overall course performance for Term 07-1 and 08-1

When asked on the midterm survey whether they thought they were doing better taking the quizzes as a team than if they were taking the quizzes by themselves, 84% of the students said they thought they were doing better as a team.

- *I am doing better as a team, becaue it helps eliminate careless mistakes, such as misreading or misunderstanding the question.*
- *I think we perform better on team quizzes as it allows two different memories and perspectives a chance to work the best answer out as a team.*
- *Often I can provide responses to some questions and my partner will be able to answer others.*

A few students thought that they would do better by themselves, as reflected in the comments listed below:

- *I second guess myself when I am with a partner*
- *I would probably do better on my own since I would try to study more if they were single person quizzes.*
- *I don't receive any help from my teammate anyways.*

Overall, the combined knowledge of two students and the ability to debate answers led to improved performance on the quizzes.

Discussion

This study focused on using team testing during daily quizzes. Each quiz was less than one percent of the student's grade. However, added up over the semester, the quizzes were worth about 6% of the

student's grade. Therefore, there was still individual accountability for learning. Team testing may be viewed differently by the student's if the teams were used on major examinations.

The sample size for this study was relatively small, with only 26 students. Future research should include assessing larger groups. There was also no control group with which to compare the team testing results. Ideally, a control group that was taking the exact same test under individual testing conditions with the same instruction should be compared to the collaborative testing group. The sample for this study was also relatively homogeneous. All of the students were Mechanical Engineering majors in their senior year. Results may vary across classes and majors.

The test attitude survey was only used to assess whether anxiety was an issue. Further analysis should include investigating the correlation between individual anxiety level and performance on team testing. Certain personalities may perform worse in the team testing situation. Anxiety levels could also be checked immediately before being tested as well as on comprehensive surveys.

Conclusion

Students were allowed to take daily quizzes with a "battle buddy" throughout the semester. The general consensus was that the cadets preferred taking quizzes with a partner. The students felt less anxiety while taking the quiz and while preparing for class. Most students stated that they were more motivated to prepare for class because they did not want to disappoint their partner. Participation in class increased since cadets were more prepared and they were forced to share their thoughts with their partner during quizzes. Students scored better taking quizzes as a team versus individually. However, scores did not improve when compared with previous semesters. Overall, team testing provided an opportunity to develop critical thinking skills and teamwork abilities.

Acknowledgement

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