The Journal of Applied Instructional Design

Volume 3 · Issue 2 · October 2013

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an **Association for Educational Communications and Technology** publication

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The Journal for Applied Instructional Design

ISSN: 2160-5289

The purpose of this journal is to bridge the gap between theory and practice by providing reflective scholar-practitioners a means for publishing articles related the field of Instructional Design.

JAID's goals are to encourage and nurture the development of the reflective practitioner as well as collaborations between academics and practitioners as a means of disseminating and developing new ideas in instructional design. The resulting articles should inform both the study and practice of instructional design.

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For questions contact Don Robison at
drobi036@odu.edu

Guest Editorial

Wilhelmina C. Savenye, Ph.D.
Arizona State University

Instructional Design: Vibrant, Motivational, and Global

The editorial staff members of *The Journal of Applied Instructional Design* are delighted to welcome you to our autumn, 2013, issue of the journal. Now that our academic year has begun, we hope this issue finds you rejuvenated and eager to carry out your own instructional design and development projects and research. Once again, many thanks to all of you who have contributed mightily to the journal, as authors, as reviewers, and as readers.

We would like first to thank Don Robison, JAID Production Editor, for his inspiring and elegant tribute, in the form of our cover and his essay, to a true hero, Malala Yousafzai.

In this issue, I hope you find, as we do, strong evidence of the vibrancy, currency, effectiveness, and global relevance of instructional design. Our authors present research and development work that focuses on the processes of instructional design from needs analysis to evaluation, and everything in between, in many varied settings.

One strong theme in several of the articles is learner motivation, an aspect of instructional design that some would argue has been somewhat neglected in the past. The writing of these talented authors spans a great range of motivation work, and yields for us a comprehensive picture of this area of design work today. We are presented with, for example, a thorough review of the research and theoretical literature, leading to a set of guidelines for building motivation into instructional simulations. In another article, the authors show how they have applied Keller's ARCS model of motivation to building e-learning for zoo employees and volunteers across the globe. In the third motivation-focused article, the authors describe an interdisciplinary and collaborative project to completely redesign a mechanical engineering course, based on the SUCCESS model of motivational design.

Other articles in this issue further illustrate the great range of instructional problems instructional designers effectively tackle. A needs assessment focused on the perceptions of undergraduate university students of their online courses and system yielded findings that may apply to many of our university settings. In another project, students in a graduate class conducted a formative evaluation, with junior-high students and their teacher, of a game-based curriculum to teach civics. Moving outside of schools and colleges, another set of authors describe how they applied systematic design principles to build an informal learning, web-based "walking tour" of historic Wilmington.

The power of storytelling, video and visuals, along with learner interaction with real-life cases, are other themes exemplified in this issue's articles. Motivation guidelines support the use of stories and cases. In the zoo e-learning project, video cases provide learners with examples of the relevance of what they are learning. A design study conducted in a business course shows the value, based on case-based reasoning theory, of case libraries to help learners to solve authentic, complex problems.

In short, we are pleased to present this issue of JAID. We hope that the fine work of these authors inspires you, as it has the editorial staff. Many thanks, also to you, our readers, for your interest in, and contributions to, the field. We welcome your comments and submissions.

2013 AECT International Convention

Innovate! Integrate! Communicate!

AECT's Annual International Convention
October 29—November 2, 2013
Anaheim, California

SCHEDULE: Wed-Sat, October 30-November 2 (Convention program)
Tue.,Wed.,Sat. October 29, 30, and November 2 (Workshops)

Inviting Book and Blog Reviews

If you have noticed a particularly important book or blog that focuses on learning and instructional design in an applied context, we would love to hear from you.

You may review the item, provide constructive critique, point to the value of it, and submit your reviews to our editor, Les Moller, at LesMoller@aol.com.

We look forward to hearing from you!

Cover Story

Malala Yousafzai: A Voice Worth Hearing

Don G. Robison, Old Dominion University
Production Editor

Her name is Malala Yousafzai, she is 16 years old, and she is a hero.

She is no rock star, she is not a politician, and she has starred in no movie. She is no James Bond, working behind the scenes to bring down enemy governments. Malala Yousafzai is more courageous than that. She stood up in her native Pakistan, in the violent SWAT region controlled by the Taliban, and said, "…All I want is an education. And I'm afraid of no one" (Taseer, 2012).

She has been called the most famous teenager in the world, and has provided the spark for a growing world-wide movement to provide an education to every child on the globe. As people who are all about learning, we at *The Journal of Applied Instructional Design* (JAID) see her as *our* kind of hero.

I visited Pakistan as an educational consultant in 2003, working with a grade school there to develop a distance learning capability. There is a special place in my heart for the Pakistanis. The people I met were noble and gracious, generous to a fault, and believed that receiving visitors (like me) was an honor. I was humbled by their hospitality. They told me they were "shamed" by their few countrymen who were violent extremists. The Taliban had not yet gained the strong foothold it would grasp a few years later, but they were frightening even then.

I was struck when I first heard about Ms. Yousafzai's courage. I could picture where she was and the peril into which she willingly walked. I like to think of myself as having a modest measure of courage, but I could not imagine standing in the forum of such a brutal and senseless adversary, and speaking simply and in compelling terms about things that I know they would abhor. But she spoke her mind.

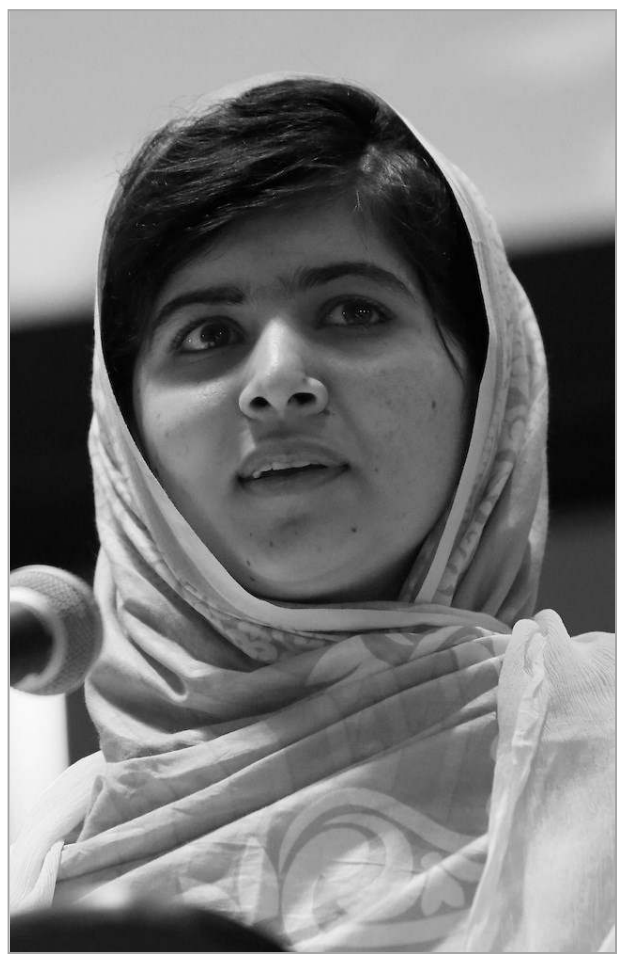
She paid for her boldness. On October 9, 2012 she was shot in the head and neck by Taliban who had boarded her school bus on its way back from school (BBC, 2013). She struggled to survive, remaining in critical condition for an extended period. Her countrymen were outraged. A group of 50 Islamic clerics issued a fatwa against those who tried to kill her. But, the Taliban continued to threaten her.

Malala Yousafzai spoke boldly into the profound problems of her beloved Pakistan, promoting education for women. She continues to speak out even after having paid such a steep price, and as a result the world is tilting on its axis: it is changing.

Her message is simple: allow children to grow, to learn the things they need to learn, to get an education.

We are listening with both ears to a young woman worth hearing.

She is a hero and we at JAID salute her. Would that the world were filled with people like Ms. Yousafzai.



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SUCCESS in Engineering Education: Applying an ID Motivational Framework to Promote Engagement and Innovation

Patricia L. Hardré, University of Oklahoma
Zahed Siddique, University of Oklahoma

Abstract: The purpose of this study was to identify motivational gaps and design to optimize for motivational needs in a current university course in mechanical engineering. The course instructor and instructional designer collaboratively used the SUCCESS framework (Hardré, 2009) to assess the existing motivational components of the course, examine gaps in the course relative to its goals, and then propose motivating strategies to address those gaps. This paper presents the model and course description, process and products of the analysis, and strategic redesign of the course to optimize motivation for engagement and innovation. This project demonstrates the iterative process of exposing both implicit and explicit motivational elements of instruction and identifying opportunities to improve them. For this process it utilizes coursework in an applied profession that requires open-ended problem-solving and solution design. It illustrates the utility of the SUCCESS framework, as well as an implementation process, for identifying and addressing motivational gaps in instruction, based on key competencies and performance goals.

Keywords: Motivational design, engineering education, collaboration of designer with SME-faculty member.

No instruction is ever only cognitive, informational or rational in nature (Dai & Sternberg, 2004). All teaching and learning includes and is powered by motivational features, for better or worse (Merriam, Caffarella & Baumgartner, 2006). Motivation and learning are situated within the context of learning environments (Brown, Collins & Duguid, 1989). In every professional field and academic subject area, instruction can be improved by explicit attention to motivational features (Hardré, 2009; 2012). Such attention is even more critical in fields with historically lower motivation, lower retention rate and existing skill gaps, such as engineering.

Need for Motivation in Engineering and Mechanical Engineering

The United States is facing an unprecedented shortage of engineers (Blue, Blevins, Carriere & Gabrielle, 2005), while the alignment of engineering curriculum models with professional career preparation is in question (Lang, Cruse, McVey & McMasters, 1998). Engineering matters more now than ever, with much of our technological innovation in every area of specialization depending on superior engineering design and development (Sheppard, Macatangay, Colby & Sullivan, 2009). Today's engineers formulate complex problems as well as solve them (National Academy of Engineering, 2004, 2005). Engineering work in the twenty-first century demands a sophisticated understanding of the interface between the natural world and the artificial (Sheppard, Macatangay, Colby & Sullivan, 2009), an interface that is central to technological advancement (Williams, 2002).

There is clear evidence of attrition and demotivation in engineering education in the United States, which has resulted in a lack of a next generation of well-prepared engineers (National Academy of Engineering, 2004, 2005). Engineering student retention represents a significant challenge in engineering education, as only about half of students who enter engineering majors actually earn engineering degrees (Burtner, 2005; Felder, Shepard & Smith, 2005). Course and program attrition are high for engineering programs nationally (Grose, 2008; Marra, Rodgers & Shen, 2012) and even higher for some engineering specialties (Hoit & Ohland, 1998). Yet fewer than 10% of students who leave engineering do so because of low grades (Kuh, Kinzie, Buckley, Bridges & Hayek, 2006). This apparent gap between demonstrated ability and success indicates that there are other (negative) motivational factors in play. As engineering educators and partners in the development of engineering educators, we cannot afford to ignore an opportunity to improve the motivational potential of engineering instruction.

Nature of Expertise in Next-Generation Mechanical Engineering

Engineering involves a good deal of technical expertise and some elements of creativity, similar to other scholarly and applied design and technical professions (Chi, 2006; Nelson & Stolterman, 2003). Corporations and employers historically report a lack of critical professional skills, such as critical thinking, problem-solving, communica-tion and teamwork among engineering graduates (e.g., Allan & Chisholm, 2008; Bradford School, 1984; Earnest & Hills, 2005; Evers, 2005; McLaughlin, 1992; Sparkes, 1990). These gaps have led the U.S. Accreditation Board for Engi-neering and Technology (ABET) to transform its accreditation criteria from content-based to out-comes-based (ABET, 2012). ABET now proposes to hold engi-neering schools accountable for the knowledge, skills, and professional values engineering students acquire (or fail to acquire) in the course of their educations.

The skills of the next-generation engineer need to be adaptive enough to address changing needs, and include innovation to address unforeseen challenges (Blue, Blevins, Carriere & Gabriele, 2005). In an innovation economy, critical thinking provides the foundation for developing meta-compe-tencies to the highest possible degree (Business Roundtable, 2005; Christensen, 2011; Dai, 2013). Consistently engag-ing in higher level cognitive activities (of analysis, synthesis, and evaluation) that lead to adaptive design expertise involves more than following a new set of procedures (Lave & Wenger, 1991; Lawson, 1997; Lawson & Dorst, 2009). As engineering educators, we want learners not merely to adopt a rote process cycle or follow a set of simplistic, external procedures; we want them to develop higher order habits of mind (Chubin, May & Babco, 2005).

Every professional field has two levels of competencies, field or task-specialized competencies, and generalized skill sets (or meta-competencies) (Bereiter & Scardamalia, 1993; Brown & Green, 2003). Task-specific competencies are benchmarks for graduates in a given field, and their level of attainment defines how prepared students are to meet job demands and excel in future (Allan & Chisholm, 2008; Earnest & Hills, 2005). General (meta) competencies are skill sets that enable them to function glob-ally, such as to communicate effectively, work in teams, function in organizations and meet quality standards, and transfer task-specific skills to new challenges or tasks not previously encountered (Radcliffe, 2005; Wulf & Fisher, 2002). Future engineering innovation will increas-ingly originate from teams of collaborators who can bring together multiple skills and perspectives (Downey, Lucena, Moskal, et al, 2006; Warnick, 2011). To revolutionize learning, we need to develop an intentional culture of reflection, in which both students and faculty develop strengths in meta-cognition and self -regulation.

The competencies and meta-competencies required of successful next-generation engineering are different from those needed in earlier eras, due to increased demand for innovation (ABET, 2012). Raw production of ideas and technical skills are insufficient for achieving innovation (Business Roundtable, 2005). The problems facing society today are increasingly global and complex in nature, so engineers need to be equipped to address issues involving economic, social, ecological, and intel-lectual capital (Christenson & Raynor, 2003). These needs include global competencies encompassing, "knowledge, ability, and predisposition to work effectively" with diverse groups of people who define problems differently (Downey et al. 2006, p. 110), to facilitate communication and understanding across nations and cultures, teams with diverse backgrounds, and technologies (Warnick, 2011).

The development of competencies to support engineering in general, and innovation in particular, spirals upward with students building on existing competencies and adding new ones as they progress through the curriculum. In this paper we focus on motivation related to developing meta-competencies that support innovation, with the understanding that specialized technical domain competencies are pre-requisite to expert problem-solving. We build on a set of meta-competencies for engineering innovation complied by various educators and researchers (e.g., Allan & Chisholm, 2008; Radcliffe, 2005). These are summarized in Table 1.

Current State of Instructional and Motivational Practice

One of the basic premises of project-based course design is that projects—in and of themselves—are motivating (Sheppard, Macatangay, Colby &

Table 1. *Metacompetencies for Engineering Innovation*

Manage Information • Ability to gather, interpret, validate and use information • Understand and use quantitative and qualitative information • Discard useless information
Manage Thinking • Ability to identify and manage dilemmas associated with the realization of complex, sustainable, socio-techno-eco systems • Ability to think across disciplines • Holistic thinking • Conceptual Thinking • Ability to speculate and to identify research topics worthy of investigation • Divergent and convergent thinking • Ability to engage in critical discussion • Identify and explore opportunities for developing break-through products, systems or services • Ability to think strategically by using both theory and methods
Manage Collaboration • Ability to manage the collaboration process in local and global settings • Ability to create new knowledge collaboratively in a diverse team • Competence in negotiation • Teamwork competence
Manage Learning • Ability to identify the competencies and meta-competen-cies needed to develop to be successful at creating value in a culturally diverse, distributed engi-neering world • Ability to self-instruct and self-monitor learning • Ability to interact with multiple modes of learning
Manage Attitude • Ability to self-motivate • Ability to cope with chaos • Ability to identify and acknowledge mistakes and un-productive paths; • Ability to assess and manage risk taking

Sullivan, 2009). Research does demonstrate that active learning (hands-on and project-based learning) is generally perceived as more motivating and engaging than passive learning (such as by lecture and reading alone) (Bransford, Brown & Cocking, 1999; Huber & Hutchings, 2005; Laster, 2009). At the same time, the nature and goals of a given project can be more or less interesting, important, engaging and motivating for different learners, based on their interests, value for the content and outcomes, and prior experience in the field of application (Cross, 2007; Fox & Hackerman, 2003; Hardré & Burris, 2011). Thus, for different tasks and learners, different projects and ways of designing project-based learning environments can have very different motivational effects (Hardré, 2009). The most effective projects for engineering education are not simple and linear, with well-defined end goals, but are characterized by true problems, that is, issues and questions without "right" or absolute answers, amenable to a range of possible solutions, some more creative and innovative than others (McCray, DeHaan, Kasper & Schunk, 2003; National Science Foundation, 2004).

The SUCCESS Framework—Potential Toolkit for Change

No instruction is ever motivationally-neutral. Every item of information, every activity, every appearance by an instructor, and every item of instructional material has motivational potential (Hardré, 2003). If these are not explicitly designed with positive motivating effects, then they may inadvertently have negative motivational consequences (Hardré, 2011). However, motivation is a rich and complex area of research and practice. It is informed by myriad theories, subfields and perspectives that can leave many designers and instructors confused and frustrated. Knowing and integrating each of these theories, and reconciling their various outcomes into a consistent motivational approach for instruction can be time-consuming and difficult, so many designers and instructors give up or default to simplistic approaches (Hardré, 2003). However, a tool that helps them make sense of this complexity can provide the structure necessary for selecting and implementing motivational components systematically in the design of instruction, and optimize effects for both designer-instructors and learners (Hardré & Miller, 2006).

The SUCCESS framework of motivating opportunities for instructional design is just such a tool (Hardré, 2011). It integrates an array of useful, theoretically-based motivating principles into a structure that supports their systematic application to instructional needs (Hardré & Miller, 2006). The seven-part structure provides a framework for applying the principles, and the mnemonic (SUCCESS) cues the various areas of application to promote coverage of all aspects of instruction. It can be used to examine the motivating elements of current instruction, and to identify and fill gaps in those areas not yet motivationally optimized.

Applying SUCCESS to Engineering Education

The following section uses an extended case illustration of implementing the SUCCESS motivational design framework in mechanical engineering education. It begins by describing the course goals, content, tasks and learners as context for the application. Then it illustrates use of SUCCESS for both assessing current strategies and guiding design of additional strategies. First, the framework is used to assess the current state of instruction, through identifying and classifying its existing motivational elements (both explicit and implicit). Second, it is used to identify where gaps exist and to design in additional motivating opportunities and elements to address SUCCESS components that were previously less well-supported, to fill those gaps.

Course Overview

Principles of Engineering Design (AME 4163) is a required university undergraduate course in mechanical engineering (ME). It functions as the pre-capstone experience for all ME majors, which means that it provides opportunity for students to synthesize and integrate their previous 80 hours of mathematics, physics and engineering subject-specific coursework, through applied team and individual projects.

AME 4163 is a single, semester-long course, which meets twice weekly for 75 minute sessions, over a 14-week semester (28 meetings, 150 contact hours). The single course section generally has 80 students enrolled. It has no outside labs, but students are required to meet in project teams, scheduled on their own times and locations. There are no content-based examinations, only applied projects comprising all graded assignments. Students form and remain in the same project teams (of 4-5 students) for the whole semester.

About ¾ of the way through the semester, the students transition to spending more time focused on preparation for the degree-culminating Capstone experience, which involves them in teams (4-5 students) working on an authentic design challenge with industry project sponsors and faculty advisors. The teams work to understand a design problem, then submit a solution design to the sponsors and instructor for the capstone project at the end of the semester

Instructor

This course is taught by a single instructor, a full professor in ME at the university, who has taught this course, in this university program, annually for 13 years. His philosophy of instruction is linking engineering fundamentals to a range of professional applications through project based learning. His research is in the area of product family design, Computer Aided Design, and Design Theory. He is also interested in understanding different aspects of engineering education and developing new tools to enhance student learning. This instructor also coaches the award-winning [university name masked] Racing Team, which participates in the Formula – SAE (Society of Automotive Engineers) student design competition. The instructor coordinates the Mechanical Engineering Capstone Program, engaging students in sponsored industry projects.

Target Outcomes and Assignments

The overarching goal of instruction for Principles of Engineering Design is that learners will demonstrate through instructor-supported experiences that they are equipped with the knowledge and skills to do eight performance tasks in mechanical engineering. These tasks are demonstrated in nine different assignments. The performance outcomes and assignments are summarized in Table 2.

Learners

Students take this course in their fifth semester of the structured degree program, so all are college juniors majoring in ME. Immediately following this course, all will progress to the Senior Design Capstone experience, so they share a vested interest in preparing for success there. In the longer term, these learners are preparing for somewhat similar career trajectories and share many of their future-oriented goals. They function as a near-cohort, in the curricular framework. Though they have not moved through the program in a single group, all have all taken the same set of 16 courses required for ME majors, from the same instructors, over the past two years. Thus, they have been in classes together numerous times, have worked together on projects before, and know each other as students.

All of these learners entered with high math and science aptitude scores (SAT average of 1280; mathscores 600-700) and combined 28.3 in ACT scores (ACT Math range of 32-25), so this is a relatively homogeneous group characteristic. Since they have all

Table 2. *AME 4163 Performance Outcomes and Assignments*

Specific Outcomes of Instruction: Students will demonstrate (through supported performance) that they have acquired adequate knowledge and skill to: 1. Apply a systematic approach to solve design problems. 2. Plan the design process. 3. Generate, evaluate and develop engineering design concepts by applying knowledge of facts, science, engineering science, and manufacturing principles. 4. Use analysis and simulation tools to understand design performance and then improve the design. 5. Manufacture an engineering design prototype 6. Generate solid models and engineering drawings of a final design using 3D modeling software. 7. Give an oral presentation and demonstration of a design project. 8. Work on a team to complete a design project.
Assignments The following list includes the graded assignments for the course, both individual (I) and team (T) projects: 1. Assignment 1 (Planning and Customer Requirements) (T) 2. Assignment 2 (Concept generation, and reduce to 4 concepts) (T) 3. Assignment 3a (CAD) * (I) 4. Assignment 3b (FEA – Structural and Heat)* (I) 5. Assignment 4a (Selection of Concepts) (T) 6. Assignment 4b (Detail design – Engineering drawings, CFD, & Simulation) (T) 7. Project 1 Final Deliverables: (T) a. Presentation b. Report (Putting everything together) c. Prototype Demonstration 8. Short and In Class Assignments/Quizzes (T) a. Short Assignment 1: Setting Goals and Evaluating your competencies b. Short Assignment 2: Understanding the Design Process – Building bridges c. Short Assignment 3: Professional and Ethical Responsibilities d. Short Assignment 4: Thermal analysis 9. Learning Essay (Self-evaluation of learning and competencies) (I)

taken the same course program for the past two years (as required by the major curriculum) they have fairly homogeneous course-relevant, recent prior knowledge and academic experiences.

Individually and viewed as a group, ME students in this institution are diverse in characteristics and background, such as socioeconomic status, race and ethnicity, nations of origin, family status and career experience. The gender mix is about 88% male and 12% female. From 90-95% tend to be traditional and 5-10% non-traditional students. About 94% are US citizens, 6% international students, and 5-10% non-Native English speakers. The diversity of the students in the course in any given semester has increased over time, so the instructor is interested in reaching a potentially broader range of motivational needs.

Design

The design of instruction is a combination of whole-class lecture-with-discussion and projects. The professor uses large-group lecture, questioning and discussion to review and support recall of students' previous course content, and to introduce principles of engineering design. Lectures are accompanied and illustrated by Powerpoint slides, presented in class and also uploaded to the course management system (CMS) website.

Students synthesize and apply the content holistically on a set of individual and group projects over the semester, with instructor support and feedback, as well as peer discussion and feedback. Projects are completed mostly outside of class and submitted as demonstration of a physically functional prototype. Each team submits a final written report to the instructor, and verbally presents its design to the class. Feedback occurs explicitly through instructor and peer feedback, and implicitly through performance of the functional prototype relative to project requirements. Students spend about 60% of class time in lecture and 40% in various forms of dialogue (questioning, discussion, feedback).

Defining the Need

The instructor has seen reduced engagement and less effective synthesis of information over the past few years. The designer and instructor recognize that a number of motivational factors can influence students' engagement, and that motivation influences students' learning, understanding and ability to synthesize information and ideas and apply them adaptively, leading to innovation. We proposed that redesigning the motivational aspects of the course across all elements would present the greatest potential for improving these key outcomes and more effectively meeting students' needs. We chose the SUCCESS framework as a strategic tool to structure that process.

We proceeded intentionally, not assuming that any existing element (such as the course being project-based) was already optimally motivating. Instead, we used the nature of existing design components as foundational starting points from which to build an even more motivating dynamic, whole-course design. We focused on individual design aspects for analysis and examined them each fully, yet throughout the process considered the course and learning environment as an integrative, coherent whole, together much more dynamic than merely the sum of its parts. Through this lens, we utilized the existing motivational elements as resources on which to leverage additional motivating strategies.

Procedure

Together the course instructor and the designer used the previously-published SUCCESS framework: first, to examine the existing mechanical engineering course and identify existing motivational strategies; and second, to identify areas that could be enhanced and to design in additional and more effective motivating strategies. The analysis and redesign process was carried out iteratively and collaboratively, with the instructor contributing primary expertise in the learners, task and subject area, and the designer contributing primary expertise on motivation theory, principles and practice. To keep the SUCCESS elements flexible and clear in our analysis and redesign processes, we referenced those sharing starting letters in the mnemonic as sequentially numbered (S_1-U-C_1-C_2-E-S_2-S_3). We also coded the strategies that supported each of our two key outcomes: engagement (e) and innovation (i).

Phase I—Analyzing Existing Strategies

In phase I, the instructor and designer used existing materials from several recent course years to identify the types of motivating components, both global design elements, and explicit strategies, that were already included in the course. This required not only extracting the elements documented in the materials, but also the designer and instructor developing an elaborated think-aloud dialogue, to illuminate additional fluid and implicit components that the instructor tended to use in his actual teaching practice. Some of these were strategies implemented as cognitive learning strategies, but which also contained embedded motivational elements informed by the SUCCESS framework. Others were strategies for communication or class management that had underlying and previously unrecognized motivating elements. Table 3 shows the results of the analysis of existing strategies.

Summary of Motivational Analysis

We identified particular strengths in the Situational (S_1), Utilization (U), Competence (C_1), Content (C_2) and Social (S_2) components. The course was already team and project-based, and included a high degree of student autonomy and control. It already provided reference to the professional design competencies in the field, and access to the technical tools needed to develop specific required performance skills. The cohort nature of the program and the digital LMS provided access to social support to develop teamwork skills and seek out expertise if individual students needed it and sought it out.

An apparent weakness across these areas was the observed lack of use of these resources, so we concluded that while access technically existed, the limited number of students actually taking advantage of them might be explained by one of three motivational phenomena: 1) lack of *perceived* (vs. actual) access (students being unaware or feeling unable to access the resources they needed); or 2) inaccurate perceptions of need (students thinking they didn't need help when they did); or 3) ego-involvement/performance goals (students perceiving that seeking help communicated perceived weakness or or incompetence). Thus, motivating more active use of the existing resources emerged as a critical goal for the redesign.

Areas with fewer or less robust motivational strategies identified were the Emotional (E) and Systemic (S_3) components. These had not been a focus of the instructor's design decisions historically, as he had concentrated on content and competence-related motivation strategies, as do most subject-area experts (instructors and trainers) without specific training or expertise in human motivation. We did identify some motivating elements in these areas, but more implicit than explicit, and most were residual effects of content-focused design decisions. Seeking to add explicit motivational enhancements in these two components was an additional goal of the redesign. In addition, the instructor adopted the goal of adding at least one enhancement strategy in each of the seven SUCCESS

Table 3. *Using the SUCCESS Framework to Identify Existing Motivational Features in the Course*

S_1: Situational (Contextual and Access issues)	Focuses on nature of learning and performance contexts, their support for autonomy, authenticity, access and control (both actual and perceived by learners). Learners provided with motivationally-positive situational features (such as choice about how they do tasks) and with access to materials and support resources more readily engage and fit instruction to their needs.	1. The learners are given a description of a problem, which requires them to address an open-ended problem -solving task. This supports engagement for active learning, along with adaptive application for innovation. (e)(i) 2. Some requirements for the device are set, but other requirements are more flexible and are not provided. Students set boundaries for their solutions. This supports autonomy independence. (e)(i) 3. Students set their own steps for solving projects, based on the phases of design processes. Deadlines for assignments and the final prototype are fixed, but students are free to determine steps needed to get from one assignment to the next. These are authentic elements, analogous to professional demands. (Assignment 1) (e)(i)
U: Utilization (Use and Transfer Issues)	Focuses on facilitating transfer by bridging the relevance gap from instruction to application. Utilization-focused motivational features of instruction connect learning and transfer through a motivational framework. Instruction needs to address how learners recognize their need for instruction and see themselves using it, both during instruction and later.	1. Lectures provide information on how material is linked to design of devices and systems. This scaffolds perceived transfer needs & relevance. (e) 2. Learners utilize the steps to solve the project, which is a novel problem (has not been solved yet), so they experience the relevance of skills in-process. (e)(i) 3. Students are shown the use of "House of Quality" for a simple problem, to support understanding of performance expectations. (Assignment 1) (e) 4. Use of engineering tools (CAD, FEA, CFD) provided for examples. (Assignments 3A, 3B) Having the tools they need accessible frees up students' thinking and motivation for problem-solving (e)(i) 5. During detail design (Assignment 4b) students set parameters and dimensions for components before building the prototype. They plan and envision goal achievement using their chosen strategies. (e)(i) 6. Students observe how other groups solved the same design problem, but generated a different solution, which supports understanding of innovation. (i)
C_1: Competence (Considerations Focused on Expertise Development)	Focuses on motivational considerations related to current competence development and future, continuing expertise development in the field. Competence is more than just confidence; it's both the actual and perceived components related to an individual's achieving target standards of knowledge and skill. This includes prerequisites (preparation), current position (readiness), and future-oriented perceptions and expectations of success (confidence and efficacy). It can be normative (comparing their ability to others'), or criterion-based, (comparing to established standards of expertise). Competence goals can be ego-involved (working to look good and be better than others) or mastery-focused (aimed at learning and being one's personal best).	1. Course uses the professional competencies as implicit scaffolds and rationales to justify design demands. This supports students in relevance and clear, credible expectations of expertise targets (e) 2. Students evaluate their own and teams' competencies, along with setting goals to develop skills. (Short Assignment 1) This causes them to review the competencies and rehearse them continuously, in order to develop definitions and vision for professional expertise. (e) 3. All assignments require students to use course material in novel situations, to develop actual and perceived competence. (e)(i)
C_2: Content (Knowledge & Information Components)	Focuses on motivational elements of information provided and supported through instruction, and needed for performance. In considering motivational features of content, designers focus on how information is communicated, how it is supported, and what is emphasized (explicitly or implicitly) about it. Content features are the most familiar to most designers, but their motivational components are often neglected.	1. Students use materials from various previous courses, to analyze components and develop project devices (Assignment 3) (e)(i) 2. The performance of the prototype provides students with feedback on their design process, leading back to evaluation of content knowledge and its utility. (e) 3. Uses students' content knowledge to support relevance perceptions, linking current instructional demands to past design courses and experiences. (e)

Table 3. *Using the SUCCESS Framework to Identify Existing Motivational Features in the Course (continued)*

E: Emotional (Affective & Personal Issues)	Focuses on personal, perceptual factors with motivational implications for instructional effectiveness. Emotional, affective, and personal issues in motivation include characteristics and thoughts about the job, knowledge, and skills that create positive or negative emotions and states (hope, optimism, anxiety, fear, curiosity, hopelessness). Emotions drive responses such as trying (vs. giving up), taking risks to innovate (vs. stay safe), and honesty (vs. cheating)—to protect the emotional self. Temperament & tendencies (relatively stable), moods (less stable & more circumstantially-driven), and emotions (complex & volatile).	1. The project and the competition present some anxiety and frustration for students, which is an authentic part of the design process. If they resolve ego issues, this is stimulating and productive. (e)(i) 2. Students get to observe how their device performs, which informs their competence and provides success experiences, or recognition of need to remediate. 3. Students design and build the prototype by themselves, so they own the project and products, promoting independence and empowerment. (e)(i)
S_2: Social (Group & Interpersonal Interactions, Relationships)	Focuses on motivational effects of social & interpersonal elements of instruction. These include how groups learn & work together, how they communicate, and how they interact with teacher-trainers and systems. Social environment considerations influence learning and performance.	1. Students work in teams, enabling social support, sharing of expertise, and encouragement. (e) 2. The near-cohort program model ensures that by this point students know each other, recognize relevant strengths, are reasonably comfortable together. 3. Teams have high degrees of shared knowledge and skill (supporting common discourse and effort), promoting healthy teamwork. (e) 4. Members also each bring some unique expertise, promoting recognition and value of individual skills, and insights gained through differences. (e)(i)
S_3: Systemic (Organizational & Systems Considerations that Facilitate Performance Improvement)	Focuses on motivationally-relevant elements of instruction, related to the system & organization in which it exists & for which it occurs. Systemic motivational elements support learners' being motivationally positioned to put forth consistent effort. Designers need to examine reasons for instruction in the larger workplace system and determine how to inform & align learners' motivations & efforts.	1. Students use mathematics, physics, statics, dynamics, etc. learned during their course of study and try to apply it to design a device to solve the problem. This presents authentic use of discrete information selection and application to unique, open-ended problems. (e)(i) 2. Course pulls together and requires synthesis and application of all courses to date (solids, thermal, mechanical components), supporting the links across the whole curriculum to competent design. (e)(i)

components, whether analyzed as strong or weak, to help ensure optimizing motivation for this instruction. In particular, these enhancements are targeted to address an even broader range of this increasingly diverse student group.

Phase II—Enhancing Instruction with Additional Strategies

In phase II, the instructor and designer used the SUCCESS framework to identify additional motivating opportunities in the course, both in its global design elements, and among more nuanced explicit strategies. This required identifying those course components that were more and less well-supported with motivating features, across the scope of motivating elements presented in the SUCCESS framework. We used the terms, lists and illustrative examples from the SUCCESS model to cue possible ideas and then collaboratively developed these into motivating elements. The focus of optimizing motivation was on areas of the course that we had judged as less motivationally optimized, and those historically demonstrated as either more challenging or less engaging based on learner behaviors and explicit feedback (e.g., verbal comments and formal course evaluations). The target instructional outcomes of this process were to enhance engagement to support learning and development, aimed at facilitating ME innovation. Table 4 shows the results of the development of additional strategic motivating opportunities based on the SUCCESS framework.

Summary of Motivational Redesign

We identified a number of implicit motivating strategies that the instructor saw but admitted that some students apparently understood and used, but others were probably missing. These were not functioning as optimally motivating, because of an apparent gap in students' perceived needs or access. The instructor added explicit elements to make these strategies clearer, more obvious to all learners. In some instances this involved actually *explaining why* they were included in

Table 4. *Using the SUCCESS Framework to Identify Additional Motivating Opportunities in the Course*

S_1: Situational (Contextual & Access issues)	Focuses on the nature of the learning and performance contexts, their support for autonomy, authenticity, access and control (both actual and perceived by learners).	1. Students will be provided with greater access to information and examples of design processes, to improve the range of challenge and meet diverse needs of learners (remedial/ advanced-extended). This also offers the motivational benefit of independent exploration for solution development. (e)(i)
U: Utilization (Use & Transfer Issues)	Focuses on facilitating transfer by bridging the relevance gap from instruction to application.	1. Students provided with more complex examples of "House of Quality" to show that it is used in practice to determine & set different requirement targets. (Assignment 1) (e)(i) 2. Examples will be provided for detail design (Assignment 4b) to set parameters and dimensions for components before building the prototype. (e)(i)
C_1: Competence (Considerations Related to Expertise Development)	Focuses on motivational considerations related to current competence development and future, ongoing expertise development in the field.	1. Final prototype provides more specific and concrete performance feedback, opportunity for students to go back and reflect on their design decisions, to determine what worked & what did not. (e)(i) 2. Use professional competencies more explicitly and openly to scaffold design reasoning and also model how they operate in multiple solution paths. (e)(i) 3. Innovation will be even more explicitly encouraged, and as component of future professional needs. It functions as an indicator of advanced competence in addition to basic performance on assignments. (i)
C_2: Content (Knowledge and Information Components)	Focuses on motivational elements of information that is provided and supported through instruction and needed for performance.	1. Develop scaffolds that will build on student knowledge of CAD, FEA, and other simulation based design software to analyze and predict performance of design. (e)(i)
E: Emotional (Affective and Personal Issues)	Focuses on the personal, perceptual factors with motivational implications for instructional effectiveness.	1. Encourage more active group-based learning, by modifying some of the assignments to more team-oriented tasks, where students can learn from each other. (e) 2. To help ensure productive effects of competitive stress, instructor will monitor for learning versus performance goals. (e)
S_2: Social (Group, Interpersonal Interactions, and Relationships)	Focuses on motivational effects of social and interpersonal elements of instruction.	1. Students will have greater access to instructor and peers in class through message boards, lectures & office hours. (e) 2. Instructor monitors even more closely not providing students with answers, but supporting original ideas for possible approaches to independent problem-solving. (e)(i) 3. Strive to balance competition and the cooperative climate, to gain motivational advantages of both. (e)
S_3: Systemic (Organizational & Systems Considerations that Facilitate Performance Improvement)	Focuses on motivationally relevant elements of the instruction in relation to the system and organization in which it exists and for which it occurs.	1. Students are provided with examples that relate how the different concepts are applied to design systems, across a broad range of systems and in the context of different jobs that students may have after graduation. (e)(i)

the course.

To address the goal of increasing actual use of the existing resources, we designed explicitly to address the three possible causes of students' lack of use. For possible perceived lack of access, we added more information about the resources, where they were located and how to access them. These were embedded in the instruction both up-front in the syllabus and at strategic points in the lecture-discussion notes (to remind the instructor when to feature them). To address the issue of possible lack of perceived need, we added more explicit guidance on how and when particular resources could or should be most useful, and under what circumstances students should seek them out. These also were embedded both in the general course information (within the LMS) and also highlighted in the lecture-discussion notes, for the instructor to explicitly share in class.

Addressing the possible explanation of students' individual or group performance goals preventing them from seeking help they needed was a more complex challenge that required explicitly supporting a culture change toward reduced ego-involvement and a shared culture of learning-through-error. While this culture was consistent with the instructor's philosophy and style, he had assumed the students "caught" it implicitly, so he didn't need to have "taught" it explicitly. In discussion, the designer and instructor determined that given the potential value-added for students, it would be worthwhile to make this component of the course design much more explicit. Designing in this type of goal revision required several elements: 1) intentional role modeling of error acceptance and value of learning goals by the instructor (instructor modeling or "stepping off the pedestal moments"); 2) explicit and clear statement of the importance and necessity of seeking help (or "it takes a village messages"); and 3) acknowledgement and celebration of students demonstrating productive help-seeking (highlighting peer modeling). Together these strategies addressed the key components required for goal retraining. Some students already demonstrated high error tolerance, willingness to take risks and learning goal orientations, so the instructor and designer believed they would readily adopt the learning culture and support the shift for their peers retaining performance goals.

Specific strategies to address the two weaker areas included attention to systemic features of the course and curriculum, along with balancing some emotional class features. The instructor was already aware of strong emotions and expectations tied to the course, but was concerned that these were not always healthy emotions. He identified a high level of performance anxiety around the design competition for some students, while others just seemed to thrive on the competitive element. Based on these observations and our discussion of various goal sets and their benefits for different students, he more explicitly designed in balance across the competitive and cooperative components of the course, in an effort to gain the motivational benefits of both.

Additional enhancements across the course design included one or more in each area, including:

- S_1: Enhancing access to examples
- U: Providing more complex illustrative examples
- C_1: Enhancing performance feedback, Linking more clearly to professional competencies, and More explicitly encouraging risk-taking toward innovation
- C_2: Increased scaffolding for use of software tools
- E: Encouraging more group-based learning and monitoring goal sets
- S_2: Increasing access to instructor and peers, supporting original and innovative ideas
- S3: Providing a broader range of examples across professional systems and contexts

Some key elements of the redesign overall included: making implicit efforts more explicit, drawing students' attention to resources that already existed, enhancing students' willingness to seek help from others by infusing that value into the learning climate, and addressing the "why" question regarding design elements with underlying motivational potentials. It is notable that most of these enhancements constitute only minor, not major, course revisions. They require only small investment of additional resources, costing little to implement (in terms of funding, equipment or technology, or extra instructor time or energy). They result mostly from redirecting or increasing the students' and instructor's awareness and perceptions of opportunities already afforded to them. Part of the redesign was the shift to assuming less and making explicit more, increasing the accessibility, salience and motivational effectiveness of existing instruction for more of the students in the class.

Discussion

This collaborative project illustrates the strategic process of systematic motivational redesign, showing how to make an already good course or educational program even better. It is grounded in first design principles (Merrill, 2007), and moves beyond them to integrate advanced principles of motivation (Hardré, 2009), along with domain-specific competencies (ABET, 2007; NSF, 2004). This approach supports solution-driven design via developing critical thinking and innovation (Kruger & Cross, 2006), contributing to future needs of mechanical engineering design (Lattuca, Terenzini & Volkswein, 2006). It takes engineering education beyond rote tasks or procedures, into a dynamic of learning environments that targets requisites of next-generation engineering. This process addresses the need for focused scholarly work on the redesign of teaching and learning environments (Weimer, 2006).

Engineering courses and curriculum are notorious for very low retention rate of students, and many who do finish are not developing adequate skills to be successful. Motivation plays a crucial role in retention and development of basic competencies, and even more in the adaptive thinking necessary to support innovation demanded of future engineers. Yet, at the course level, many engineering instructors do not focus on motivational features, let alone design them systematically to infuse motivation. Ironically, direct attention to motivation is lacking, while engineering educators and employers raise concern about factors that motivation has the power to influence, like task performance, course completion and program retention. One reason for ignoring motivation may be that engineering instructors lack knowledge and expertise in this area and have not yet found a tool to make it accessible. Even instructors with knowledge of and consciousness of motivation tend to focus on content and information almost exclusively, rather than the broader social, contextual and systemic features of the learning environment captured in the SUCCESS framework. Like the engineering professor in this project, instructors with or without expertise in motivation and psychology can utilize a framework like SUCCESS, which contains a no-frills distillation of key motivating strategies. With it they can analyze the existing motivational features of their courses, identify gaps and areas for improvement, and fill the gaps with strategies to enhance the motivational effectiveness of their courses.

Another reason that engineering instructors may not see the need to attend to motivation in more advanced and applied courses is that they assume that project-based courses are automatically motivating. Indeed, research does demonstrate that doing something is generally more motivating than doing nothing, that having content-relevant hands-on activities tends to help most learners engage than sitting for hours listening to lectures. However, there is a vast range of motivating potential among project-based components and designs, so they are not all equally or optimally motivating. This project demonstrated that even an already project-based, learner-centered, hands-on engineering course can be further enhanced through systematic analysis and redesign. Implementing this kind of motivational enhancement program-wide offers potential not only to increase immediate engagement, but also to improve longer-term course completion and program retention. For students, value and utility in course content and activities, and positive motivational culture in learning environments help keep them going even when challenges arise. Beyond individual students and courses, the accrued effects of motivated learning yield lasting benefits for instructors and programs.

From a curricular perspective, as engineering students develop more advanced skills, laboratory and project-based courses with open-ended design problems provide students with opportunity to work on authentic projects and consequently can improve student motivation. However, in most fundamental and foundational courses, it is more difficult to introduce authentically complex projects because students do not yet have adequate skills to succeed at them. While any course can be motivationally enhanced, foundational courses present even greater motivating challenges than more advanced courses. They tend to be taught by less experienced instructors, and include fewer applied (more lecture) activities. It is in the first years, in these foundational courses, that most engineering student become disillusioned (or simply bored) and quit to pursue other majors. It is also in these early courses that students need to develop the foundations of expertise, which include not only technical skills but also habits of mind like adaptive and creative thinking. Students can benefit from motivational strategies explicitly considered and implemented in all courses and at all levels, particularly in these foundational courses that set them up for success or failure. As demonstrated in this engineering design course, the SUCCESS framework provides instructors with a tool to identify motivational gaps and redesign motivational features of both the course content and the learning environment. The framework and approach are also applicable to courses at all levels (not just advanced), to all types of engineering (not just mechanical), and to other complex applied sciences beyond engineering.

From a professional development perspective, having instructors learn to use a toolkit based on a broader framework than they normally plan within can help them think about and become aware of more potential strategic design options than before. As the engineer-instructor in this project found, the process of strategically implementing the SUCCESS framework on even a single course may have residual effects on instructors' thinking about future courses and less formal mentoring, promoting innovation and ongoing development in teaching. It is, in effect, giving them tools to go on teaching themselves (colloquially "teaching them to fish" for motivating students).

The process demonstrated in this project was also an example of reciprocal, collaborative interdisciplinary faculty learning, as the engineer-instructor grew to better understand the terms and principles of motivation, and the instructional designer grew to better understand the terms and principles of engineering. As each developed deeper and more integrative understanding, we were individually and collectively more able to leverage that understanding to develop nuances within the course redesign. By working iteratively and collaboratively, we checked and vetted each other's ideas, refining as these developed, and considering options from multiple divergent perspectives. As we worked, we recognized that we were engaged in the very same process that we were working to promote in the learners. We also recognized that we were experiencing the same motivational characteristics that we sought for students to experience.

From a program improvement perspective, beyond individual faculty, such strategic improvement offers potential to update and improve whole programs, providing documentable change aligned with the demands they face. Through improved student learning and skill development, motivation can address student performance standards like improving scores on engineering professional exams (which now explicitly reflect on quality judgments of engineering programs). It can address needs like the recent ABET challenges to program accountability and innovation. Instructors often resist unfamiliar, novel or innovative changes to their teaching, but resist less if the change is consistent with some aspects of their style and expertise, if it fits in some way with their existing habits of mind. The SUCCESS framework offers a reasonably intuitive and palatable way to promote faculty improvement that leverages the pragmatic tendency of engineers to integrate theory and design for adaptive problem-solving (in what one engineer termed "a design-it, build -it, and make-it-work" way). Because of these parallels, born of the similarities between instructional design and other design disciplines (like architecture and engineering), the nature of the framework may help bridge the gap to improve motivation and its critical effects in engineering education.

Overall, this applied case demonstrates the utility of the SUCCESS framework as a tool for analyzing and optimizing motivational elements of instruction design to address specific instructional outcomes. The SUCCESS framework is multi-theoretical so it reconciles the conflicting strategic messages and assertions that practitioners often experience from trying to collect ideas from discrete theories separately. It is integrative of cognitive and affective elements of instruction with potential motivational impacts, so that learning and motivational goals of instruction need not compete in design decision-making. The framework is designed to be independent of any particular instructional design process or curriculum model, to function adaptively across them. It has further been demonstrated as applicable across learner groups, disciplines and subject areas, and target outcomes from foundational knowledge and applied skill development to social and cultural change.

Engineering is a challenging field, requiring the integration of advanced math and science skills, a depth of both discipline-specific "book knowledge" and applied skills, and a degree of creativity and adaptivity to support innovation. However, it can be made accessible and motivating to many more students who possess the requisite background and ability, those whom the field has historically not retained. As this application project demonstrates, a strategic motivational framework can be used to gain a broad and integrated perspective of the motivational elements of a course or program; to examine their theoretical effects for a given learner group, context and tasks; and to consider the potential for motivationally enhancing the whole from this perspective. The benefits result from a bit of design engineering, integrating information on motivation theory (operationalized into a usable strategic framework) with subject area expertise (that enables leveraging those strategies into the specific goals and context).

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Motivating e-Learners: Application of the ARCS Model to e-Learning for San Diego Zoo Global's Animal Care Professionals

James Marshall, San Diego State University
Matthew Wilson, San Diego State University

Abstract: With dropout rates more than double that of classroom-based training, online learning comes with inherent challenges. Careful and deliberate instructional design can increase the effectiveness of online courses—including the motivating of learners to engage with the instruction and persist to course completion. This article describes the application of the ARCS Model of Motivation to the development of animal care e-learning at San Diego Zoo Global. It highlights five tactics represented in the developed training as best practices, and describes the alignment of each to ARCS model components.

Keywords: e-learning, ARCS, motivation, instructional design, training

Introduction

Not-for-profit zoos, aquariums, museums, and analogous non-profit institutions often face steep budgetary and other resource-related barriers. This is certainly true when it comes to providing consistent employee and volunteer training, and ongoing development of these important human resources. San Diego Zoo Global (SDZG) sought to address this challenge by implementing an online learning program for employees and volunteers. The anticipated benefits included standardized, replicable training that was cost-effective to deliver.

Beyond its own workforce, SDZG envisioned delivering the e-learning to similar institutions around the globe. Careful consideration was given to the organization of content and module topics. The initial development included a 13-module program to train individuals who care for exotic animals. SDZG anticipated that sitting behind a computer could be an unattractive way to learn for many in this audience of animal keepers. With their typical day spent outdoors, caring for, and interacting with, animals, it is not difficult to imagine some disfavor when it comes to being "sentenced" to complete e-learning modules in an office, on a computer or tablet.

The design team dedicated itself to the application of motivational strategies to address both the audience, and its acquisition of the complex content to be covered. The team leveraged the ARCS Model of Motivation (Keller, 2010; Keller, 1987) as its framework and integrated related strategies both in the overall course design, and throughout each of the developed modules.

This article describes the integration of tactics to motivate the organization's e-learners as organized by Keller's ARCS Model of Motivation (2010). In particular, the case highlights the e-learning modules produced to train animal care professionals as an applied example.

Background

Moving to an e-learning delivery model can be a challenging transition for any organization. Yet, this transition is occurring. The American Society of Training and Development's 2012 industry report found 37.3% of training hours overall are now delivered via online or computer-based technologies (ASTD, 2012). Mobile and social network-based learning are more recent contenders with which organizations must increasingly grapple.

Table 1. *Keller's ARCS Model Summary (Keller, 1987)*

Category	Definition	Basic Tactics
Attention	Capturing the learner's interest; stimulating curiosity to learn	• Perceptual arousal: capturing learner interest • Inquiry arousal: stimulating an attitude of inquiry • Variability: maintaining learner attention over time
Relevance	Meeting the learner's needs and goals, effecting a positive outcome	• Goal orientation: meeting learner's needs • Motive matching: providing learners with appropriate choices, responsibilities, and influences • Familiarity: tying instruction to learner's experiences
Confidence	Helping the learner build the belief that s/he will succeed, and giving the learner control over his/her success	• Learning requirements: building a positive expectation for success • Success opportunities: enhancing learners' beliefs in their competence • Personal control: illustrating that learner success is based on their efforts and abilities
Satisfaction	Reinforcing the learner's accomplishments with internal/external rewards	• Natural consequences: providing meaningful opportunities for learners to use their newly acquired knowledge • Positive consequences: providing reinforcement to learners' success

When compared to the corporate sector, most non-profit organizations face smaller budgets. Smaller organizations may also lack the internal know-how—both with regard to subject matter and instructional design. Plus, e-learning comes with its own challenges. Carr (2008) estimates the dropout rate for online students to be 10–20% higher relative to that of the traditional classroom. Levy (2007), in a review of the literature, notes attrition rate estimates for distance and correspondence education range from 25% to 60%. While reported attrition rates for adult, organization-based e-learning courses vary widely, most are unquestionably higher than their traditional, classroom-based training equivalents.

For organizations to optimize their investment in e-learning and combat the threat of attrition, instructional designers must carefully attend to the learner. Careful consideration and accommodation of the target audience's prior knowledge, interests, and experiences all inform the design of motivating instruction.

Motivating the e-Learner

Motivational design in the context of learning refers to "strategies, principles, processes, and tactics for stimulating and sustaining the goal-oriented behavior of learners" (Keller, 2010, p. 23). It is not separate from the process of instructional design and learning environment design, but rather a subset of those disciplines.

The ARCS model was developed by John Keller based on an extensive review of motivational literature, and then honed through application and research over time. A clustering of motivational concepts based on their shared attributes yielded four major categories: *Attention*, *Relevance*, *Confidence*, and *Satisfaction* (Keller, 1987). Each precipitates specific strategies for stimulating motivation. Successful application requires a keen understanding of the targeted audience, the involved content, and the application of that content on the job. Table 1 (Keller, 1987) provides an overview of the ARCS Model and includes a brief summary of related tactics.

Motivating San Diego Zoo Global's e-Learners

San Diego Zoo Global is not your typical non-profit. Over 3,000 employees in more than 35 countries, and over 2,000 volunteers, support an organization that is ranked the number one zoo in the nation for attendance. Over 5 million people visit one of its campuses each year. The organization's rich history dates back to the zoo's founding in 1916 with animals left behind by the Panama-California exposition. The 97 intervening years have seen the organization grow in many ways. Its innovations in animal care, exhibit design and interpretation have garnered global recognition. But these advancements, and the resulting best practices, often remain within the organization, buried in pockets of its two campuses and countless research posts across the globe. The organization recognized that dissemination of this expertise could benefit its employees and peers in similar organizations if leveraged as the foundation for its workforce development.

Begun in 2010 through a partnership with San Diego State University's Department of Learning Design and Performance, SDZG and its development partner have now produced more than 20 training modules that cover animal care, animal natural history, human resources, customer service and interpretation content. The initiative commenced with the development of animal care-focused e-learning. ARCS-supported tactics were employed throughout the coursework to build and sustain the learner's motivation for engaging with the instruction and achieving the outcomes it involved. Table 2 provides an overview of these tactics that have been applied to the full complement of e-learning modules—whether targeting animal care, customer service or interpretive training. Descriptions and examples of each of the five tactics follow Table 2.

Tactic 1–Case Studies using Zoo-related History and Experience

Many consider storytelling to be the oldest instructional strategy. Societies have conveyed key pieces of information in this way throughout history (Andrew, Hull & Donohue, 2009). Yet, in 2009 a study e-learning practice, Marshall & Rossett (2010) found that just 25.8% of responding practitioners regularly based their e-learning programs on realistic scenarios that press employees to make choices and learn from the results of those choices. Only 14.3% indicated aspirations to do so in the future.

SDZG wanted its workforce professionals, as well as those in similar organizations around the world, to benefit from the considerable institutional knowledge generated by a century's worth of experience. The e-learning design benefits from the organization's vast experience through integrated case studies that provide a vivid context for the content each module delivers. The case studies align with the ARCS model categories of *Attention* and *Relevance* in particular.

Case Studies to Attain and Maintain the Learner's Attention

Inquiry arousal involves raising a question in the learners mind. That question serves to press the learner to find an answer, which is accomplished through engagement with the instruction. The animal care e-learning modules are designed with "bookends" that provide an introduction and conclusion in the form of a video-delivered case study. The introductory video introduces the case by presenting a real-life problem or case that the San Diego Zoo faced at a given point in its history. The learner is then challenged to consider how

Table 2. *Overview of Strategies and ARCS Component Examples*

Strategy	Examples ARCS Components Addressed
1. Case Studies	• Uses inquiry arousal to gain **attention** by stimulating curiosity. • Connects the learner's interest in, and familiarity with, animal care with **relevant** problems from SDZG's history.
2. Rich Visuals	• Stimulates perceptual arousal, captivating the learner's **attention** through visual interest. • Visually demonstrates techniques to aid in their demystification, creating a positive expectation for success, and thus building the learner's **confidence**.
3. Module Organization	• Standardized interface and module sequencing reduces extraneous cognitive load and makes learning more efficient, resulting in increased **confidence** for learning, and **satisfaction** with the learning experience.
4. Interaction	• Interaction provides variability in the learning experience to support maintaining the learner's **attention**. • Interactive assessments that closely follow the presentation of new material allow learners to test their mastery in a safe environment, building **confidence** and positive expectations for success. • Feedback provides learners with reinforcement and positive outcomes from their efforts, which can boost **satisfaction**.
5. Learning Guidance	• Advance organizers, coupled with case studies that pose questions and stimulate inquiry, help to gain and maintain learner **attention** by providing clues as to how topics will build on and connect to one another. Supporting the learner in making such connections increases **confidence.** • Provides an overview of how information will progress, indicating how the mastery of one topic can lead to the mastery of the next. Examples vs. non-examples present a view of what success looks like, building **confidence** by providing a concrete path to success and guiding against potential pitfalls. • Elaboration theory provides a roadmap that gives learners cues as to what successful assimilation of information looks like. When learners successfully traverse that roadmap, the schema that the advance organizers presented support **satisfaction**.

Table 3. *e-Learning Module Organization and Strategy*

Menu Category	Strategic Purpose
Introduction	The introduction section profiles module creators and presents the introductory video-based case study. **Introduction to the module creator(s).** The introduction provides a brief biography of each Subject Matter Expert (SME) and a brief statement of why he or she believes the material presented in the module is of vital importance. This serves to promote the accuracy and credibility of the module content in a field where such authentication is regularly questioned. In addition, it serves to establish the topic's relevance in the animal care field. **Video case study.** A 2-3 minute video case study depicts a real-world case relevant to the module material. Each concludes by prompting the learner with a question that should be considered as he or she accumulates new knowledge throughout the module.
Objectives	The objectives section alerts the learner to the model's outcomes which he or she is expected to master. The objectives provide the learner with an advance organizer or basic scaffolding for the content with which the learner will engage. Understanding what is expected serves as a building block toward increasing learner confidence.
Content	The core content in each module. It contains text for the learner to read, multimedia such as video and visual diagrams, and opportunities for interactive practice and feedback. Strategies employed here, and described throughout this article, attend to all ARCS model categories.
Practice	The practice section provides a final opportunity for practice and feedback before the learner proceeds to a mastery quiz. Practice topics are comprehensive and provide a variety of questions that involve content across the entire module. Practice and feedback are a critical means for building confidence. In addition, and when well designed, such opportunities support the satisfaction component of ARCS.
Conclusion	Here, the resolution to the video case study is presented. It explains how the module material applies to the challenge posed in the case study and examines the best practices as they relate to addressing that challenge. Again, because case study content is drawn from real-life, critical episodes in SDZG history, these e-learning elements serve to gain and maintain attention and establish relevance for the instruction. In addition, learners may build their confidence as they reach the case study conclusion and observe their solutions and underlying thinking match that of the experts.

that challenge might best be resolved. As the module concludes, the e-learner is reminded of this framing case study. He or she is challenged to offer a solution, after which the historical solution is presented in a concluding video.

Inquiry, or curiosity, arousal has been shown to increase recall and performance. Keller (2010) cites an interesting example of how this can work. He explains how Berlyne (1954) conducted a study in which one group of students was given a set of "fore" questions prior to instruction, while another group was given only instruction. This researcher found that the fore questions resulted in greater curiosity towards the instruction and better recall when presented with a set of post-questions following instruction.

Keller notes that attention is heightened when case study details are concrete, rather than abstract. Keller suggests, "Generally speaking, people are more interested in specific people and events than in abstractions" (Keller, 2010, p. 93). The e-learning benefits from "real," animal care-related episodes from SDZG's rich history. For example, Newcastle's Disease, which could have affected the organization's entire avian population, is used to bookend the Zoonosis and Biosecurity module. The learner is presented with the problem of a potential spread of the disease throughout the collection and challenged to pursue the instruction for a solution. Each module's conclusion provides the historical resolution to the presented case.

Video, with rich images and sounds, was employed for the case studies with purpose. As Bishop and Sonnenschein observe, "sounds are particularly good at gaining attention because, unlike eyes, ears can never be averted or shut with 'earlids'" (p. 6). Here, the dual emphasis on visuals and sounds reflects the animal care audience. These are professionals who rely heavily on both senses when caring for animals, not to mention assuring their safety, in the field.

Case Studies to make Learning Relevant

A carefully selected case can also motivate learners by making the e-learning relevant. Careful analysis that explores the work, worker and workplace (Rossett, 1999), is prerequisite to identifying a relevant case topic, and designing a case study that aligns with the target audience. Zoo personnel are passionate about animals and dedicated to providing their charges with the best, and most proper care. The fact that case studies are pulled from historical challenges faced by SDZG animal care professionals like themselves provides authenticity and relevance. The audience is challenged to solve problems similar to those they will face in the course of their daily work and career.

Tactic 2–Rich Visuals to Convey Content

Integrating rich visuals into the e-learning was largely a foregone conclusion, given the audience and content. Caring for animals is a visually-intensive pursuit. Will Rogers said, "The best doctor in the world is the veterinarian. He can't ask his patients what is the matter—he's got to just know." The same is true for animal keepers. Their daily observations of animals must detect the subtlest of changes in appearance or behavior.

Given the considerable visual component of their work, it is not difficult to imagine how a largely text-based e-learning experience would threaten the e-learners motivation to persist. Rich visuals were carefully integrated into the e-learning to motivate the learner, most directly in the *Confidence* and *Attention* categories.

Building Confidence through Illustration of Facts and Concepts

The act of animal husbandry and care is comprised of many active, physical tasks. At first glance, such outcomes may seem a less-than-optimal match for e-learning delivery. The fact that these types of outcomes may not be best presented verbally or via text was carefully considered and directly addressed. A significant part of the solution was deliberate use of visuals to facilitate learning, and support the e-learner's burgeoning confidence toward mastering the subject matter.

Creating a positive expectation for success is one strategy for building learner confidence. The ability to depict important tasks visually, especially complex procedures, demystifies those tasks. That demystification enables the learner to visualize his or her own successful completion of those tasks, thus increasing learner confidence.

The *Zoonotic Disease and Biosecurity* module provides an example. It includes significant amounts of content addressing the proper use of Personal Protective Equipment (PPE) to reduce the probability of contact with infectious material. This includes specific steps for donning and doffing PPE properly. Physical motor skills for a task such as removing gloves without coming in contact with potentially contaminated areas can be difficult to describe verbally. As a result, the use of video was vital for communicating these particular concepts. The step-by-step process for proper donning and doffing PPE was shot in high definition video and enhanced to highlight crucial details by attending to

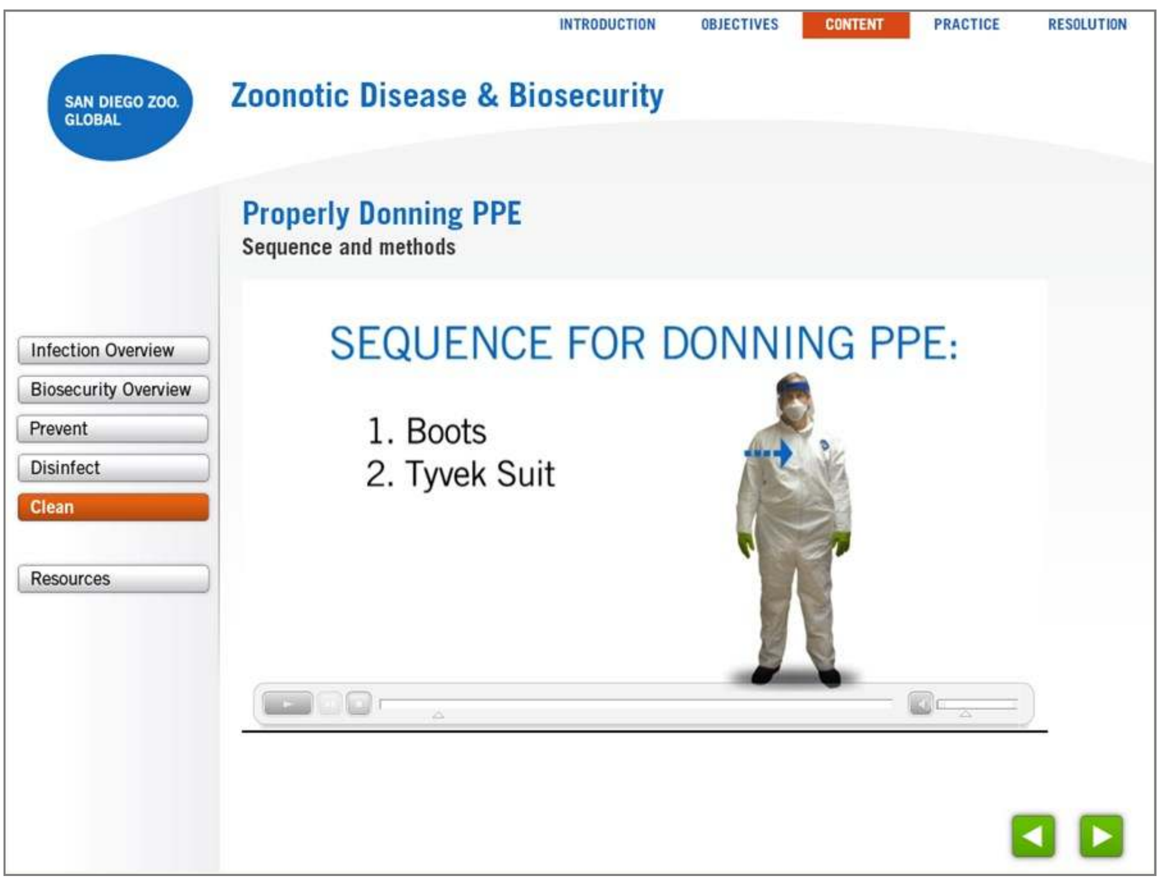

Figure 1. Rich Visuals and Video to Support Confidence in Procedural Tasks Gaining Attention with Visuals.

optimal performance and common mistakes identified through task analysis (Figure 1).

Gaining Attention with Visuals

The use of rich visuals is an equally effective tactic for gaining and maintaining learner attention. One of the ARCS basic tactics for gaining attention is perceptual arousal; in this case, using dynamic visuals to captivate the learner. With thousands of visual assets to choose from, San Diego Zoo Global e-Learning extensively leverages perceptual arousal to capture attention.

Here too, the need for concreteness is accommodated. Using rich media provides both specificity and concreteness. In addition, variability in the types of media employed helps maintain the learner's attention over the course of an instructional session.

Tactic 3–Standardized Module Organization and Flow

Managing the learner's cognitive load is an important aspect of any product's instructional design (Sweller, 2005). This is especially true for e-learning products that must facilitate the learner's focus on content, and minimize extraneous cognitive load (i.e., time spent understanding the module's organization, or determining how to operate the interface). Successful management of cognitive load not only promotes learning, but can also positively affect learner persistence in a given learning experience.

The e-learning design carefully attended to cognitive load through both the user interface (UI) and flow of information. Major module sections were standardized. Modules were outfitted with a standardized top menu (Figure 2). The module organization, represented in the highest-level, five-section, top-right menu, is consistent across all modules (see Table 3). As the learner traverses the module, the menu automatically highlights his or her position. As a result, this menu serves two primary functions:

- Advanced organizer: The menu serves as the module roadmap, laying out the path for the flow of content in a standardized way across all modules.
- Position Tracking: Tracks the learner's current location.

As a result, learners become familiar with the structure, and dedicate less processing time to interpreting the module's organization and operation (AlTaboli & Abou-Zeid, 2007). Table 3 describes each module element and highlights its strategic role in motivating the e-learner.

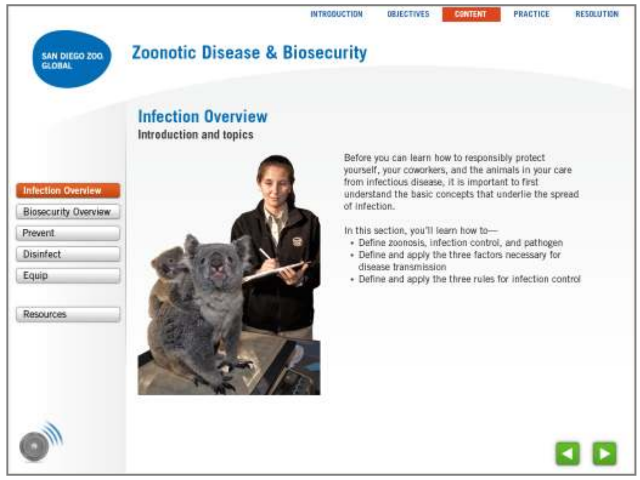

Figure 2. Standardized Interface to Reduce Extraneous Cognitive Load

Tactic 4–Interactive Practice and Feedback

Embedded opportunities for the learners to interact with the module content provide another tactic that supports motivation. Interaction stands in stark contrast to e-learning products that are little more than document text repurposed for online delivery. Interactivity can impact each of the ARCS categories, but is perhaps most directly aligned with *Attention* and *Confidence*.

Maintaining Attention with Variability

Variation in module's content delivery helps to maintain learner attention over time. Interactivity is a helpful tool to vary module content in an intuitive way. Presentation of new information can be followed by interactive, informal checks for knowledge. Regular e-learning segments that require the learner to take action and control of the content delivery and progression provide this variability.

Building Confidence and Ensuring Satisfaction with Feedback

Motivating instruction also supports the learner in building confidence with the module's content. Providing opportunities for the learner to "prove" newly acquired knowledge supports incremental increases in confidence as the subject matter is mastered. The SDZG animal care modules incorporate interstitial checks for understanding and provide opportunities for application of learned content. Each interaction allows the learner personal control over the experience. As a result, the learner's success is within his or her own grasp. Interactivity, in the form of a variety of interactive exercises and queries, cue the learner to exert his or her mastery over newly acquired material. Basic examples include multiple choice, matching, and fill in the blank questions. More complex, scenario-based activities that challenge the learner with multiple dimensions are also offered (Figures 3-7).

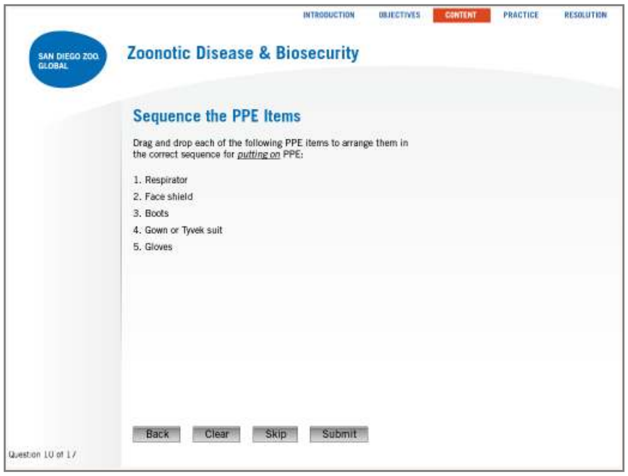

Figure 3. Example Interactive—Sequencing Question.

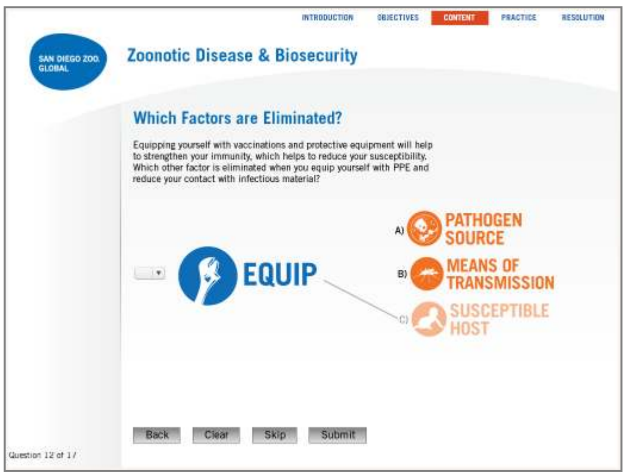

Figure 4: Example Interactive—Visual Multiple Choice Question.

Figure 5: Example Interactive—Fill-in-the-Blank Question

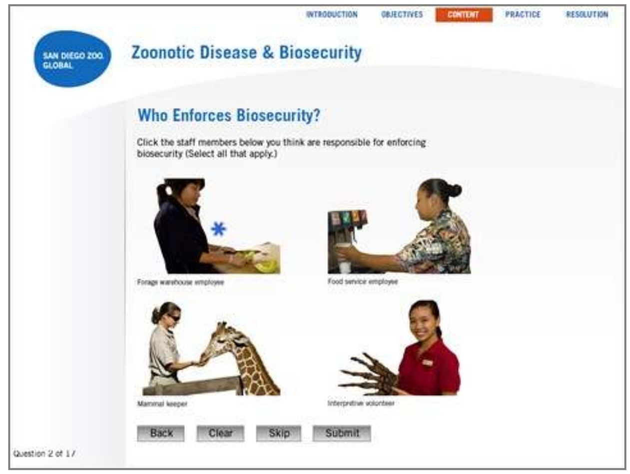

Figure 6: Example Interactive—Visual Identification Question

Figure 7: Interactive Example—Scenario-based

Successful instruction also attends to learner satisfaction. Feedback is a helpful tactic for accomplishing this important ARCS category. In particular, Keller (2010) suggests that designers "provide feedback and other information that reinforces positive feelings for personal effort and accomplishment" (p. 189). Regular opportunities for both interaction and feedback promote learner satisfaction. Such interactions must be perfectly aligned with presented content. A difference between the content that is presented and assessed causes a significant threat to learner satisfaction.

Tactic 5–Learning Guidance through Examples and Non-examples, Advance Organizers and Mnemonics

Learning guidance provides the learner with instructions and support as he or she works to internalize the module content. Here, the modules employ specific strategies to direct the acquisition of knowledge. Successful design helps manage the learner's cognitive load over the course of a multi-hour, content-rich e-learning module. As a result, learning guidance can support the e-learner's motivation across each of the four ARCS categories.

Using Elaboration Theory and Advance Organizers to Motivate

Elaboration Theory (Reigeluth, 1992) suggests that instruction should be structured and presented in an order of increasing complexity. Fundamental ideas are presented first, with increasingly complex, related ideas added throughout the course of instruction. The complexity of the animal care module topics provided regular opportunities to sequence instruction in this manner.

The Zoonotic Disease and Biosecurity module provides a helpful example. The initial content section defines a zoonotic disease, proceeding to describe its characteristics and how it is spread from host to host. This introductory segment is followed by multiple sub-sections identifying various, increasingly complex, strategies for preventing disease transmission. The instruction moves from simple strategies like proper hand washing, to more complex procedures such as proper sequencing of donning and doffing personal protective equipment.

The use of advance organizers further supports this elaboration of content. Advance organizers present the learner with a high-level roadmap of how the instruction will unfold. This prompts awareness of the relevant knowledge ahead, before that knowledge is actually presented. As a result, the learner can construct a preliminary schema onto which increasing levels of elaborated content can be placed.

The Zoonotic Disease and Biosecurity module employs advance organizers, as depicted in Figure 8. This screen is from the introductory segment that defines zoonotic disease and modes of transmission. After these fundamental ideas are presented, this screen closes the segment. It primes the learner by highlighting the topics to come, and representing each topic graphically and with text. These key words and corresponding images are then used throughout the module to activate the learner's schema as established by this advance organizer.

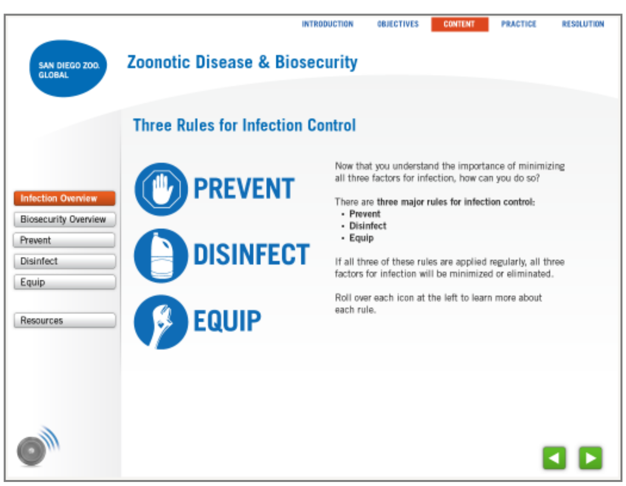

Figure 8. Advance Organizer Example

The use of elaboration theory, coupled with advance organizers, serves to motivate the learner in each of the following ways.

- Attention is gained through inquiry arousal. For example, in the Zoonotic Disease and Biosecurity module: Following presentation of the means by which disease is transmitted, the learner is presented with an overview of topics to come that serve to prevent transmission. This stimulates a natural inquiry process during which the learner envisions how those topics might be connected.
- Relevance is established by linking constructed schema to upcoming content; learners observe how the information just learned connects to content ahead. Advance organizers provide a "bigger-picture" view—in this case a full view of the basics of disease prevention.
- Confidence with the subject matter is realized as the learner actively makes connections among diverse pieces of content, and realizes his or her evolution from a basic, to an increasingly more complex understanding of the involved content.

Establishing Relevance with Examples and Non-examples

Examples of best practice contrasted with examples of poor performance can be powerful tools for building learner confidence. Such examples can provide a definitive picture of what success looks like for the learner to model. Non-examples are equally important. Understanding sub-optimal performance and common mistakes can help insure against such challenges resulting from incomplete training.

The Zoonotic Disease and Biosecurity module utilizes video to define optimal practice for a seemingly simple, yet often incorrectly performed, hand-washing procedure. The learner is initially presented with a video that shows hands washed for only 10-12 seconds and is then prompted to input whether he or she believes video depicts adequate washing (Figure 9). This serves as the non-example; the learner is instructed that the hands in the video were not washed for a proper duration and proper technique was not used.

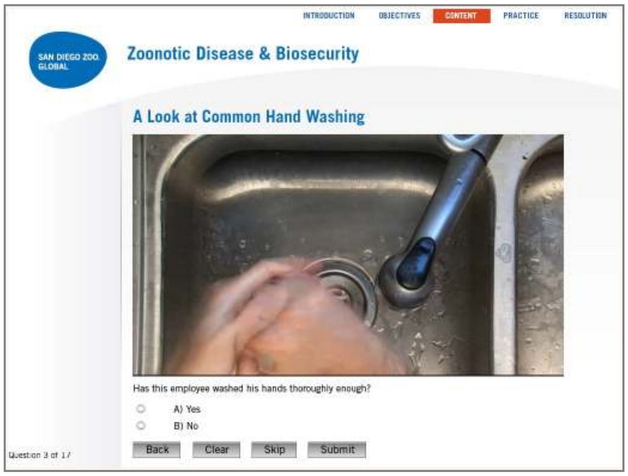

Figure 9. Non-Example—Handwashing Challenge

The following screen presents a video with the optimal duration and method for hand washing, followed by text that describes key performance points for hand washing technique (Figure 10). The contrasting non-example/example sequence serves to build the learner's confidence by modeling proper technique and guarding against typical shortcomings identified through task analysis.

Figure 10: Handwashing Worked Example

Conclusion

Learner motivation is an important element of any instructional endeavor. When designing e-learning, careful attention must be paid to the e-learner—including attaining and maintaining attention, demonstrating content relevance, building confidence, and ensuring satisfaction. Research has demonstrated that each of these elements promote learner persistence and ultimately, mastery of e-learning content.

e-Learning designers must be especially vigilant when it comes to motivating their e-learners. Keller's ARCS Model provides helpful guidance that frames motivational design. This case study has demonstrated one organization's application of ARCS to e-learning module design.

As Keller (2010) suggests, motivational design is not separate from instructional design. This article has provided an example of how careful instructional design and relevant strategies can serve to motivate learners. The range of tactics employed in the SDZG e-learning carefully attend to each ARCS model category in an effort to motivate the learner throughout his or her online learning experience—and beyond, as he or she applies trained skills in the workplace.

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Applying Case-based Reasoning Theory to Support Problem-based Learning

Andrew A. Tawfik, Concordia University - Chicago
C. Wayne Keene, University of Missouri - Columbia

Abstract: Research has shown that learners have difficulty as they transition to ill-structured problems tasks. One way for educators to facilitate this transition is by applying case-based reasoning (CBR) theory in the form of case library learning environments. However, the research about how to best implement CBR theory remains limited. This is surprising given the importance of cases within goal-based scenarios, anchored instruction, problem-based learning, and cognitive flexibility theory. As such, further research of this educational technology will help ensure the application of these learning environments establish a foundation for effective higher order learning and problem-solving expertise. The current study evaluated three conditions (lecture, case library used in a collaborative context; case library used on an individual basis) on a problem-solving task. Results found the CBR collaboration group outperformed the other conditions on a posttest designed for problem-solving. Implications for implementation for instructional design are also discussed.

Keywords: case-based reasoning; case libraries; collaborative learning; problem-solving

Introduction

Modern cognitive scientists have noted the importance of ill-structured problem-solving to engender higher order learning skills such as causal reasoning, argumentation, and evaluation (Hmelo-Silver, 2013; Jonassen, 2011). While some have posited that problem-based learning (PBL) is an important instructional strategy, the research is somewhat mixed as to its efficacy (Leary & Walker, 2009). Some have further argued that implementation and scaffolds are a key factor that requires further examination in the PBL literature (Dabbagh & Dass, 2013; Hung, 2011).

Case-based reasoning (CBR) theory suggests that as knowledge and expertise increase, practitioners are able to assess the current problem, find previous cases relevant to the current problem, leverage that case to inform a solution, assess the potential solution, and update internal memory as one learns from the experience (Aamodt & Plaza, 1996). As such, one such way to support PBL is by the utilization of case library learning environments that include stories of practitioners' problem-solving experiences. However, very little empirical research currently exists as to the best means to support higher order learning through case libraries. Some might argue that individual analysis on these narratives might best support learning because learners are able to reflect on the case. Alternatively, others might argue that a collaborative approach would afford collective meaning-making as learners evaluate the case. If CBR might be used as a strategy to engender problem-solving competencies, further research is required to ascertain how to best apply case-libraries learning environments and its role in PBL (Jonassen, 2011).

Problem Solving

As learners move from the role of student to practitioner, they are initiated within a community where s/he is expected to perform (Wenger & Snyder, 2000; Wenger, 2000). In contrast to the classroom experience, practitioners are expected to perform in often ill-structured problem-solving contexts where no one "right" answer is verifiable. As such, the ability to engage in causal reasoning and argumentation to justify a solution within a community of practice during problem -solving are essential skills of everyday practitioners (Henning, 2004; Jonassen & Kim, 2010; Kuhn & Udell, 2007). However, previous classroom approaches of learning have emphasized the didactic model, which requires the learner to merely become recipients of information. A fundamental limitation of the didactic instruction model is that content is often conveyed in a decontextualized manner. This mode of instruction often falters because this approach emphasizes conceptual recall or recognition rather than problem-solving (Brown, Collins, & Duguid, 1989; Hung, Jonassen, & Liu, 2008; Lave & Wenger, 1991). Specifically, the learner may be unclear how to extrapolate, combine, and employ concepts to solve authentic problems.

Brown et al. (1989) suggested that since knowledge is situated within authentic practice, instruction should be conducted in a similar manner. The authors further argued "students need much more than abstract concepts and self-contained examples. They need to be exposed to the domain's conceptual tools of authentic activity" (p. 34). Modern cognitive scientist have suggested that knowledge obtained through authentic activity is learned better and is therefore more applied to problem-solving compared with knowledge obtained through passive observation (Collins, Brown, & Newman, 1989; Jonassen, 2011; Schank, 1999). Schank (1993) further maintained a problem-solving emphasis on pedagogy engenders overall comprehension, retention, recognition of appropriate condition, and transfer.

Problem-based learning (PBL) has emerged as an important instructional strategy to address these issues. In contrast to the traditional classroom model, PBL prescribes the following (Barrows, 1996):

- Student-centered learning
- Self-directed learning
- Collaborative learning in small groups
- Teacher serves as facilitator
- Problem-serves as the catalyst for learning

While this instructional strategy began in the medical field, it has since seen increased emphasis in other domains such as education and business (Hung et al., 2008). To date, research has shown learning gains using PBL in causal reasoning (Jonassen & Ionas, 2008), argumentation (Andriessen, Baker, & Suthers, 2003; Kuhn & Udell, 2007), and knowledge construction (Riedel, Fitzgerald, Leven, & Toenshoff, 2003).

Despite the positive results, some have argued that PBL is counterintuitive to learning because the strategy taxes cognitive load (Kirschner, Sweller, & Clark, 2006). Henry et al. (2011) found that first-year PBL students had difficulty with issues such as collaboration in groups, role of facilitator, and ambiguity about what resources to employ. Similarly, recent meta-analyses of PBL have argued that its effectiveness is often impacted by how PBL is implemented (Leary & Walker, 2009). In a review of the research, Hung (2011) identified the following as barriers to learning in PBL: beginning the problem-solving process; information searching; application of scientific reasoning; and evaluation of solution. The information seeking process in particular is an aspect that causes frustration and requires significant time investment as individuals navigate through the ill-structured nature of problem-solving. For instance, Authors (2012) found that students cited the information searching, variable identification, and evaluation of resources as barriers as engineering students engaged in a PBL course for the first time. Similarly, Laxman (2010) found that students cited difficulties in variable identification and information searches during an ill-structured problem-solving task. Based on this research, we argue the information seeking process requires further evaluation as students transition to PBL.

Case Based Reasoning

One potential way to overcome these challenges is through an application of case-based reasoning (CBR) theory and case library learning environments. The CBR model of cognition is based upon a form of analogical reasoning which suggests individuals encode previous experience in memory in the form of contextualized cases (Kolodner, Owensby, & Guzdial, 2004; Schank, 1999). In practice, solving problems is frequently supported by recalling prior experiences of similar situations (Jonassen, 2010). These experiences, stored in the form of cases, represent the interpretations of previous problem-solving experiences and the subsequent lessons learned. As knowledge and expertise increases, practitioners rely more on reusing previous cases that are relevant to the current problem rather than linear problem-solving processes, a process known as case-based reasoning (CBR) (Kolodner, 1993). According to CBR theory, an encountered problem (the new case) prompts the individual to retrieve cases from memory, reuse the old case (i.e. interpret the new in terms of the old), which suggests a solution (Aamodt & Plaza; 1996; see Figure 1). When the effectiveness of the new solution is confirmed, the knowledge is then stored in memory as a case for later use. Embedded within each case are a series of indices, which aide in memory retrieval. As such, learning is thus largely comprised of accumulated problem-solving experiences (Kolodner, Owensby, & Guzdial, 2004; Schank, 1999). Over time, these experiences are often stored in a 'case library' within memory from which the practitioner can reference to solve novel problems (Jonassen, 2010;

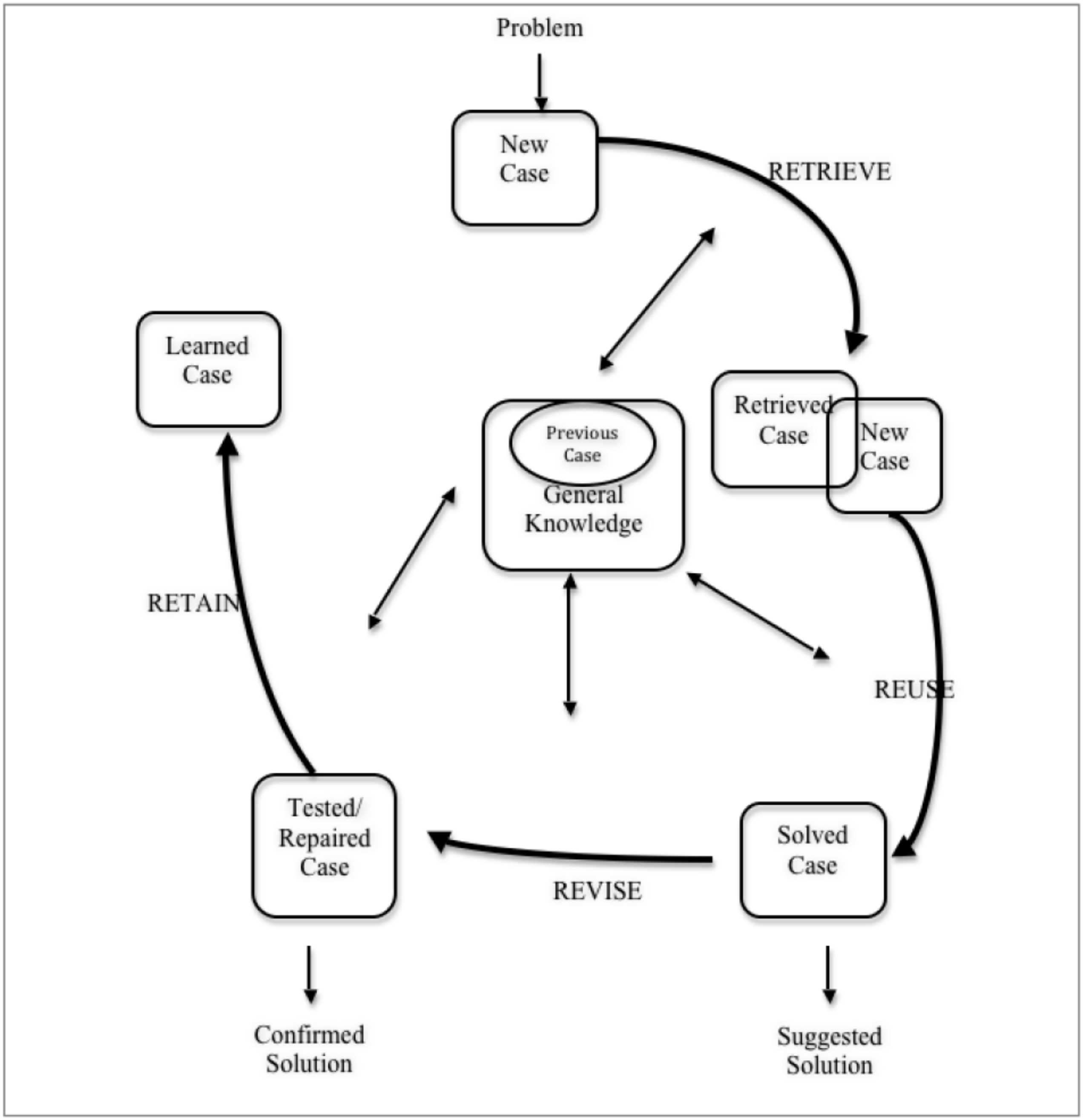

Figure 1. CBR Cycle, adapted from Aamodt & Plaza, 1996.

Schank, 1999).

CBR posits that remembering relevant cases situated within an authentic context better facilitates knowledge acquisition and subsequent analogical transfer (Kolodner, Cox, & Gonzalez-Calero, 2005; Kolodner et al., 2004). In communities of practice, experts generate scripts as problem-solving experiences throughout their careers (Schank & Abelson, 1977). For example, physicians generate increasingly comprehensive knowledge based on previous diagnostic cases, often referred to as illness scripts (Jonassen, 2011). Problem-solving is thus is based on a kind of pattern recognition constructed from previous cases (Schmidt & Boshuizen, 1993; Schmidt & Rikers, 2007). This form of analogical reasoning is important to problem-solving because it allows individuals to apply concepts learned in one context to as an aide in solving similar problems (Gick & Holyoak, 1983). Experts are often able to identify patterns and engage in high-level reasoning with additional expertise (X. Wang et al., 2012) as case libraries and indices subsequently grow within memory.

Case Library Learning Environments

Kolodner et al. (2004) argued novices have the following problems during transfer when problem-solving within a new domain: poor encoding of previous experiences that impedes appropriate retrieval; inadequate mapping between concepts; and difficulty employing experiences when they do not have appropriate recall experiences. To overcome these challenges, one option is to provide a database of cases that consist of various practitioner experiences for learners to reference. Case libraries learning environments are databases of practitioner stories that are made available to learners as advice during a problem-solving task. In doing so, the case library learning environment is analogous to the case library found within the memory of practitioners. Reflection upon the narratives of practitioners serves as a proxy for the experience the novices do not yet possess (Hernandez-Serrano et al., 2002). Case libraries learning environments also play a critical role in learning by providing experiential knowledge of practitioners and expert modeling to novices who lack the experience (Kolodner et al., 2004). Ideally, the learner is able to avoid a linear view of problem-solving as the read about the diversity of challenges experienced by multiple practitioners. As multiple stories are encountered within the case library learning environment by the learner, the stories become indexed in the learner's episodic memory (Kolodner et al., 2005; Schank, Berman, & Macpherson, 1999).

Because cases libraries memory structures are largely built upon narratives of how experienced practitioners have solved similar problems, case libraries learning environments augment the previous experiences of novices who have yet to encounter critical experiences by modeling problem-solving when a learner is uncertain about how to solve a problem (Jonassen & Hung, 2006). As multiple stories are encountered within the library, the narratives supplement learner's episodic memory and serves as a just-in-time learning resource to solve the problem (Kolodner et al., 2005; Schank et al., 1999). Case library learning environments may also help alleviate some of the information seeking challenges cited in PBL (Henry et al., 2012; Hung, 2011), while still allowing for self-directed learning and analogical transfer as students garner meaning from the cases.

Case library leverages the power of story-telling shared with a community of practice to convey these experiences and the associated problem-solving competencies. In memory, Schank (1995, 1999) has argued that understanding of a story requires an individual to engage in index extraction as s/he finds similar stories. Stories are therefore essential to the CBR model of cognition and case libraries because these narratives include numerous indices within a story such as locations, beliefs, attitudes, decisions, and conclusions (Schank, 1999). As such, story-based memories are a way of "preserving the connectivity of events that would otherwise be dissociated over time" (p. 95) within a community of practice. In relation to problem-solving, sharing of stories helps to activate and connect other relevant problem-solving stories that aide in analogical transfer. Furthermore, stories are able to relay tacit knowledge that is not easily expressed within traditional knowledge artifacts (Sanchez, 2011; Sole & Wilson, 1999). Workplace research has shown that communities of practice collaboratively employ stories as a way to share knowledge amongst its members (Henning, 2004; Hernandez-Serrano & Stefanou, 2009). Story-telling thus serves the primary medium that provides increasingly concrete and cohesive representations of interrelated, complex concepts and passes along cultural principles to peripheral members within communities of practice (Wang, Jonassen, Strobel, & Cernusca, 2003; Wenger & Snyder, 2000).

Despite the potential benefits, the efficacy of case libraries to support learning is still largely lacking in empirical research (Jonassen, 2011). However, some research has sought to investigate the impact of case library learning environments to support PBL. In one study, Hernandez-Serrano and Jonassen (2003) compared three groups that accessed different resources during a PBL activity: case library learning environment, fact sheets, and textbook. The researchers found that students who accessed a case library learning environments where able to outperform a control group on a multiple-choice test that assessed problem-solving skills (prediction, inferences, explanations). In another study, Authors (2013) found that those students that individually accessed a case library learning environment that detailed failure stories outperformed students that accessed stories of successful problem-solving. The authors argued that the failure stories helped to make the causality more overt and thus more memorable for future problem-solving. Both studies suggest that the resources students employ supports students learning as they problem-solve in PBL.

Research Questions

Despite the promising results of the case libraries, further research is needed to understand how to best apply case library learning environments. In the previous study (Authors, 2013), students were asked to individually view the case library learning environments. However, advocates of PBL have argued collaboration and group work is a central component to the PBL model of instruction (Barrows, 1996; Hmelo-Silver, 2013). The Authors (2013) study only compared two different versions of case library learning environments (success, failure), but did not address whether a PBL approach using these supports would outperform a lecture-based approach. To address these gaps in the research, we posit the following research questions:

1. To what extent does learning performance differ on a

problem-solving assessment if the participant engages in a lecture or case based learning environment?

2. To what extent does learning performance differ if the participant employs case based learning environment on an individual or collaborative basis?

Methodology

Participants

Participants were drawn from undergraduate business students enrolling in a Sales Management course, an upper-division course offered in the College of Business at a Midwestern university located in the United States. A total of 76 students were enrolled in the course across three sections (Male = 39, Female = 37). This particular course generally enrolled junior level marketing students. All participants voluntarily elected to participate in the study.

Procedure

Rather than randomly assign individuals to the different treatments, participants were assigned the case libraries based on their course section (intact groups). Participants were assigned by section because participants often employed group work in the sales management class. The course sections were assigned to different case libraries using a Microsoft Excel randomization macro. In the eighth week of the semester, participants were given a pretest to establish any difference in prior knowledge between the groups. Upon completion of the pretest, participants in two groups (individual, collaborative) were asked to navigate to a web-based learning environment to access an ill-structured, decision-making problem to solve. The task required participants to construct an argument as to why they would hire a particular individual. The control group proceeded as normal using a lecture-based approach. In the ninth week, all participants were given a posttest to assess differences in learning.

Materials

The problem to solve embedded in the learning environment presented the participants (individuals and collaborative conditions) with an authentic ill-structured hiring problem the SME had encountered (see Figure 2). The decision-making problem details "Nick" as he tries fill a traveling sales position at a large corporation. "Lewis" is a potential candidate that has strong character references and relatable skills, but Nick discovers Lewis failed to disclose a driving under the influence citation from years ago. This presents a problem because it suggests Lewis still has character issues and increases insurance costs for the company. However, the training costs for candidates without experience is substantial and the character references imply the indiscretions were aberrant. Based on these factors, it is unclear whether to hire this individual or revisit the job search.

While solving the task, students were prompted to access five cases that detailed practitioners failed problem-solving experiences (see Appendix A for example) . In general, the cases were designed using the following framework: setting (e.g., steel mill, entrepreneurial endeavor), general problem description (e.g., changing jobs within industries, hiring qualified workers), assumptions (e.g., different roles require different skillsets), constraints (e.g., market pressure, glass ceiling), social issues (social fit, employee morale), overarching lesson (e.g., hiring qualified workforce, job placement alignment), and outcome (e.g., loss of customers, increased turnover). This framework helped to maintain instructional consistency across each of the narratives.

Figure 2. The Learning Environment

Table 1. *SME Case Library Interview Protocol*

Stories Protocol – Failure	Goal
1. Please explain to me a failed story in regards to a hiring and selection strategy?	Problem-situation-topic indexes
2. What were the relevant concepts (indices) embedded within story you just described?	Problem-situation-topic indexes
3. What were the goals-subgoals-intentions to the context?	Problem-situation-topic indexes
4. What were the constraints of the context described?	Problem-situation-topic indexes
5. What solution was developed to solve the problem?	Appropriate solution indexes
6. What was the justification for the proposed solution?	Appropriate solution indexes
7. What acceptable, alternative solutions were suggested but not chosen?	Appropriate solution indexes
8. What unacceptable, alternative solutions were not chosen?	Appropriate solution indexes
9. Why was this solution unacceptable?	Appropriate outcome indexes
10. If failure, what repair strategies could have been employed?	Appropriate outcome indexes

To construct the case library, the researcher interviewed a subject matter expert (SME) who had over 20 years of experience in various areas of business. The researcher interviewed the SME using the semi-structured protocol prescribed by Jonassen and Hernandez-Serrano (2002) (see Table 1). After the researcher translated the interview into the narratives, the SME reviewed the cases for accuracy.

Instruments

A 25-item, five-option multiple choicetest was administered as the primary assessment method for the pretest and posttest. The assessment consisted of the learning objectives for the module. At the beginning, the assessment was used as a pretest to identify any differences in domain knowledge between the treatment groups. Towards the end of the experiment, the assessment was used to ascertain learning gains.

Various measures were taken to ensure the validity and reliability of the tests. In terms of validity, the test was created by the SME and reviewed by three graduate assistants. Each item was assessed in two areas: learning objective and problem-solving. In terms of the former, the SME created the test and cross-checked it with the learning objectives. When SME and researcher identified questions that were not related, the question was omitted from the test or revised to accurately reflect the sales management concept.

After the SME created the test questions, the SME and researcher met once again to determine if the assessment were posed as problem-solving questions. At this stage, we created the assessment in accordance with the methods prescribed by Jonassen (2011). That is, questions were contextualized and answers were largely focused on causal reasoning, inferences, predictions, and explanations. Upon completion, the test was given to three graduate students as a pilot of the test.

Results

The experiment analyzed differences between the three groups using an analysis of variance (ANOVA) test. Prior to the analysis, a Shapiro Wilk test was conducted to identify potential problems with normality. Results of the test allowed the analysis to proceed with the assumption of normal distributions between groups (Lecture $p = .455$; CBR Collaborative $p = .738$; CBR individual $p = .273$). Upon completion, an ANOVA test was completed for the pretest to ascertain potential differences in prior knowledge. However, no differences were found between the pretest scores (DF = 2, 74; F = 1.186; $p = .311$). As such, the experiment proceeded assuming equal prior knowledge among groups.

The results of the posttest found the CBR-collaborative (60.00) outperformed the lecture (51.08) and CBR-individual (51.80) treatment groups (see Table 2). To empirically identify significant differences, we once again conducted a one-way ANOVA for the posttest scores. The analysis revealed differences between the groups (DF = 2; F = 2.35; $p = .016$). Based on these results, a post-hoc Scheffe's test was conducted. The more conservative Scheffe's test was selected over the Tukey's because of the unequal sample sizes. Results of the post hoc tests identified significant differences between the CBR collaborative and lecture groups ($p = .03$), but not between the individual groups (see Table 3).

Table 2. *Pretest/Posttest Mean Differences in Treatments*

		Pretest		Posttest	
	N	Mean	StDV	Mean	STDV
Lecture	26	49.54	10.68	51.08	8.86
CBR-Collaborative	31	53.68	12.08	60.00	16.69
CBR-Individual	20	50.00	9.75	51.80	8.65

Table 3. *Pretest/Posttest Mean Differences in Treatments*

		Mean Difference	StDV	Sig.
CBR-Individual	CBR-Collaborative	-8.20	3.61	0.08
	Lecture	0.72	3.75	0.98
CBR-Collaborative	CBR-Individual	8.20	3.61	0.08
	Lecture	8.92*	3.35	0.03
Lecture	CBR-Individual	-0.72	3.75	0.98
	CBR Collaborative	-8.92*	3.35	0.03

*. The mean difference is significant at the 0.05 level.

Discussion

The current study had two primary goals. First, to ascertain if case library learning environments are a better means of supporting problem-solving when compared with the lecture-based model. Second, to determine if an individual or collaborative application of case-library learning environments was a better means of supporting PBL. In order to assess problem-solving, participants were given a test that assessed participants' ability to engage in causal reasoning, inferences, predictions, and explanations. The results of the data analysis suggest that the participants that learned the concepts in the lecture format and individual case library treatment did not show significant differences on posttest scores when compared to the collaborative case library treatment . That is,those that accessed the case library in a collaborative context outperformed the other treatments on a problem-solving posttest.

There may be multiple reasons for these results. Schank (1999) notes that failure cases pose a mental discomfort that naturally affords an explanation by the learner. In the individual treatment, it is possible the interpretations of the failure cases were somewhat ambiguous. That is, learners were still unclear about how to garner meaning from the cases and its implications to solving the presented ill-structured problem. As such, the indices generated within memory were still circumspect in the mind of the participant as they tried to problem-solve in new contexts. This may have caused limited indices for the retain aspect of the CBR cycle, which later impeded the retrieval aspects of CBR during the problem-solving task.

This study adds to the CBR research by suggesting that a collaborative approach might best support student learning as they employ case library learning environments for PBL. It is possible that the collaborative group collectively assigned meaning and interpretations when reading the narratives embedded in the case library. In contrast to the lecture or individual approach, collaboration may have allowed individuals to articulate their interpretations of the case to peers; justify their position; provide explanations (Ge, Planes, & Er, 2010). In doing so, the indices generated during the CBR process were challenged and negotiated as the group problem-solved. This may have also lead to erroneous indices to be revised during the collaboration process. These results also coincide with the PBL model, which suggests that collaboration is a key element during the problem-solving process. Moreover, the model of learning whereby individuals negotiate meaning about how to apply cases to new problems is also representative of the communities of practice model whereby individuals negotiate what cases to apply in order to solve new problems (Hernandez-Serrano & Stefanou, 2009).

The results also build upon the previous studies of CBR and its application to PBL. In the current study those in the case library learning environments were able to outperform those in the didactic model, similar to the Hernandez-Serrano and Jonassen (2003) study. Dabbagh and Dass (2013) argued that cases can be employed to support problem-solving instruction in various ways. Similarly, others have argued that exposure to authentic learning experiences in the form of cases may be one way to facilitate problem-solving (Boshuizen, Wiel, & Schmidt, 2012; Hernandez-Serrano & Jonassen, 2003). However, little empirical validation exists as to the learning impact based on how cases are implemented and employed during problem-solving. This is surprising given the importance of cases within goal-based scenarios (Schank et al., 1993), anchored instruction (Cognition and Technology Group, 1991), and cognitive flexibility theory (Feltovich, Spiro, Coulson, & Feltovich, 1996; Spiro, Coulson, Feltovich, & Anderson, 1998). Each of these instructional strategies employ cases to convey the ill-structured nature of problem-solving and authentic problem solving, yet little is known how to strategically utilize the cases to optimize PBL. The results of the study suggest case libraries may be one way to provide expert guidance using a narrative approach that describes how practitioners solve problems. Case libraries also scaffolds the students as expert problem-solving related to problem analysis, justification, and solution generation become more overt to the learner in a contextualized narrative. Moreover, this approach may help to ease the transition of problem-solving and information searching previously supported in other PBL implementations (Hung, 2011; Vardi & Ciccarelli, 2008).

Limitations and Future Studies

While the results of the study suggest provide further empirical evidence about the efficacy of case libraries, future studies could build upon the limitations of the study. In the described study, two case library treatments (individual, collaborative) were compared with a lecture-based approach to a sales management PBL activity. However, it is somewhat unclear if case libraries unknowingly limit the creativity of students as they problem-solve. That is, students did not look for variables and factors beyond what was found in the case library. Because case libraries are dependent upon the experiences of the practitioner, it is possible that the solutions presented in the cases are limited to the his/her experience. It is also possible that an approach that encourages students to search for their own solutions outside the case library or a different information repository would identify solutions not present in the cases.

Another interesting study could investigate whether other forms of assessment would the results presented in the study. The current study asked students to complete a posttest designed for problem-solving. However, the field of PBL would benefit from other problem-solving tasks such as argumentation essays or concept mapping to identify further differences in learning. Because these are different cognitive activities, it is possible individual or collaborative case library approach would have yielded different results and provided further insight into the case library application to PBL.

It is also unclear if the results would have been different if various scaffolds were embedded throughout the activity to help the reader reflect upon the case. Other researchers have noted the importance of scaffolds to support PBL for collaboration, argumentation, self-directed learning, and meaning making (Ge et al., 2010; Jeong & Lee, 2008). It is possible that question prompts would have caused the individual case library treatment to generate the same meaning in a similar fashion to the collaborative group. This study could build upon this research and provide further insight about how to the best means of supporting PBL and higher order learning.

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Guidelines for the Motivational Design of Instructional Simulations

Don G. Robison, Old Dominion University
Ginger S. Watson, Old Dominion University

Abstract: Learner motivation is fundamental to effective learning. This article addresses the challenges and opportunities of motivational design for instructional simulations and presents motivational design guidelines. The types and uses of instructional simulations are defined. The elements of motivation as they are described in various models and theories are surveyed. Models and theories considered include the ARCS motivation model, the intrinsic motivation model, self-determination theory, motivation systems theory, arousal theory and flow. The unique motivational challenges and opportunities of instructional simulations are analyzed, and then guidelines for the effective motivational design of instructional simulations are offered.

Keywords: Simulation, learning, design methodology, motivation, instructional simulation, learner motivation, visual design, aesthetic, social learning, Malone, ARCS Motivation Model

The research about effective learning resonates with this truth: in order for learners to process energetically and learn deeply, they must choose to engage (Blumenfield, Kempler, & Krajcik, 2006; Jonassen, 1988; Keller & Suzuki, 1988). Learning is an act: It requires the learner's energy, choice, and employment of effective learning strategies. Because learning is an act—something a learner must do—motivation is fundamental. Some instructional and simulation designers avoid serious attempts to incorporate motivational design in their instructional products because of perceptions that motivation is either too vague a concept (Weiner, 1992) or lacks predictive power in respect to learning outcomes (Gagné, 1965). It is true that motivation is complex, but it is so foundational to learning that it must be thoughtfully addressed in instructional design. This article examines the unique motivational challenges and opportunities of instructional simulations and provides guidelines for their motivational design. First, let us define two key terms: *instructional simulation* and *motivation*.

What is motivation? Motivation is about *why* people do what they do. Simply defined, it is what people *desire to do, choose* to do, and *commit* to do (Keller, 2009). It is an internal process, but can be inferred from observed choices, effort, intensity, and persistence. It is what initiates behavior, controls its intensity, maintains behavior, stops behavior, and mediates choice (Weiner, 1992). The study of motivation should also be focused on how goal-oriented activity is initiated and sustained (Ford, 1992; Schunk, Pintrich, & Meece, 2002). As previously mentioned, motivation is sometimes considered a vague concept. It is helpful to recall that the word "motivate" is a derivative of the Latin word, *movere*, which simply means "to move" (The Latin Dictionary, 2013). Motivation, then, in its broadest sense, is about what makes people move.

Learner motivation is focused on those factors that affect a learner's engagement with the task of learning. It can be thought of in two ways: as either stimulating and empowering a learner's intrinsic motivation; or, as providing extrinsic motivators that will energize learner engagement. In reality, motivation is the product of a system of influences that are both internal to the learner and external in the learning environment.

This article addresses the motivational challenges of instructional simulation and provides guidelines for their motivational design. Motivation as it applies to simulation will be addressed from several vantage points. Rather than provide a detailed description of each relevant motivation model, the elements of motivation as they are described by a broad cross-section of the literature will be presented. The theoretical or research origins and a brief description of each element will be offered. In this way, the scope of the issue and the pertinent theoretical constructs will emerge. This article is divided into four sections. First, the types of instructional simulations will be briefly described. Next, a broad overview of motivation models and research in terms of their component elements will be presented. The unique motivational opportunities and challenges of instructional simulation will be analyzed. Fourth, practical guidelines for the motivational design of instructional simulations will be offered.

Instructional Simulations

Instructional simulations provide learners with the opportunity to interact with a representation of some phenomenon or challenge, and in that interaction grow in skill or knowledge. Simulations are used in one of two ways in instruction: either the learner interacts with an existing simulation and develops an understanding of an existing model, or the learner constructs a simulation and personally designs the model, thereby developing a deep level of understanding of the model. The first method, using a pre-existing model, is the more common use of simulation in instruction. An example of this approach is the typical flight simulator where pilots sit in a virtual cockpit and perform the procedures associated with safely flying an actual aircraft. An example of the second method, where the learner constructs the model, is when a science teacher has students use a software program to develop a representation of how volcanoes erupt. The learner researches the process and then builds a simple computer model representing how volcanic activity develops. Learning occurs through the building of the model. Having learners construct models that faithfully represent real-world phenomena facilitates meaningful learning (Jonassen, Howland, Marra, & Crismond, 2008).

Four Types of Instructional Simulations. There are four main types of instructional simulations and they can be divided into two groups. The first group is simulations that teach *about* something (Alessi & Trollip, 2005), and the two sub-categories of simulations in this first group are physical simulations and iterative simulations. The second group is simulations that teach *how to do* something, and the two sub-categories in this group are procedural simulations and situational simulations. The four types of simulations (Alessi & Trollip, 2005, p. 214):

About something simulations
- Physical
- Iterative

How to do something simulations
- Procedural
- Situational

Physical and Iterative Simulations. A physical simulation is a representation of a physical object or phenomenon with which the learner interacts. A physical simulation represents a physical object and the learner manipulates variables and observes how the physical object reacts. Examples of physical simulations include the action of a rubber ball in bouncing, how oceanic wave systems develop, and how weather systems develop. An iterative system, on the other hand, is similar to a physical simulation, but rather than interacting with the simulation in process, the learner manipulates variables and then runs the entire simulation. In this way, the learner can observe the effects of various parameters on the modeled system by changing the parameters and running the simulation repeatedly. Both of these simulation types help learners understand *about* things.

Procedural and Situational Simulations. Procedural simulations train a sequence of actions to accomplish an objective. A flight simulator is a good example of a procedural simulation. Given certain conditions, the operator performs certain procedures, and the simulated aircraft is safely or effectively maneuvered. A simulation that is concerned with learning the steps in performing a procedure is a procedural simulation. In contrast, a situational simulation deals with interactions with people or organizations in different situations. A simulation using avatars to teach soldiers to interact with locals in culturally sensitive ways in a war-time scenario is a good example of a situational simulation.

Each of these simulation types presents a unique motivation profile or challenge; an analysis of these unique challenges will follow the description of key motivation principles and practices.

Motivation Theory, Research, and Practice

Relevant Motivation Theory, Research, and Practice. The body of literature relating to motivation theory and research is extensive, rather than repeat the theoretical perspectives and research in detail, the reader is invited to explore the literature and research that is so well represented in the literature. The elements of motivation presented here are drawn from several models and lines of research. These sources include the following:

- The ARCS Motivation Model (Keller, 2009)
- Flow Theory (Czikszentmihalyi, 1990)
- The Taxonomy of Intrinsic Motivation (Malone, 1986)
- The Time Continuum Model (Wlodowski, 2003)
- Motivation System Theory (Ford, 1992)
- Social Learning Theory (Bandura, 1989)
- Arousal Theory (Berlyne, 1971)
- Behaviorism (Buchanan, 1992)
- Self Determination Theory (Deci, 1975)
- Social Factors (Hacker & Bol, 2004; Palincsar, 1998)
- Identity Leveraging (Erikson, 1980; Lee & Hoadley, 2000)
- Visual Design (Berlyne, 1970; Csikszentmihalyi & Robinson, 1990; Tractinsky, Katz, & Ikar, 2000)
- Structured Story (Parrish, 2009; Schank, 1990)

Component Elements of Motivation

The extensive literature on learner motivation presents several recurring themes. This section describes the key themes, or component elements of motivation—and briefly describes their theoretical associations. The elements of motivation as represented in learner motivation models and research is presented in Table 1.

Attention. Attention is gaining and keeping the learners' attention (Keller, 2009). This idea is presented in virtually every theory of learner motivation. It includes concepts such as Berlyne's (1971) arousal of curiosity through novelty or pattern complexity. Flow theory defines itself by this concept of attention, describing a flow experience as one in which the participant's attention is completely absorbed, and time is ignored (Csikszentmihalyi, 1990). Malone (1986) prescribes two primary ways curiosity may be raised: sensory curiosity may be raised by varying stimulus intensity and pattern; and cognitive curiosity may be raised by creating uncertainty. Keller (2009) prescribes all of these methods to enhance learner attention. The goal is to gain the learners' attention and then maintain it.

Relevance. Relevance is connecting the learning with learners' goals and life experiences (Keller, 2009). For a learner to fully engage, the learning experience must have some value in his or her life. Motivation system theory proposes that this goal orientation is the center of human motivation (Ford, 1992), that goals and context are the anchors that organize and provide coherence to behavior. Wlodowski (2003) advocates for the value of this element using the word "need" rather than "relevance." He proposed that the degree to which a given instructional product matches the learner's needs is a key determinant of learner engagement.

Confidence. All of the motivation models reviewed emphasized the importance of learner confidence in determining motivation towards learning. Simply put, if a learner has no confidence that he or she can succeed, effort towards the learning goal will be minimal. Alternatively, if the learner has too much confidence—that learning success may be achieved without effort—minimal effort will be expended (Keller, 2009). Foundational to this notion is Bandura's (1977) concept of self-efficacy. Malone (1986), Keller (2009), and Rieber (1996) all emphasize the importance of outcomes being uncertain. There must be a degree of confidence that the learner can succeed, but there also must be a level of uncertainty for optimal learning effort to be expended. This idea of "optimal challenge" is explicitly repeated in several models (Malone, 1986; Csikszentmihalyi, 1990; Riever, 1996; Keller, 2009).

Satisfaction. It is important that learners value the outcome of the instruction (Keller, 2009). For example, if a medical student sees no value in the life or rewards of being a doctor, effort will be restrained. Keller (2009) proposed that this motivational dimension of satisfaction includes both intrinsic and extrinsic motivators. This unique synthesis of Skinner's (1938) behaviorism with Deci and Ryan's (1975) concepts of intrinsic motivation is creative. It is doubtful that either Skinner or Deci and Ryan would agree that intrinsic motivators and extrinsic motivators can effectively be combined in precisely this fashion. But, Deci and Flaste (1995) do describe an interaction of the two that allows for Keller's (2009) formulation. The basic principle is that for learners to energetically engage they must value the outcome of the engagement. Two key prescriptions from the literature are, do not overemphasize extrinsic motivators (this will serve to destroy competing intrinsic motivation), and whenever possible, encourage intrinsic motivation because it is more resilient than extrinsic motivation. Flow. Flow theory is a way of describing the phenomenon where people are caught up in the flow of an activity or game and so enjoy themselves that they lose track of time. Czikszentmihalyi (1990) defined flow as "…the state in which people are so involved in an activity that nothing else seems to matter." Rieber (1996), like Malone (1987), held that the most important element in the creation of a flow experience is optimizing the

Table 1: *Motivation Elements Represented in Motivation Models and Research*

MOTIVATION ELEMENTS		MOTIVATION MODELS AND PRESCRIPTIONS							
Motivational Element	**Goal in Learning Context**	**Keller (2009)** **ARCS**	**Malone (1986)** **Taxonomy of Motivation**	**Ford (1992)** **Motivation Systems Theory**	**Wlodowski (2003)** **Time Continuum Model**	**Deci (1995)** **Intrinsic Motivation**	**Skinner (1968)** **Behaviorism**	**Maslow (1970)** **Humanist**	**Csikczentmihalyi (1990)** **Flow**
Attention	Gain and maintain learners' attention	Gain and maintain learners attention	Curiosity raised in two ways: stimulating sensory curiosity & stimulating cognitive curiosity	Goals compete for attention	Appeal: The degree to which the learning experience is stimulating	Curiosity, novelty, and uncertainty are intrinsically motivating	Make stimulus clear	Relate instruction to individual's pursuit of psychological growth and fulfillment	
Relevance	Connect learning with learner's life or goals	Connect learning with learner's life or goals		Goals and context are the anchors that organize and provide coherence to behavior	Need: The degree to which instruction matches learner needs		Point out differences in stimuli, help learner determine the appropriate cues	Instruction should be relevant to psychological growth	Legitimate flow experiences are relevant—people search for them
Confidence	Enhance perceptions of self-efficacy with respect to the learning task	Enhance perceptions of self-efficacy with respect to the learning task	Give the learner control of the experience at every appropriate opportunity	The attainability of goals is important, the model resembles an expectancy-value model in this	State goals, examples, and criteria for success clearly		Shape behavior, Differential reinforcement	Progress towards "fully functioning individual"	
Satisfaction	Design to intrinsic and extrinsic motivators Don't overemphasize extrinsic motivators	Design to intrinsic and extrinsic motivators	Provide optimal level of challenge	It is typically best to balance goal directed activity rather than simply pursue one goal	Value: The amount of importance the learner places on the learning Competence Reinforcement	Intrinsic Motivation is more resilient than extrinsic motivation Extrinsic motivation diminishes intrinsic motivation	Schedules of Reinforcement	Self esteem is obtained through legitimate achievement and recognition	Legitimate flow experiences are satisfying—people love them
Flow/Experience Structure	Optimize flow experience for the learner	Included in "Relevance" dimension of ARCS Model			Perseverance: The degree to which learners maintain their engagement.		Schedules of Reinforcement		The optimal state of experience… People lose track of time. People search these experiences out
Context	Place the learning in its real world context			Unitary Functioning: The person always acts as a unit in coordination with the environment			Match to behavioral performance to its real world context		
Social Effects	Make best use of group and others' presence effects in the learning experience			Emotions help regulate social behaviors		People who are "authentic" are caring and related to others	Social interactions may have reinforcing or punishing effects		
Identity Leveraging	Use learner interests in identity to facilitate task-directed motivation					"Being truly oneself" is important: autonomy, responsibility, and relatedness.		Point to how learning leads to achieving one's "highest self"	
Fantasy	Leverage dreams and long-term objectives in instruction (Use things that are not *yet* real)		Leverage dreams and long-term objectives (Things that are not real yet)		Clearly state goals and success criteria				
Aesthetic (Includes experience structure [e.g. plot] and sensory attractiveness)	Present the instructional experience in a way that is attractive to the target audience	Important in gaining attention	Used games as a model for interaction of learners/materials	Considered part of the goals taxonomy	Instructional experience should be stimulating		Attractive aesthetics can have a reinforcing effect		The appreciation of beauty consists of the same elements as the flow experience
Foundational: Basic Needs Fulfilled	Insure the basic human needs are met prior to instruction							Basic needs met: hunger, thirst, clothing, shelter, safety	

challenge. This idea is consistent with Keller's ARCS Model as the optimal state for learner confidence (1987). How important is flow in motivational design? People actively seek flow experiences, and will expend energy and resources to find them (Gee, 2008).

Context. Ford (1992) proposed that motivation is the product of the interaction of the person and the context. According to his motivational systems theory, motivation is defined as the pattern of a person's personal goals, personal beliefs, and emotions. A unique perspective this theory brings is the idea of the *person-in-context*. This is the idea that motivation results from an interaction of the person and the environment. The person will always act as a unit in coordination with the local environment. Motivation is an integrated construct that gives the direction a person is needs, emotional energy to move behavior change towards the direction, and expectancies the person has about progress towards the goal. These three constructs may be represented as a motivation formula:

Personal goals X Emotion X Personal Agency beliefs = Motivation

Social Factors. Researchers from various theoretical orientations agree on the basic principle that people are social creatures and social factors influence learning motivation. Social learning theorists, for example, argue that much of what one learns is learned from the example of others (Bandura, 1977; Bruning, Schraw, Norby, & Ronning, 2004). Cognitive learning theorists maintain that much of learning is devoted to "meaning making" which is essentially a collaborative and social process (Bruning et al., 2004). Interestingly, Hacker and Bol demonstrated that the mere potential presence of others affects individual cognition and behavior (Hacker & Bol, 2004). One does not have to fully adopt all of these perspectives to grant that social factors powerfully influence learner motivation. Palincsar (1998) held that learning and understanding are inherently social, and that meaning making is a social process; she presents constructivist approaches, such as reciprocal teaching, when students teach to learn, as necessarily social. Furthermore, the research regarding the motivational impact of group association is clear: identifying with a group effects behavioral choice and intensity (Zaccaro & Dobbins, 1989). Motivational designs of learning experiences should capitalize on group association or group learning effects if possible.

Identity Leveraging. The search for identity is a primary motivator, particularly for adolescents and young adults. Erikson proposed that this search for 'who I am' and 'what I am capable of' in young adults energized behavior and choice (1980). Intentionally incorporating elements that encourage ego identity discovery or exploration (particularly with adolescents and young adults) was discussed as part of the explication of the motivational component of satisfaction above. Since the search for identity is a broadly motivating issue, incorporation of identity facilitating elements would improve the motivational appeal of an instructional simulation, if appropriate to the simulation objective.

Game developers capitalize on this human interest in identity when they create role-play games that allow users to personalize their avatars. Players do not likely expect to find their real-life identities through such features in games, but they are extremely popular and players appear to be fascinated by the options for altering or extending their personalized game identities. Lee and Hoadley (2007) refer to this as "leveraging identity for fun" and observe that game players enjoy the activity. In *The World of Warcraft* (WoW), players may edit personality and physical features of their personal avatars to match their fantasies or values (Blizzard, 2010). *Second-Life* (2011), a virtual micro-world, exists almost exclusively for this purpose: providing users with an outlet to play out roles that express hidden or fantasized aspects of their identity. On its home page, *Second-Life* asks the user the question: "Who will you be?" *Second-Life* provides robust features for altering a user's avatar's appearance and exploring a wide range of activities and adventures.

Visual Design. That learner persistence leads to improved learning may seem axiomatic, but that the visual design of an instructional simulation may lead to persistence is not. Yet, it appears that attractive visual designs are motivating. Berlyne (1971) described the affective response to aesthetic as energizing and directive to behavior. Czikszentmihalyi and Robinson (1990) proposed that beauty is broadly motivating, observing that the components of aesthetic experience are essentially the same as the components of flow. Not only is visual aesthetic motivating, the motivational challenge rises because today's learners come from cultures saturated with excellent quality visuals. Though preferred styles vary, global cultures are almost universally visual cultures, and becoming more so over time (David & Gore, 2010; Pink, 2005). Specifically, visual design plays a significant role in user perspectives of credibility and quality of computer applications. Internet users assess the credibility of websites primarily by their visual design (Fogg et al., 2002). Keller (2009) places this visual "excellence" dimension in the "Attention" factor of the ARCS Model, but it is possible that this visual or aesthetic variable is also foundational to learner perceptions of relevance and satisfaction.

Figure 1. The Witcher: Assasin of Kings, Courtesy of CD Projekt

Game developers often put a great deal of emphasis on visual design. Note the visual detail and attractiveness of the screenshot from the popular Atari® game, The Witcher, pictured in Figure 1. Great care was taken in depicting characters and environments that may be objectively assessed as 'beautiful.'

This game was developed with such visual quality that it became a source of national pride in Poland where it was developed, and Polish Prime Minister Tusk presented a copy of the game to President Barack Obama during the U.S. president's official visit to Poland in May 2011 (Rainier, 2011).

One practical method for designing an attractive visual aesthetic into an instructional product is to use the *preferred aesthetic*. Beauty may be difficult to define (Berlyne, 1971), but the preferred aesthetic of a target audience may be reliably identified from a group of visual treatments using paired comparisons (Nunnally, 1967). The process is practical: identify candidate visual motifs from popular games or software, select one scene and develop it in each of the candidate motifs, present the treatments to members of the target audience using a paired comparison process (Nunnally, 1967), and utilize the audience's preferred aesthetic in the instructional product.

Structured Story. Screen, theater, and novel writers have made a study of developing story structure patterns that engage users in their products. Parrish (2009) proposed learning experiences should have "beginnings, middles, and endings (i.e., plots) (p. 519)." He then articulated practical guidelines for building and incorporating story-like tension in learning experiences.

Some claim that stories provide the primary means by which we understand our world: that story provides context, data, and use-cases for how we live (Schank, 1990). The five-act story plot structure, illustrated in Figure 2, is so ingrained in writing practice that its origins are unclear. Recent neuroscience research has shown that certain patterns of plot engage large percentages of audiences in similar ways (Hasson et al., 2008). Game developers, as described above, use stories to create interest in their games. The five-act story structure pictured in Figure 2 is common in novels and cinema as a means for gaining and keeping

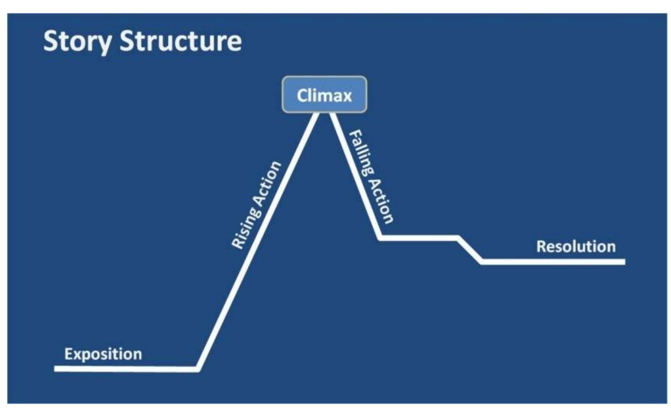

Figure 2. The typical five-act story structure used in literature.

participant interest. Such patterns could be assessed and used in instructional simulations for the same purpose.

Fantasy and Humor. Schank (1990) proposed the life is understood by story. If life is understood by story, then a related axiom may be that stories engage through humor and fantasy. These are actually two different but complementary concepts. Malone and Lepper (1988) define a fantasy environment as "…one that evokes mental images of physical or social situations not actually present (p. 241)." For an instructional simulation, an example of incorporating fantasy is to allow the learner to operate in a world that is beyond his or her current status. For a student ship-handler, have her be the commanding officer in a scenario. For the student athlete, have him be a professional basketball player in a scenario. The motivational impact of this sort of future-fantasy is powerful. Humor—particularly humor that is relevant to the learning goals—can often make a point with more impact than straight narrative. Further, relevant humor has been effective in improving learning performance (Wazner, Frymier, & Irwin, 2010).

Motivational Challenges Specific to Instructional Simulations

Instructional simulations pose unique motivational challenges and opportunities. The most striking opportunity is that instructional simulations are, by definition, active learning. With minimal design forethought, learners may experience a contextualized challenge that approximates real life. This is a significant strength and can serve to offset many of the other challenges in motivational design. Unlike passively listening to lectures, reading a book, or watching a video,
an instructional simulation requires learners to construct responses—often in real-time. This is a significant motivational strength integral to instructional simulations.

The motivational challenges of instructional simulations are, in many ways, related to this strength that the experience is an active learning experience. What can happen is that learners can become lost in the experience, particularly if they are novices to the performance or to the simulation system. This is the most significant motivational challenge to instructional simulations. Care should be taken to guide novice learners through the complexity of the performance or the use of the interface. Otherwise, they may become overwhelmed. The motivational challenges are different for expert performers, novices, and part-task simulations.

Motivational Design for Expert Performers. Expert performers who use a simulation for practice or refresher do not judge the simulation against book learning or classroom experiences, but they evaluate the simulation against the actual task performance (Alessi, 2000). Consider the example of an aircraft pilot taking refresher training in an aircraft simulator. While the pilot may grant some differences between the simulation and the actual flight experience, if the simulation does not include all of the most important performance variables in the task the pilot may reject the simulation completely. It is essential that simulations designed for expert users include all of the salient variables and controls that the performer would use or experience in the actual performance.

This highlights the importance of making intelligent decisions about model and simulation fidelity. Fidelity can never be 100%, but, different simulation contexts require different features. A second useful concept is that model fidelity should be high for the performance being trained, even if the simulation or interface is not a total match to the actual performance. For expert performers, the model should react consistently and accurately, even in simulations that are more simple.

Motivational Design for Novices. In the case of novices, the designer must be aware of the complexity of the task performance and manage cognitive load accordingly. This may be accomplished by developing a model with high fidelity with an interface that presents only the features or controls that are involved in the initial task performance. For example, in a simulation designed to train young ship-handlers the basics of managing wind and current in ship handling, the simulation may present a two-dimensional interface and only the factors relevant to understanding the procedure for maneuvering the ship given the effects of wind and current. The design simulation may leave out the crew, the details of buildings and trees, and other distracting variables.

In addition to managing cognitive load through a simple presentation, novice learners may need both initial simulation orientation and orientation to particularly demanding aspects of the task performance. This may be accomplished prior to the novice's first simulation experience, or as the simulation unfolds. Further, assistance or support may be offered as a pre-programmed feature or as an elective help feature that the learner accesses when needed. Either way, overwhelming a novice performer by either over-complicating the simulation display or forcing the learner into a too-difficult situation is not conducive to motivation relative to the task.

Having said all that, there is an optimal level of complexity that is energizing to learners, so the designer should not create too simplistic an environment or offer too much background support. The 'Goldilocks

Principle' applies: graphic presentation complexity and background support need to be "just right." There is an art and science to these design decisions. A good learner analysis is the key to solving the challenge. One technically simple way to address this challenge is to provide learners with choice of difficulty levels, and then design more complexity into higher levels. In this way, simulation complexity may approach real-life complexity while not overwhelming the learner.

Motivational Design for Part-Task Simulations. In some cases, a simulation only addresses a portion of a task, skill, or phenomenon: this is called part-task simulation. This approach is used to train learners component parts of larger skills. The motivational approach is similar to the motivational approach used with novice learners, the under-lying model should respond faithfully, but learners are only presented with the parts of the task that are salient for the component skill. To enhance transfer, it may be advisable to include a few visual elements that will be necessary in performing the subsequent parts of the task, but this is a decision that must be evaluated on a case by case basis. For part-task simulations, then, the key is to present all the relevant stimuli and controls for performance of the identified partial task, and you may decide to add a few visual details that will be incorporated in the subsequent tasks, leaving a path for the next steps in learning the larger task.

Guidelines for the Motivational Design of Instructional Simulations

The following guidelines are drawn from the literature regarding types of instructional simulations, motivation and motivational design principles from diverse perspectives, and the specific motivational challenges of instructional simulations.

Pre-Simulation Design

Learner and Content Motivational Analysis

- Conduct a motivational analysis of the target audience using the ARCS Model to structure the effort (Keller, 2009, pp. 197-222).
- Use the ARCS Model to guide materials/ content analysis (Keller, 2009, pp. 222-229).

The Learners' Entrance to the Simulation

- Provide an intuitive interface (Alessi & Trollip, 2005).
- Clearly define first steps for user (Alessi & Trollip, 2005).
- Clearly define the simulation's purposes and desired outcomes early in simulation (Rieber, 1996).
- Specify performance objectives in plain language (Keller, 2009).

Stimulate Curiosity

- Begin by instilling tension, posing a problem, or pointing out conflicting information (Parrish, 2009; Keller, 2009; Berlyne, 1970; Malone & Lepper 1988)
- Change task, setting, or context to introduce variation (Keller, 2009).
- Pattern, routine, or established motif can sustain engagement (Parrish, 2009).
- Create sustained suspense by enhancing complication (Parrish, 2009).

Intentionally Structure the Simulation Experience

- Design the simulation with a beginning, middle, and end; and create resolution or reflection activities for closure (Parrish, 2009).
- Create a short back-story for the simulation scenario (Schank, 1991).
- Place the simulation in the context of an on-going story structure that brings the activity to a climax and then resolution (Schank, 1991).
- Theme and plot should rise from subject matter but should not be more than subject matter (Parrish, 2009).
- Endings should integrate everything that has occurred up to that point (Parrish, 2009).
- Honor setting or simulation context… Make it fit with and serve objectives (Parrish, 2009).
- Whenever appropriate, model desired performance (Bandura, 1989) .

Create Optimal Challenge

- Design the learning experience to optimize challenge (Malone & Lepper, 1987). This is accomplished three ways: 1) Use the audience analysis to match learner skill levels, 2) Allow learners to select levels of difficulty, or 3) Program the simulation to detect learner skill level and present challenge at difficulty levels slightly above current level.
- For experts, the simulation must be developed with a high degree of model and simulation fidelity. Experts will judge the simulation against the actual task performance (Alessi & Trollip, 2005).
- For novices, great care must be taken to manage cognitive load (Sweller, 2002). Develop a very basic beginning to the simulation and appropriately increase difficulty during the process of the simulation.

- Vary activity and challenge during the simulation (Keller, 2009).
- Incorporate competition carefully. Competition against others may be de-motivating to the losers, and Deci and Flaste (1995) demonstrated that it may also decrease intrinsic motivation for the winners.
- Provide opportunities to compete against the computer or against self-determined goals (Malone, 1981).

Provide Feedback and Consequences

- Provide clear and consistent feedback systems that allow learners to determine whether or not they are reaching the goals on a real-time basis (Rieber, 1996).
- Carefully design consequences to match your objectives. Natural consequences are best, but could overwhelm a novice performer (Deci & Flaste, 1995).
- Do not present such lavish positive consequences that learners could conclude they are being positively "controlled." Even positive control diminishes intrinsic motivation (Deci & Flaste, 1995).
- Provide novices (with either the performance or the simulation) with 'Goldilocks Support': Not too much, and not too little. Judging this is art and science. The general rule of thumb here is to allow the performer to perform as much as possible, and support only when necessary (Allessi & Trollip, 2005).
- Insure that "rules" and behaviors of the simulation are fair, that there is an appropriate opportunity for success and that all participants have equal chance for success (Keller, 2009).

Provide Opportunities for Social Learning

- Accept that learners as protagonists are fully human (Parrish, 2009).
- Incorporate the stories or examples of like-models and how they struggled and succeeded (Bandura, 2000).
- Create simulations that may be used in small groups, as teams, or on networks (Zaccaro & Dobbins, 1989; Palincsar, 1998; Zaccaro & Dobbins, 1989).
- Use avatars to model performance, offer advice, or perform with the learner (Baylor, 2011).

Leverage Learners' Interests in Identity

Encourage Learners to Articulate and Associate with Desired Futures

- Have learners enter (or select) roles or benefits they see stemming from successful performance of the simulation's learning objectives in real life (Rieber, 1996).
- Provide learners with options to personalize their participation through modifying an avatar (Malone, 1981) (Lee & Hoadley, 2007).
- Allow learners to choose roles, settings, tools, or tactics for performance (Malone & Lepper, 1988).
- Create Identity Forming Events and Linkages
- Foster a change or growth in sense of identity; make learning a rite of passage (Parrish, 2009).
- Create opportunities for success in the context of a desired role (Keller, 2009).
- Create opportunities for success in the context of the task performance (Keller, 2009).
- Provide feedback in the context of learner's values or goals (Malone, 1981; Ford, 1990).

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Match Learner Goals to Simulation Objectives

- Have learners select or articulate personal and performance goals relevant to the simulation task (Malone, 1981).
- Have learners select their personal values from a menu, or enter them in a database (Malone, 1981).
- Allow learners to choose tasks that interest them (Malone, 1981).

Present an Engaging Visual Design

- The interface must be intuitive—especially for new users (David & Gore, 2010).
- Visual designs may vary in complexity, but they must always have an "apparent excellence." That is, when the target user views the screens, the user must assess them as having quality. Aesthetic judgments are made quickly so the quality of "first views" is important (Zajonc, 1980).
- Every visual design must be attractive—such are the contemporary demands of our culture (Pink, 2005) (Alessi & Trollip, 2005).
- Design visuals to the preferences of a sample of your target audience. The elements of high aesthetic are elusive, but preferred aesthetic may be reliably identified (Berlyne, 1971).

Incorporate Relevant Fantasy and Humor

- Offer scenarios in which users may assume valued future roles (Malone & Lepper, 1988).
- Use appropriate and relevant humor to lighten a heavy task or to engage learners (Wazner et al., 2010).

Conclusion

Instructional simulations are effective in teaching *about* things and in teaching *how to do* things (Alessi & Trollip, 2005). By definition, they require learners to construct responses, and this learner act of constructing a response is to some degree inherently motivating. However, they can also be profoundly confusing to novices, or may miss the degree of realism required by experts. Therefore, motivational analysis and design is an important part of the larger instructional design process for instructional simulations.

Keller's (2009) ARCS Motivation Model is the most comprehensive contemporary motivation model for instructional designers and provides a cohesive framework for analyzing and designing motivation in the instructional environment. Keller's processes for audience and content motivational analysis are effective. The ARCS model alone, as currently defined, is insufficient for the motivational design of instructional simulation. The issue is not the framework, rather, the current explication of the applied details. Therefore, we have drawn from several motivational perspectives in addition to ARCS to construct the conceptual framework for these guidelines. It is a testament to Keller's work that each of the unique motivation elements described here may be appropriately positioned within a dimension of the ARCS framework.

Motivation is a complex process, but motivational goals and objectives may be systematically articulated, and effective tactics and strategies developed. Motivation is the result of a system of factors: attention, relevance, confidence, satisfaction, volition, challenge, identity, social factors, flow, story, and aesthetics that energize learners and encourage them in the learning task. Learning is the result of experience as well as the feedback, correction, and reflection that follows the experience. It is the result of shared meaning making. Learning is an act that a learner undertakes and so motivation is fundamental. Motivation cannot be guaranteed, but it can be systematically encouraged. The guidelines provided here for the motivational design of instructional simulations are offered as a beginning step in the right direction.

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A Needs Assessment of Online Courses in Blackboard for Undergraduate Students

Kangdon Lee, **University of Northern Colorado**
Joseph Marler, **University of Northern Colorado**
Mark Savignano, **University of Northern Colorado**
Deborah Genet, **University of Northern Colorado**

Abstract: The purpose of this research study was to measure the gap between the current state of online classes in Blackboard and the needs of undergraduate students enrolled in online courses at a major western university, and to find possible improvements to Blackboard that will help meet the needs of students. The condition of online courses in Blackboard at the university was determined based on the analysis of data collected from a survey, interviews, and a literature review. The final results of the research address student perceptions of Blackboard in terms of its ease of use, presentation of instruction based on a variety of learning styles, and student suggestions for possible improvements.

Keywords: online, course, Blackboard, undergraduate, needs assessment, satisfaction

Introduction

Perspectives on online distance education are universally expanding, without time and space limitations, with the assistance of not only advancements in technologies and learning environments, but also the growing acceptance and popularity of online course offerings (Eom, Wen & Ashill, 2006). Rates of enrollments in online education have far exceeded the increases of higher education students in the US (Allen & Seaman, 2010).

According to Allen and Seaman (2010), as of fall 2009, the estimated number of online enrollments in degree-granting post-secondary institutions showed a consecutive increase of twenty-one percent by the fall semester of 2008, to a total of 5.6 million online students. The importance of online courses in higher education is steadily increasing, with nearly thirty percent of higher education students enrolled in online courses. Moreover, Allen and Seaman reported that, in a survey of academic leaders from more than 2,500 colleges and universities nationwide, those who felt online education had a critical role in their long-term strategy had risen to 63.1% in 2010, from 50% in 2002.

However, online courses may not be meeting the needs of the diverse learners in higher educational settings. A number of indicators of user satisfaction for online courses, in higher education, have shown that learners found their experiences with online education dissatisfying (Eom, Wen & Ashill, 2006). Online learning has been criticized as a passive learning environment, equal to sitting in the back of the classroom (Sharp & Huett, 2005). Furthermore, designers and instructors of online classes may not always consider the diversity of students' learning styles, which encompass the four types of the physiological dimensions of learning styles, such as visual, aural, read/write, and kinesthetic (Drago & Wagner, 2004).

The purpose of this study was to analyze the gap between the present online learning systems in Blackboard and the needs for online education of undergraduate students at one major western university.

The performance gap was analyzed in four areas: motivation, learning styles, course structure, and interaction. Based on the analysis we suggest specific, acceptable, and executable alternatives to the current state of online education systems in higher education, as exemplified at this university.

Literature Review

Motivation

The motivation of the online learner has been defined as the intrinsic desire to achieve a goal or an end (Eom, Wen & Ashill 2006). This is a critical concept when researching and examining the future success of students in online learning environments. Motivation of the online student can be separated into three categories: Intrinsic, Extrinsic, and Self (Kim & Frick, 2011). The intrinsic desire to achieve is central to the success of any student participating in online education (Sahin & Shelley, 2008). Extrinsic motivation can be fostered by how the online classroom is set up in terms of student perception of material covered and the interactions between participants (Sharp & Huett, 2005). Self-motivation is how the students see their ability in terms of confidence and ability to succeed (Lim, 2004). All three concepts play an important role when students sign up and participate in online or distance education.

Kim and Frick (2011) argue that participating in an online class takes self-discipline and motivation. A student taking a class online needs to have the drive and desire to be educated. Learners who are motivated tend to have more positive results with both online classes and the material learned (Kim & Frick, 2011). Intrinsic motivation can be increased when the subject matter the student is learning is relevant, and has a purpose.

When examining extrinsic factors of student motivation in online education, characteristics of the online learning, reasonable workload requirements, and academic support are essential for a successful learner. Workload issues can decrease the motivation of the student in an online environment (Kim & Frick, 2011). Instructors can foster student engagement by requiring a reasonable amount of relevant work. If instructors require too much work, as perceived by students, they may not become engaged to get the work done. Conversely not requiring enough relevant work may make students see assignments as busy work, with little to no relevance.

The instructor can provide positive, constructive feedback as one method of supporting the student (Lim, 2004). Students taking online classes can improve the quality of their work by applying their instructor's feedback. Online instructors should endeavor to create a climate of positive learning for the student (Kim & Frick, 2011). Positive interactions between the instructor and the learner will foster greater motivation to complete work, and create a positive experience for students in an online learning environment (Sharp & Huett, 2005).

The perception of a learner plays a vital role in motivating learning in an online class. Student motivation may decrease if the learning style of the student does not match well with the teaching style of the teacher (Kim & Frick, 2011).

In summary, many factors affect a learner's motivation when taking an online class. Intrinsic motivation, extrinsic motivation, and self-motivation all may be influenced by the structure of the class, the communication of the instructor and the learners' own confidence in being successful in an online class.

Learning Styles

The diverse learning styles of individuals encompass many different ideas, but the idea at the core is that learners are not homogeneous, but are diverse individuals, with a variety of instructional needs and approaches to learning The various models of learning styles attempt to identify significant learner characteristics so that instruction can be optimized by adapting it to each learner's unique needs. Coffield, Mosely, Hall, and Ecclestone (2004), for instance, categorized learning styles into five major groups: constitutional, cognitive, personality type, learning preferences, and learning approaches. Hawk and Shah (2007) described the VARK model, which defines learning styles by sensory input, (visual, auditory, read/write, and kinesthetic). These researchers hypothesize that individuals have preferences for processing and communicating information through one or a specific combination of these channels. The implication of this theory is that students will learn best when instruction is delivered through channels that the learner prefers. The beauty of the theory is that it is very easy to adapt the type of instruction provided, based on a given student's learning style. Peter, Bacon, and Dastbaz (2010) have argued that one of the most significant problems associated with learning styles is that no one has produced a "proven recipe" for adapting learning based on learning styles. They cite this as one reason for the appeal of the VARK model. Zajac (2009) proposed that one approach is to create multiple learning resources for the same instructional objective in a variety of formats. She explained that these learning resources, known as Reusable Learning Objects, (RLO), can be reused and recombined to meet the needs of learners with specific learning profiles.

Although there is thus disagreement about the best way to define and measure the differences of learners, one of the implications of the learning style research is that students can benefit from learning in a variety of ways to process information. The VARK model may provide a map for diagnosing and delivering content specific to student preferences.

Course Structure

As with other factors in online education, such as motivation, learning style, and interaction, course structure may affect not only student satisfaction, but also the extent of skills and knowledge that learners obtain from online courses. The course structure plays a significant role in determining student satisfaction and the quality of online education systems, and is a decisive element that affects the successful outcome of online distance education (Eom, Wen, & Ashill, 2006).

According to Moore (1991), course structure represents the firmness and flexibility of online education systems. That is, the educational objectives, teaching strategies, and evaluation methods of online courses all fall under course structure. Moreover, Moore (1991) argues that the design of online instructional courses determines the extent to which online courses can adapt to or comply with diverse learners' needs in order to employ diverse teaching strategies, effective environments, and rich instructional media.

Eom, Wen, and Ashill (2006) have postulated that course structure has two essentials, course objectives and course infrastructure. Course objectives include particular information related to an online course, such as topical issues to be addressed, expected workload, desired types of class participation, assignments, projects, and the like. Course infrastructure, according to these researchers, is related to the overall ease of using the web site in an online course and the organization of course materials. In other words, learners should be able to not only interactively and contextually use the web environment of an online course, but also utilize various course materials efficiently and effectively.

Arvan, Ory, Bullock, Burnaska, and Hanson (1998) examined a number of studies in which improvements were made to online course structure. They found that a number of simple redesigns of the course structure resulted in increasing the number of students enrolled in an online course. Improving grading systems and counting on peer support resulted in improved learner engagement.

On the other hand, Eom, Wen, and Ashill (2006) contended that changes to an online course structure only resulted in a favorable degree of students' satisfaction with the online course. This may be interpreted to mean that a better measure of the quality of learning activities are other learning factors, such as interaction, feedback, and the like, rather than the usability of the online course. In other words, meaningful feedback that occurs among students or from an instructor may have a greater impact on perceived learning outcomes than does course structure.

Interaction

Participating in an online course requires 21st century skills that are rapidly and constantly changeable. One of the most enlightening successes of online education is that dialogue and learning can incorporate collaborative models of learning and decrease instructor-dependency. Of note, however, are the drawbacks that may be involved in interacting online. Technology may not compensate for the superiority of face-to-face communication. However, the inconvenience of traveling to campus has been replaced by anytime, anywhere online accessibility and affordability (King, 2002).

Landry, Griffeth, and Hartman (2006), in their study indicated that students found the elements associated with course content, such as the class documents, lectures, announcements and quizzes were viewed as more useful than the tools for interaction and support, i.e. discussion boards, emails, faculty information and external sites.

"Students often report that their favorite features of the Blackboard system are around-the-clock access to course materials (especially when they have misplaced something) and ready access to their grades in a private, secure medium" (Loubert, 2004, p. 99). In 2011, Blackboard upgraded a component package called Blackboard Collaborate™. This conferencing platform enables both students and instructors to experience a virtual classroom directly in the Blackboard course structure. Students have access to live virtual sessions and recordings with a single click, and greater opportunity to interact in real time in social learning opportunities with peers and instructors. They benefit from live, dynamic interaction in the online learning environment.

In May of 2007, for example, Blackboard enabled students to more actively engage in their academic lives by providing notifications and course updates sent via Facebook. This is an elective application and when enabled, students can receive class information on new assignments, discussion board postings, course materials, and even new grades while logged in to their Facebook accounts. Additionally students can connect with their classmates via Facebook, giving them more opportunity to turn social interactions into collaborative student-to-student learning efforts.

After a thorough review of the literature, the researchers designed the present study in order to measure the gap between the current state of online classes in Blackboard and the needs of undergraduate students enrolled in online courses at this major western university, and to determine possible improvements to Blackboard and the online courses in an effort to better meet the needs of students at the university. The researchers employed a student survey, as well as interviews with two faculty members and an online expert, to collect the primary data. The study, therefore, was designed to examine student perceptions of Blackboard in terms of its ease of use, presentation of instruction based on a variety of learning styles, and student suggestions for possible improvements.

Method

Participants

The participants in this study were 56 undergraduate students who were enrolled in at least one online class at a major western university in 2011. These 56 participants were those who responded, of 100 students enrolled in two undergraduate online courses at the university. The two instructors from the same online courses as the survey participants, as well as one expert from the department of information management and technology at the university, also participated in focus group interviews.

Measures

The primary data were collected through the use of an online survey. The survey, developed by the researchers, included 44 questions; 34 of these questions employed a Likert-type scale that measured students' perceptions of the online courses they had taken in 2011. In order to gain a broader picture of students' experiences with online courses, ten additional questions were used that asked students about their preferences, and for their suggestions for improving the online education environments at the university. Nine of these questions consisted of checklists and one was an open-ended question. (See Appendix A).

In addition to the data gathered using the student survey and results of the literature review, interviews with the two course instructors and one online education expert from the university were also employed in order to gather deeper data, with the goal of enabling the researchers to suggest recommendations for developing more satisfactory online education systems and courses at this university, ultimately, with implications for higher education in general (See Appendix B).

Procedures

The researchers administered the student perception survey to students in two undergraduate online classes at the university. The classes were chosen because they met two criteria: they consisted of more than forty students, and more than eighty percent of the class was online. The survey was given to approximately 100 students taking at least one online course and 56 participants out of 100 responded to the survey. The selected students completed the online survey within a one-week window.

The two course instructors and one additional online education expert at the university were also interviewed to gain their perspectives on online education and their recommendations for possible changes to the system in order for them to be able to create and deliver more satisfactory online courses. The two faculty members were selected as interviewees because they have been managing quite a few online courses at the university. The expert on online education systems at the university was selected to be interviewed as his primarly responsibility is to maintain the university's online education systems and gather feedback from students and faculty members at the university. These three individuals were asked about their perceptions and ideas about online education systems at the university, and about such issues as students' feedback and complaints about online courses.

Data Analysis

All data were used to describe the current state of online education systems in Blackboard at the university. By examining the needs assessment survey data, students' perceptions and levels of satisfaction could be described, yielding a potential gap between students' expected satisfactory online class experiences and the observed perceptions of their online courses. Frequencies of students' responses and participants' preferences were determined. In addition, the outcomes of the interviews with the two faculty members and one online education expert were employed to develop recommendations for more satisfactory online education systems at the university.

Reliability

To determine the internal consistency of the survey questions, Cronbach's Alpha analysis was conducted on the 34 multiple-choice questions out of all 44 questions in the survey. The value of Cronbach's Alpha on these questions was 0.844, which can be interpreted to mean that the 34 Likert-scale type survey questions have strong internal consistency.

Results and Discussion

Student Motivation

The findings of the literature review indicate that there is a noticeable gap between students who succeed and students who do not. One of the aspects of greater motivation is the student's perception of the class and the class work requirements (Sahin & Shelley, 2008). Results on the survey questions related to motivation indicated that students were confused about the format and objectives of most of the classes. Students reported that they had a difficult time navigating through links and communications; as a result they became unmotivated to continue working. One participant in the survey stated that he or she did more work in the online classes for the same amount of credit than in a face-to-face class. Online classes need to meet the students' assigned work expectation in relationship to a comparable traditional class.

Motivation was also decreased due to the confusion caused by unclear course objectives. One participant stated that the class did not follow the posted guidelines. The survey results indicated that over 78% of students felt more motivated when taking a face-to-face class than when they are taking an online class. (See Figure 1). This can be compared to the 52.6% of students who indicated that they felt that online classes were less important than offline courses. Because students did not find value in the classes they took online they were less motivated to take the classes and found participating in online classes more difficult. From the literature review, Kim and Frick (2011) indicated that if the workload is not relevant to the student, motivation decreases. The present survey results support those of Kim and Frick (2011), who reported that students did not find value in the online learning environment, and that the size of the workload during the class will increase or decrease the motivation of the student.

Results of the present survey tend to support this position; 61.4% of students reported having a difficult time staying updated on the course work demands. In the open response section of the survey one student stated: "I found myself being very confused with the online class and received a lot of email from other confused classmates trying to figure out what exactly the assignment was or how to do it". Time spent navigating through the purpose or requirements of an assignment can add to the overall workload of a class. Without clear, well written, workload lists, students can be left trying to figure out what is required of them. This confusion can add to a lower personal confidence level in the students' own ability to complete or accomplish tasks. These factors are evident in the survey, as 63% of students stated that they found taking

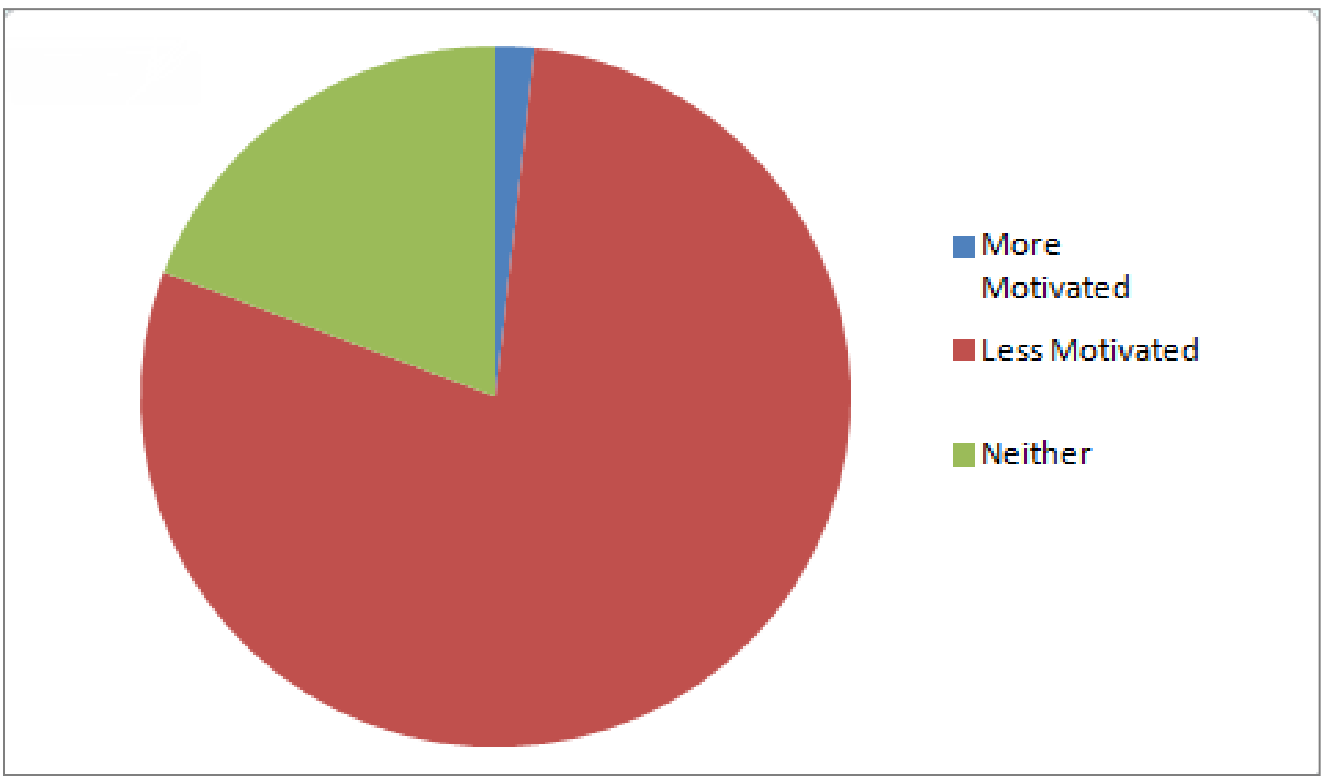

Figure 1. Percentage of students' motivation in online compared with face to face classes

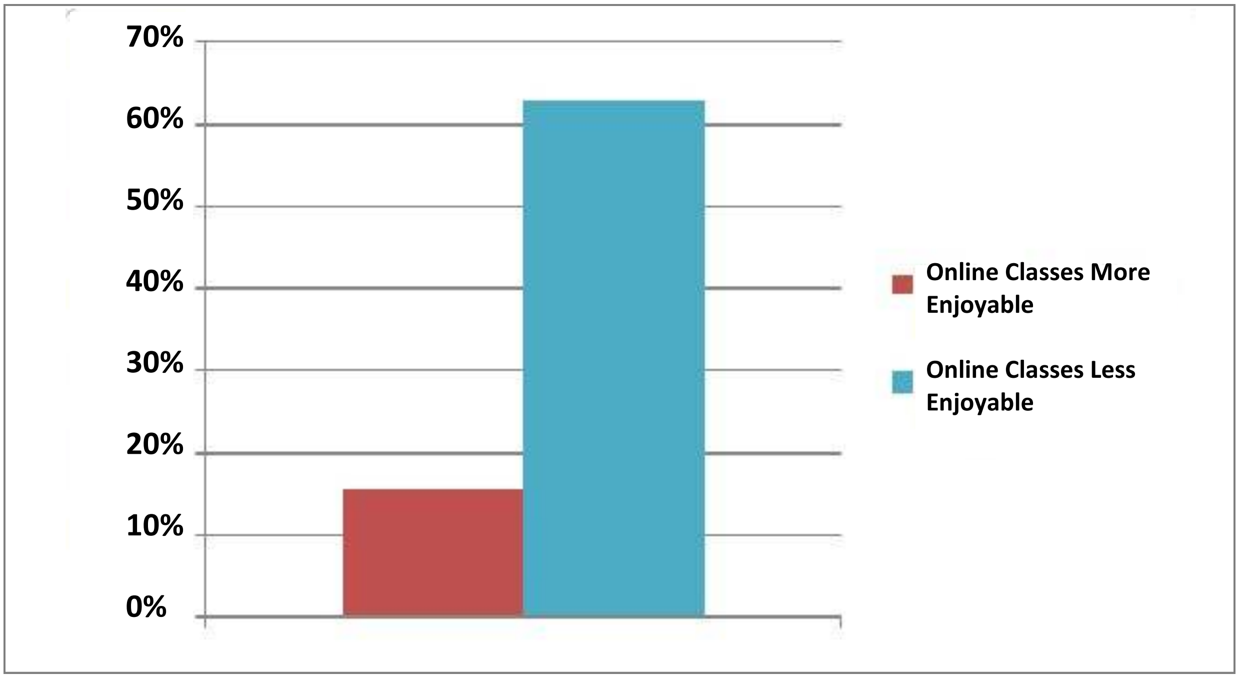

Figure 2. Percentage of students' enjoyment

an online class to be less enjoyable than taking a traditional class. (See Figure 2).

The results of the present online course survey suggest some of the factors that may cause students' motivation to decrease when they are enrolled in online classes through Blackboard. Two factors are the students' expectation of a reasonable workload and their perceptions about a clear course structure. Students indicated they had a difficult time navigating the requirements for the classes, adding to the already substantial workload required by the classes. Both of these issues are avoidable and can be corrected.

The survey results were mixed when students were asked about their overall learning satisfaction toward the online courses. Thirty-three percent of the students reported that they were satisfied, 38.5 % reported being unsatisfied, and 28% of the respondents indicated that they were neither satisfied nor unsatisfied. Making changes to how students take online classes may lead to an increase in the overall level of student motivation. (See Figure 3).

Learning Style

In this section is examined the gap between the perceived learning needs of online students and the instructional resources currently available. The pattern of responses to the question, "Does Blackboard meet the needs of students with diverse learning needs?" is complicated. The results of the survey indicated students' learning preferences did not significantly affect student satisfaction. Students acknowledged that Blackboard courses were heavily biased toward text-based instruction; however, the majority of students were comfortable with that medium, even though it was not their preferred learning style. The majority of students felt that, despite a lack of variety in the content on Blackboard, their needs for learning were adequately addressed by the current form of Blackboard at the university.

When asked about their learning preferences, a large majority of students identified themselves as having visual and kinesthetic learning styles. In response to the question, "What type of learning style are you most comfortable with," the visual learning style was identified 39% of the time, kinesthetic learning was selected 31% of the time, auditory learning was chosen 18% of the time, and read/write learning was chosen only 12% of the time. The read/write learning style was only chosen approximately 1 out of every ten times, making it the least popular learning style by a large margin.

Consistent with findings in the literature review, the students identified read/write as the learning style that dominates course content on Blackboard. When asked, "Based on your experiences, which learning styles are most commonly addressed in Blackboard," the read/write category was selected 52% of the time, visual was picked 35% of the time, auditory was identified 16% of the time, and kinesthetic was chosen just 3% of the time. This represents a large gap between student preferences and how the content is typically delivered. It would seem to follow that students might be deeply dissatisfied with the instructional materials used on Blackboard; however, our research indicates

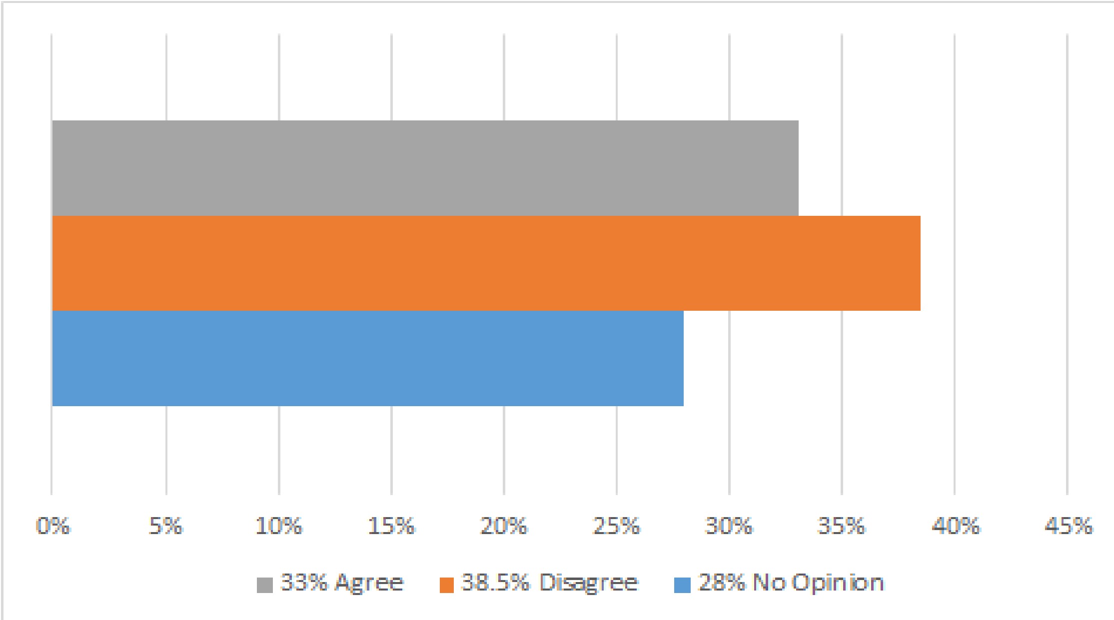

Figure 3. Percentage of overall students' satisfaction

this was not the case.

One of the most puzzling results of the survey was the relatively positive student assessment of Blackboard in relationship to learning styles. Of the students surveyed, 64% agreed that, "Blackboard adequately facilitates learning in the style that is most effective for me." Only 5% disagreed and no one disagreed strongly. This is an interesting paradox. Why would a group of students who largely identify themselves as visual and kinesthetic learners report that their learning needs are being met by courses that are heavily biased toward the read/write learning style? One possible explanation is that online students have different learning needs than do traditional students.

In their research, Drago and Wagner (2004) speculated that, based on the learning profiles they compiled of online students, those who have the option of choosing between traditional and online classes may choose based on their learning preferences. While few students in our survey chose the read/write learning style as their preference, their answers indicated that they were very comfortable with learning from text-based instructional materials. Students who were uncomfortable with the read/write learning style would be less likely to take an online course. (In order to more fully assess this question it would be necessary to survey students who have opted out of the online course work and determine their motivation.) In addition, Diaz and Cartnal (1999) reported that students who enroll in online classes were not as "dependent" on their learning style to be able to learn, (as cited in Drago and Wagner, 2004). This could explain why students, who clearly preferred visual and kinesthetic learning, reported that Blackboard met their learning needs. It is possible that these students are better able than are traditional students to learn from materials that do not match their preferred learning style.

A commonly cited reason for taking online classes is the convenience of the flexible schedule and the ability to work from home. Students may expect to make some trade-offs for these benefits, such as doing work that involves more reading and writing. This would mean that while students may not enjoy or prefer to learn in the read/write style, they accept it as the price of taking online classes.

The survey results indicate that while Blackboard courses are delivered in a way that heavily favors the "read/write" learning style, the platform is meeting student needs and expectations. Based on the survey answers and a review of the literature it is proposed that this is probably because of the type of student who takes online classes. As the number of students who take online classes continues to increase, it is likely that online classes will attract students with more heterogeneous learning needs, that is, learners who will require more diverse learning materials in order to be successful. It also likely that as learning materials improve, student expectations will rise accordingly, and they may no longer find classes dominated by reading and writing to be acceptable. Therefore, despite current student satisfaction with the way Blackboard addresses learning styles, diversifying the types of learning materials used is likely to become increasingly important.

Course Structure

Regarding course structure, including objectives and infrastructure, student were asked to respond to six questions about how they think of course structure in terms of adequate flexibility and consistent follow-up throughout an online course. Overall, students were satisfied with the online course structures provided by their instructors, with a mean score of 3.37 out of 5.00. In addition, the median and mode of course structure were 3.50 and 4.00 respectively. This shows that a majority of students were inclined to rate course structure as satisfactory in their online classes. However, student satisfaction with course structure in online education may not be the best way to determine the quality of course structure. In this study, the mean score on the question asking students' overall satisfaction of their online courses in Blackboard was 2.98, which is below the mean of all six questions about course structure, which was at 3.38. In addition, the difference was a margin of only two participants between positive responses (29) and negative answers (27) from the mean value, 3.37. (See Figure 4).

As shown in Figure 4, results on only two questions yielded a mean score below the total mean on course structure, and on the rest of the four questions the mean scores were more positive than was the total mean regarding course objectives and infrastructure. For the question about the overall satisfaction with the online course structure (Figure 5), 18 (32.15%) students responded that they were not satisfied with the overall online course structure. On the other hand, 20 (35.7%) students answered that the flexibility and consistent follow-up of online courses were satisfactory. The remaining 18 participants were neutral in their stances toward online course structure in Blackboard, representing 32.15% of the 56 survey participants.

Furthermore, on the other questions regarding accessibility, feedback easily found, consistent feedback, and course materials, participants responded positively, yielding mean scores at 3.66, 3.50, 3.48, and 3.71 respectively, all of which are above the mean score on the online course structure, 3.37. These mean values can be interpreted to indicate that students were satisfied with the accessibility of online courses, feedback from instructors, and course materials.

The final question related to course structure asked students about the level of reflection of students' needs in the online course structure. In Figure 6 it can

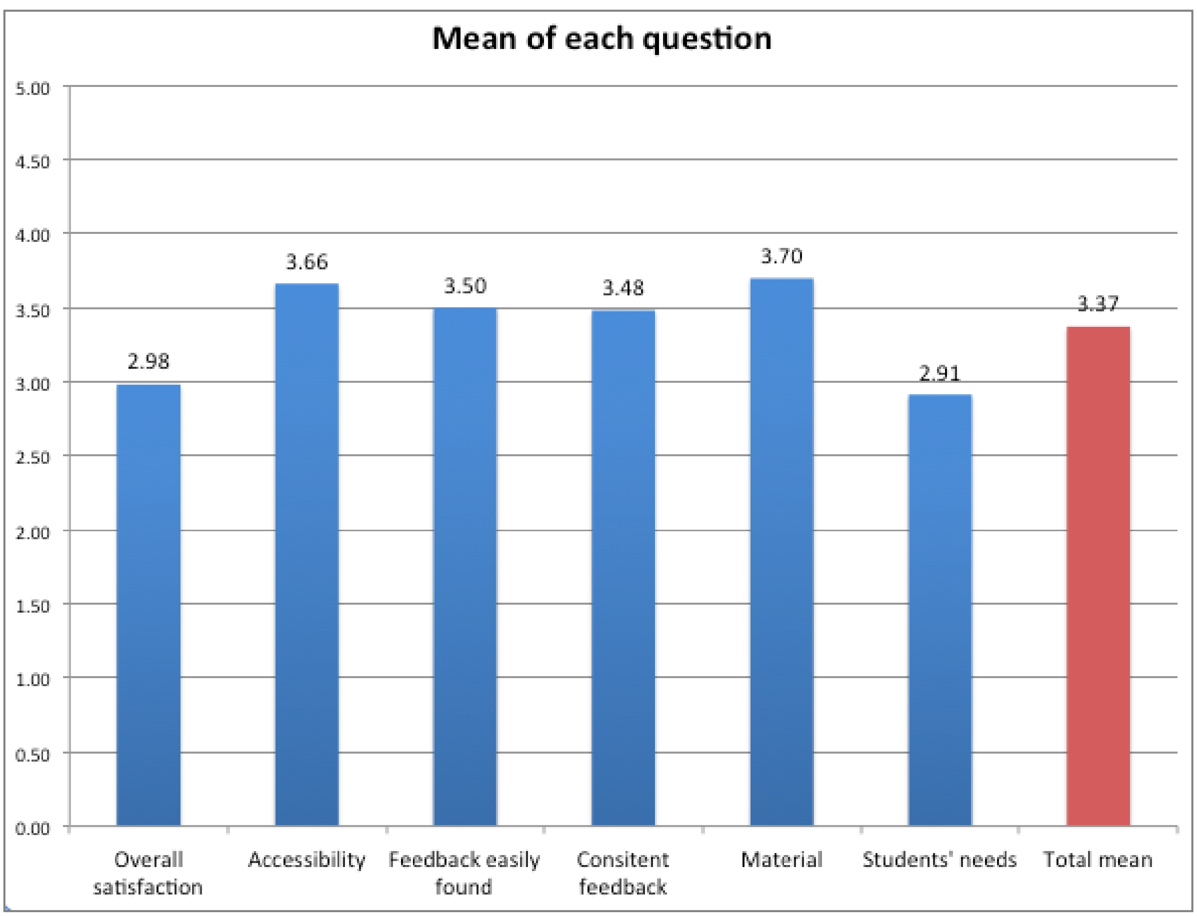

Figure 4. Mean scores on course structure questions

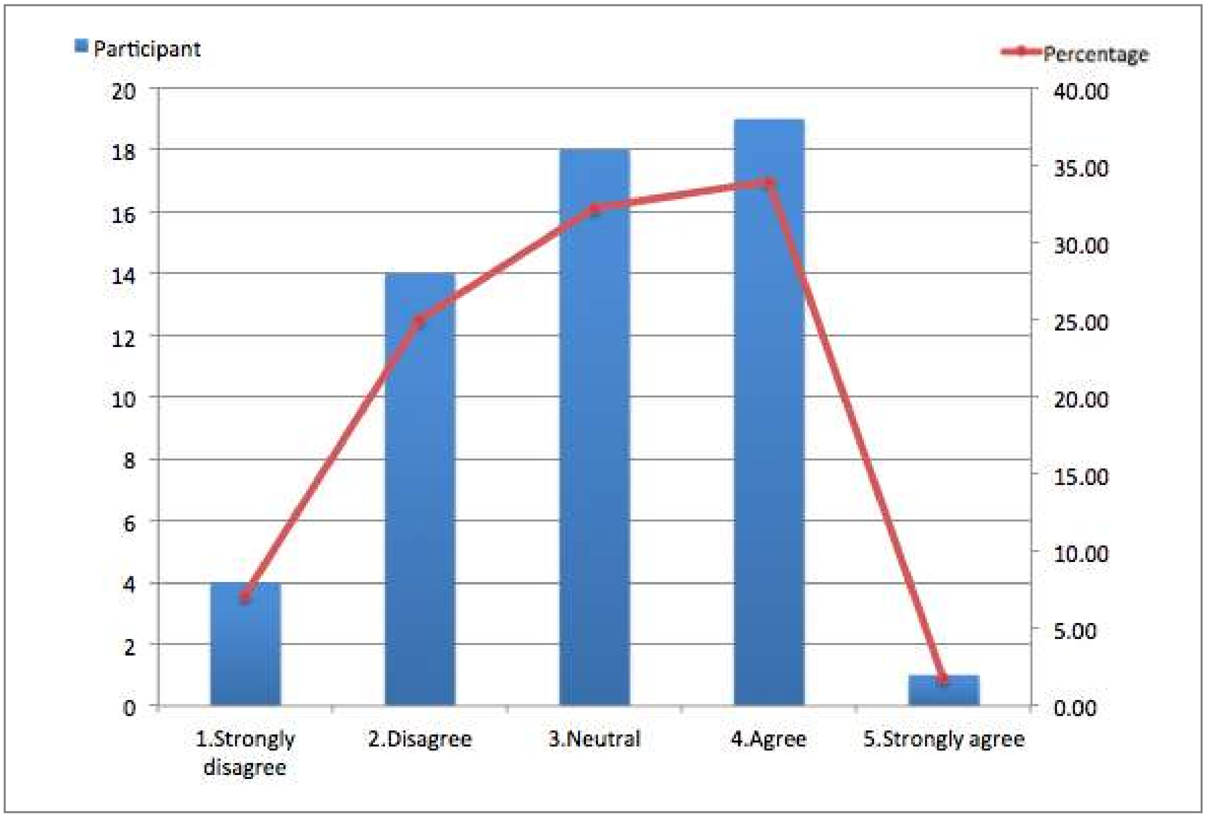

Figure 5. Participants and percentage about overall satisfaction

be seen that students' showed the highest rate of dissatisfaction with this question, with a mean value of 2.91, within the context of the six questions concerning the online course structure. Specifically, 21 students (37.5%) responded that they were not satisfied with the reflection of students' needs in the course structures. On the contrary, 19 participants (33.9%) answered that students' feedback and comments on the online course structure were well reflected by instructors or online education experts. The rest of the 16 students were neutral in their stances toward reflecting students' needs in the online course structure, representing 28.6% of the 56 survey participants.

To sum up the results of students' attitudes toward online course structure, students were satisfied with the overall online course structure, with a total mean score of 3.37 out of 5. However, some questions about course structure indicated students' dissatisfaction in the reflection of students' needs into the course structure. This result can be interpreted to mean that online course structure does not significantly affect the students' overall satisfaction of online education systems. This finding supports those of Eom, Wen, and Ashill's (2006) that what matters more as a measure of the quality of learning activities were other learning factors, such as active interaction and timely and sincere feedback, rather than the ease of use of the online course structure.

Interaction

The purpose of this research was to measure the gap between the current state of online classes in Blackboard and the needs of undergraduate students enrolled in online courses, and to recommend possible improvements to Blackboard and online systems at the university. The students' responses regarding interaction yielded interesting results. The interaction questions were grouped into three categories: student-to -instructor, student-to-student, and student-to-content. Not only did the questions reveal the level of student dissatisfaction/satisfaction, but also what interaction tools they used most, and found most valuable.

In the student-to-instructor category, the mean score for all questions ranged from 3.23 to 3.76, with a score of 3 representing neutrality, 1 as Strongly Dissatisfied and 5 Strongly Satisfied. Of note was that there were very few instances of a response of "Strongly Disagree" to any of these questions, suggesting that only a small minority of students were extremely dissatisfied with their instructor interaction. At the other end of the spectrum, there was a multitude of "Strongly Agree" responses to student-to-teacher interaction. Of those that responded that they were satisfied, the types of interactions that they reported using indicated that over 84% relied on email. Nearly six percent used collaboration, and only a small percentage, four percent, used the phone or texting.

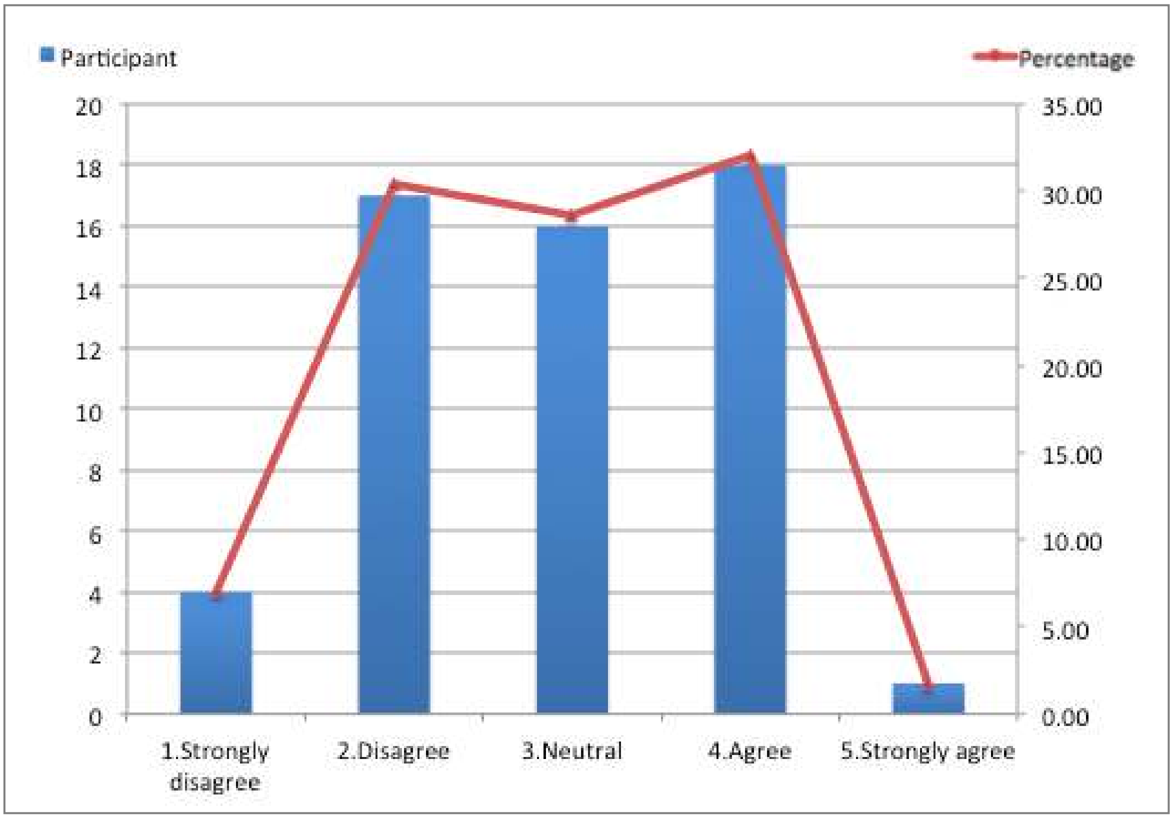

Figure 6. Participants and percentage about students' needs reflected in course

These results somewhat conflict with those of Landry, Griffeth, and Hartman (2006), who reported that students viewed course content tools to be more useful than interaction tools like email. In the current study, for those respondents that were not generally satisfied with their instructor interactions, what they reported needing more of was as follows: Email 20.29%, Phone 11.59%, Texting 10.14%, Social Networking. 11.59%, Chat 21.74%, Video 13.04% and Blogs at 4.35%. The request for more instructor interaction via Social Networking (12%) plus Chat (22%) could be satisfied by the implementation of Blackboard Sync™ (Blackboard, 2008).

Looking at the student-to-student interaction data, there appears to be a higher reported level of dissatisfaction. Specific survey questions asked about satisfaction with the overall interactions with my classmates, interaction and/or communication of more than three times a week with classmates, more communications than in a face-to-face class, and overall student-to-student interaction tool satisfaction. Overall, classmate interaction revealed a mean score of 3.2, just slightly higher than neutral, with the mode at 4.0. When asked about interactions of more than 3 times a week, students responded quite unfavorably, with the mean at 2.0, Disagree, with the mode at 1.0, Strongly Disagree. What this reveals is that overall student interaction is low in this Blackboard environment. As a result, collaboration may be being compromised. Respondents also reported disagreement with having more interactions in the online Blackboard environment than in a face-to-face class, with the mean at 1.64, and the mode at 1.0. What is extremely noteworthy is the response to overall satisfaction with student-to-student interaction tools. The mean score on this item was 4.8 (Strongly Agree), and the mode was 4.0. These results reveal that students are not interacting (or at least as much as they would in a face-to-face class), but that they are reporting very high satisfaction with the tools available. The open-ended questions showed what tools satisfied students are using: Email 37.82%, Texting, 16.81%, Phone 12.61%, Social Networking 5.88%, Chat 5.04% and Blogs at 3.36%. Dissatisfied students reported needing more Email 19.2%, Chat 16.18%, Video 14.71%, Phone and Social Networking 11.76%, Texting 8.82% and Blogs 5.88%. Email appears to be the tool used most and indicated as most desirable by these students for student-to-student interaction. In regard to dissatisfied students, we may speculate that this is an individual learner problem and not a problem with Blackboard, because the tool depends on the student initiating its use.

The last category of interaction was student-to-content interaction. The survey questions asked the degree to which students were satisfied with the content, used the content at least three times a week, and if the content facilitated their learning more than in a face-to face class. The data showed that most were satisfied, with a mean score of 3.12, and a mode of 4.0. Responses to the question about interactions with the content of at least three times a week revealed a mean of 2.69 and a mode of 4.0. The most dissatisfaction occurred when comparing the online course to a face-to -face class. The mean response to this question was 2.23, with a mode of 2.0. Most disagreed that the online course was a better facilitator of learning. For those satisfied with student-to-content interactions, students reported utilizing: Attachments 31.18%, Sharing 21.51%, Importing 10.75%, Embedded 7.53, Conversion 4.30% and Blogging 3.3%. For dis-satisfied students, the data revealed that they wanted more Sharing 22.08%, Collaboration 18.18%, Social Networking 14.29%, Blogging 12.99%, Conversion 10.39%, Attachments and Embedded 7.79% and Importing 6.49%. The implementation of Blackboard Sync™ (Blackboard, 2008) again would satisfy most of the students' concerns in this area.

Based on these interaction results, some of the conflicts between student dissatisfaction and needs may be due to the effects of the Technology Acceptance Model (Landry, Griffeth, and Hartman, 2006). This model, created by Fred Davis in 1989 (cited in Landry, Griffeth, and Hartman, 2006), states that a person's attitudes and perceptions towards technology can affect his or her behavior. If Blackboard student users do not perceive the interaction technology as "useful" or "easy", then they may not utilize it. Perceived ease of use is defined by Davis (1989) as "the degree to which a person believes that using a particular technology would be free from effort" (cited in Landry, Griffeth, and Hartman, 2006, p. 88). The fact that the data in the current study reveal that dissatisfied students want more interaction with tools that already exist, may support this model.

One of the professors interviewed for this research study proposed that a simple solution to close this performance gap would be to offer an introductory course on how to use the interaction tools in Blackboard and what the level of expected student interaction is. Stating that students should have at least one instructor interaction every two weeks, five student-to-student interactions each week and interact with Blackboard content at least three times a week would also provide some framework for acceptable interaction levels. Exposing students to the chat room, virtual classrooms, group tools, etc., would familiarize them with each tool type and provide them with experience about what each tool can do. In essence, these measures could change their perceptions of the online class environment.

Instructor Interviews

Two online instructors who use Blackboard at the university, and who taught the courses in which the student respondents were enrolled, were interviewed. Both were well-seasoned instructors in Blackboard, with a combined total of over 60 semesters of instructing online in this environment. The interviews revealed that one of the biggest challenges for instructors was reading and assessing the discussion boards. They described this process as "cumbersome", and the grade book as "challenging". Also, these instructors would like better and easier ways to interact with students. One interviewee expressed her desire to develop an introductory video for the first week of class, especially due to the number of non-native English students enrolled. She also noted that courses in Blackboard are too heavily text-based and that she wanted to see more incorporation and utilization of visuals, reducing cognitive load, not only for the student, but for the instructor as well. (See Appendix B for complete results.)

Conclusion and Recommendations

Clark and Estes (2008) propose that there are only three kinds of organizational performance gaps, that is: gaps related to skills, gaps related to motivation, and gaps related to organizational conditions. They also assert that there are only three solutions to organizational performance gaps, improving skills, motivation, and organizational conditions. The purpose of this study was to analyze the performance gaps between the needs of students enrolled in online classes at one major western university and the current resources available in Blackboard to them. We evaluated the performance gaps related to meeting students' needs in four areas: motivation, learning styles, course structure, and interaction. In this section we will discuss our recommendations based on the literature review and our analysis of the study's findings.

It was determined that there is a skills gap related to student competence in using Blackboard to interact online. There is evidence that this gap is related to the Technology Acceptance Model (Davis, 1989, cited in Landry, Griffeth, & Hartman, 2006), because the tools needed to close this gap already exist. We recommend a week-long introductory course to familiarize students with the tools available in Blackboard and facilitate their uses for interaction. This short course would provide students the skills they need to interact more effectively through Blackboard.

Results of this study revealed that many students view online classes to be less important than face-to-face classes. This attitude creates a motivation gap, because students who do not perceive online classes as important may not be motivated to produce quality work. The best way to improve the image of online education is to improve online education; each positive student experience, and each quality online graduate will build the brand of online education. That is the overarching goal of this paper and the other discussions and recommendations reported here will be part of that process.

Many students feel that the workload for online courses is greater than for comparable face-to-face classes. The disproportionate workload is an organizational condition performance gap that appears to create a motivational performance gap. Research by Kim and Frick (2011) has demonstrated that excessive workloads depress student motivation. We recommend that the workload for each online class be evaluated in terms of the actual amount of time required to do the work and that the workload be consistent with the credit hours received for the class, as well as with comparable face-to-face classes. Addressing this on an organizational level should address it on a motivational level as well.

Another organizational condition performance gap that results in a motivational gap is the course organization. Many students were frustrated by the amount of time consumed navigating the system to obtain basic course information. Time spent navigating the system added to the workload of students who already felt overworked. We recommend that the format of online classes at the university be standardized as much as possible. A consistent format would increase the student ease of use, reduce time spent navigating the system, and reduce student frustration. Again addressing this gap on an organizational level should close it on the motivational level.

With regard to learning styles, it was determined that Blackboard is meeting the needs of the current students enrolled in online classes at this university. However, it is recommended that, as the scope of online education expands and more diverse learners enroll in online classes, instructional materials should likewise expand in terms of accommodating student needs.

In relation to course structure, it was found that improvements to the organization and usability of Blackboard could be made to increase student achievement. However, the research indicated that the most important criteria for a successful online experience were active interaction and feedback from the instructor.

In conclusion, we have analyzed the performance of online courses using Blackboard at one major university, and identified significant gaps related to student skills, and the efficiency of user interactions. We have made recommendations to address these gaps on the skills, motivation, and organizational level. As online education continues to grow in scope and importance we hope these recommendations will be of use to those who develop online learning courses and materials at this university and others.

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Appendix A: Survey Questions

1. Motivation

These questions below ask you about what you think of learning motivation in Blackboard.

(SD: Strongly Disagree, D: Disagree, N: Neutral, A: Agree, SA: Strongly Agree)

Questions / Rating Scale	1. SD	2. D	3. N	4. A	5. SA
1. I am satisfied with the overall learning motivation of the online courses in Blackboard.					
2. I am more motivated in the online course than in the face-to-face class.					
3. It is harder to get assignments done on time in the online course than in the face-to-face class.					
4. I find the online course just as enjoyable as the face-to-face class.					
5. The online course seems less important than the face-to-face class.					
6. I find it easier to keep on top of the online course than the face-to-face class.					
7. I find it difficult participating in the online course.					

2. Learning style

These questions below ask you about what you think of the reflection of students' learning style in Blackboard.

(SD: Strongly Disagree, D: Disagree, N: Neutral, A: Agree, SA: Strongly Agree)

<table>
<tr><td>Rating Scale
Questions</td><td>1. SD</td><td>2. D</td><td>3. N</td><td>4. A</td><td>5. SA</td></tr>
<tr><td>1. I am satisfied with the reflection of the overall learning styles in the online courses of Blackboard.</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>2. The online courses in Blackboard meet the needs of students with different learning styles.</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="6">3. What type of the learning styles are you most comfortable with?
Visual ____; Auditory ____; Read/Write ____; Kinesthetic ____; Others (_________)
* Kinesthetic: Kinesthetic learners learn best by doing. They are often high energy and like to make use of touching, moving and interacting with their environment.</td></tr>
<tr><td colspan="6">4. Based on your experiences, which learning styles are most commonly addressed in the online courses in Blackboard?
Visual ____; Auditory ____; Read/Write ____; Kinesthetic ____; Others (_________)</td></tr>
<tr><td>5. The online courses in Blackboard favor particular learning styles.</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="6">5-1. If 4 (A) or 5 (SA) are chosen, which learning styles are they?
Visual ____; Auditory ____; Read/Write ____; Kinesthetic ____; Others (_________)</td></tr>
<tr><td>6. The online courses in Blackboard do an adequate job of presenting instructions in a visual way.</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>7. The online courses in Blackboard do an adequate job of presenting instructions in an auditory way.</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>8. The online courses in Blackboard present adequate written instructions.</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>9. The online courses in Blackboard are good media for kinesthetic learning style.</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>10. The online courses in Blackboard adequately facilitate me in the learning style that is the most effective for me.</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>11. My experiences in the online courses in Blackboard include a variety of instructional media that fit my learning style.</td><td></td><td></td><td></td><td></td><td></td></tr>
</table>

3. Course Structure

These questions below ask you about what you think of the online course structure of Blackboard regarding their objectives, organization, and materials.

(SD: Strongly Disagree, D: Disagree, N: Neutral, A: Agree, SA: Strongly Agree)

Questions / Rating Scale	1. SD	2. D	3. N	4. A	5. SA
1. I am satisfied with the overall online course structure.					
2. The objectives of the online course are easily accessible.					
3. The instructor's feedback is easy to find.					
4. The feedback given in a consistent format and location.					
5. The course materials are well organized and delivered.					
6. The structure of the online course adequately reflects students' diversity and needs.					
7. What improvements do you think the online course structure is needed in terms of their objectives, organization, and materials?					

4. Interaction

These questions below ask you of how you feel about interactions among students, instructors, and content made and incorporated in online courses.

(SD: Strongly Disagree, D: Disagree, N: Neutral, A: Agree, SA: Strongly Agree)

<Student to Instructor>

Rating Scale Questions	1. SD	2. D	3. N	4. A	5. SA
1. I am satisfied with the overall interactions with the instructor throughout the online course.					
2. I have received adequate feedback from the instructor.					
3. I am satisfied with the response time for the instructor feedback that I have received.					
4. I am satisfied with communications with my instructor regarding assignments, exams, and due dates.					
5. I am satisfied with the types of the interaction with the instructor.					

5-1. **If 3 (N), 4 (A), or 5 (SA) are chosen**, what interactions with the instructor do you have in the online course?

Email __; Phone __; Texting __; Social Networking __; if checked (_________)

Online Chat __; Video Conference __; Blog __; Collaborating work __

* *If checked, the checked items are positive to be used as a means of interactions between instructors and students throughout online course.*

5-2. **If 1 (SD) or 2 (D) are chosen**, what interactions with the instructor do you need more in the online course?

Email __; Phone __; Texting __; Social Networking __; if checked (_________)

Online Chat __; Video Conference __; Blog __; Collaborating work __

* *If checked, the checked items are what students want to have more as a means of interactions between instructors and students throughout online course.*

<Student to Student>

Questions / Rating Scale	1. SD	2. D	3. N	4. A	5. SA
1. I am satisfied with the overall interactions with my classmates throughout the online course.					
2. I interact with my classmates in the online course at least three times a week.					
3. I communicate with my classmates in the online course more than in the face-to-face class.					
4. I am satisfied with the student interaction tools provided in the online course.					

4-1. **If 3 (N), 4 (A), or 5 (SA) are chosen**, what interactions with the classmates do you have in the online course?

Email __; Phone __; Texting __; Social Networking __; if checked (_________)

Online Chat __; Video Conference __; Blog __; Collaborating work __

* *If checked, the checked items are positive to be used as a means of interactions among students throughout online course.*

4-2. **If 1 (SD) or 2 (D) are chosen**, what interactions with the classmates do you need more in the online course?

Email __; Phone __; Texting __; Social Networking __; if checked (_________)

Online Chat __; Video Conference __; Blog __; Collaborating work __

* *If checked, the checked items are what students want to have more as a means of interactions among students throughout online course.*

<Student to Content>

Questions / Rating Scale	1. SD	2. D	3. N	4. A	5. SA
1. I am satisfied with the overall interactions with the course content throughout the online course.					
2. I use the content/context in the online course at least three times a week.					
3. The interactions with the content in the online course more facilitate my learning more than in the face-to-face class.					
4. I am satisfied with the interactions of the content/context in the online course.					

4-1. **If 3 (N), 4 (A), or 5 (SA) are chosen**, what interactions with content or context do you have in the online course?

Attachment __; Embedding __; Sharing __; Importing/Exporting __;

Converting __; Blogging __; Collaborating __; Social Networking __

* *If checked, the checked items are positive to be used as a means of interactions between students and content throughout online course.*

4-2. **If 1 (SD) or 2 (D) are chosen**, what interactions with content or context do you need more in the online course?

Attachment __; Embedding __; Sharing __; Importing/Exporting __;

Converting __; Blogging __; Collaborating __; Social Networking __

* *If checked, the checked items are what students want to have more as a means of interactions between students and content throughout online course.*

APPENDIX B

Instructor A, University of Northern Colorado
Professor of Educational Technology
Interview Date 11/8/11
Interviewer: 1

Instructor

How many online courses do you teach in a semester, on average?
    2
How long (semesters) have you been using Blackboard for your instructional method?
    10 years, about 30 semesters, Fall, Spring and Summer
What difficulties have you experienced using Blackboard as a course management system?
    How disjointed things are.

What do your online students want more from you as an online instructor and from online education environments in UNC?
    Things are a layer or two away. It is hard to get a message across. Short term memory as there are too many steps (clicks). STM is compromised. There is also little to no imagery used.

What improvements can be made for more satisfactory online teaching experiences?
    There should be an easier way to video tape yourself or a lesson. The international students have a better time with verbal on video rather than just text in Blackboard. They handle a course introduction better via a taped introduction. It should be more engaging. They did add feedback to new blackboard version, but it needs to be more pronounced to the student. Some don't know when you give them feedback. Too much cognitive overload in general.

Instructor B, University of Northern Colorado, Associate Professor, Educational Technology and Social Foundations

Interview Date 11/15/11
Interviewer: 1

Instructor

How many online courses do you teach in a semester, on average?
    Too many. 1 or 2 by myself, but 4 additional with GA assistants
How long (semesters) have you been using Blackboard for your instructional method?
    Since 1999, about 11 years * 3 about 33 semesters
What difficulties have you experienced using Blackboard as a course management system?
    Biggest challenges reading and assessing the discussion board, it is cumbersome. Also, the gradebook is a challenge but it mostly works. More students glitch with the timed release repercussions of assignments and exams. Duplicate questions from the students. The same question(s) get asked over and over.

What do your online students want more from you as an online instructor and from online education environments in UNC?
    Based on teacher evaluations, clear directions and more feedback.

What improvements can be made for more satisfactory online teaching experiences?
    Better ways to interact. There should be less complicated and easier ways to interact with each other (student to teacher, and student to student).

Blackboard Expert Interview with Online Expert

Note: University A is the current university; University B is referred to by the expert, as another university with which he has experience

Q1. What kinds of requests from faculty members and students

A1.

Blackboard technical support department mostly get some requests of improvement from faculty members and students such as browser compatibility, upgrade timeline, technical issues, training items, and so on.

Based on faculty survey results (from the 2009 Faculty Task Force Review), faculty members are mostly concerned about issues below.

The inefficiency of the grade book

Lack of Printed Manuals/Classes Inconvenient/More information on advanced tools/Tip Sheets

Provide more detailed training for new faculty the week before classes

Concern about how System Announcements override instructor announcements

Blackboard doesn't integrate well with newer applications (Facebook, twitter) or allow outside applications (simulations etc.) or have the ability to show videos that are shown in class

More personal communication, not just emails from "LMS team"

Supported browsers issues

Q2. Differences between Blackboard at University A and others

A2.

The main differences between Blackboard at **University A** and other LMS like Canvas will be interface and social integration. That is, Blackboard at **University A** mostly uses traditional modules such as course sites. On the other hand, other LMSs such as Canvas has more social-friendly interfaces that Blackboard at **University A** right now doesn't have.

Q3. Improvements on Blackboard at University A that can be made

A3.

Blackboard technical support has been continuously trying to improve Blackboard services and supports in ways that Blackboard should be well functional, reliable, and stable. In addition to that, one more aspect of Blackboard to be taken into account as an improvement may be socially enhanced and integrated features including inserting social networking services, easy sharing, and efficient communications among instructors, students, and content.

Q4. Thoughts on transferring Blackboard into Canvas of LMS of University B

A4.

Since Canvas is a newer LMS found in 2008 than Blackboard, transferring into Canvas is a great opportunity for **University B** to make their LMS improved and socially enhanced. Other universities were most likely reviewing newer LMS' and had different criterion and rational for the selection of one LMS over another. I have not yet had the opportunity to review Canvas and could only suggest that the last time a review was completed at **University A**, that Canvas was not an available option.

University A has been gradually upgrading its LMS, Blackboard, in various ways that faculty members and students are satisfied with including increasing functionality, reliability, and stability of Blackboard by supporting items and administering trainings. Our team of instructional designers and information technology continues to learn about and evaluate our current LMS and alternative LMS' to ensure that we address the changing needs and expectations of the campus community.

Q5. Future plans for LMS at University A

A5.

Right now, **University A** doesn't have a major change of its LMS, Blackboard, but has a upgrade schedule of Blackboard within a month or so. Blackboard version 9.1 provides a number of enhancements which we had discussed could be found within the context of the website. The specifics the IDIT (Instructional Design and Information Technology) group provided are included here:

New Features: Blackboard 9.1 includes the following new features that will be beneficial for UNC faculty and students:

- Wikis
- Graded Blogs, Wikis, Journals
- Audio and Visual content integration (direct link to YouTube to insert video)
- Advanced Accessibility Features (Gold Level certified by National Federation for the Blind)
- File Management (streamline upload of revised course documents)
- Direct link from control panel to items that Need Grading.
- Learning Modules and Lesson Plans

In terms of socially enhanced LMS like Canvas an evaluation conducted by Faculty, Staff and Students of all LMS options would need to be conducted to identify an appropriate LMS solution for our LMS. However, **University A** definitely benchmarks best practices of LMS from other organizations in order to reflect current trends of LMS to its LMS, Blackboard, for providing faculty members and students with better functionality, reliability, and stability of LMS.

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