Journal of Research in Innovative Teaching

Volume 7, Issue 1, March 2014

Publication of National University

La Jolla, CA USA

ISSN 1947-1017
When referring to this publication, please use the following: Name, (2014), title. *Journal of Research in Innovative Teaching*, 7(1), pp. (use the online version pages).

Table of Contents

Web-based Learning

Assessment and Evaluation

Book Review

Editor's Column

This is the seventh issue of the **Journal of Research in Innovative Teaching (JRIT)**, published by National University annually since 2008. It demonstrates steady progress in establishing a research culture at this institution in which the journal plays an important role.

National University's mission is to make lifelong learning opportunities accessible, challenging, and relevant to a diverse population. In accordance with this mission, the annual publication of National University's research journal is an important benchmark in the University's maturity progression. Teaching, research, and scholarship are interrelated; evidence shows that research—particularly scholarship of teaching and learning—enriches teaching and is capable of significantly improving the quality of education. Therefore research culture is one of the essential parts of the general university's culture.

JRIT is an annual multidisciplinary peer-reviewed publication of original research focused on new effective instructional approaches, methods, and tools. It is intended to produce momentum in our quest for excellence to increase efficiency of research, scholarship and learning, and to ensure better learning outcomes for our students. The journal is a forum for sharing faculty accomplishments in this area, which will ultimately benefit both the university's academic community and our students. The editorial board is composed of top scholars and administrators from National University, as well as national and internationally acclaimed scientists. The review board includes both internal and external reviewers.

This issue features 13 articles accepted after a rigorous double review. Among the authors you will find National University faculty members, outside scholars working with the university researchers, U.S. academics from outside the university, and international investigators.

Each article in this issue has been assigned to one of the following sections:

- Research at National University
- Educators' perspectives
- Teaching subject matter
- Web-based learning
- Assessment and evaluation

The first article in the section **Research at National University**, *Growing National University Research Culture: Goals and Steps*, by Peter Serdyukov and Huda Makhluf, offers an overview of the development of a research culture at National University since 2001. National University, primarily a learning institution, has witnessed steady growth in its research, evidenced in an abundance of publications and conference presentations by its faculty members. Transforming the university into a learning institution with an enhanced research agenda requires the development of a research culture grounded in a strong commitment of administration; staff; and full, associate, and adjunct faculty; plus the integration of students in this equation. The authors discuss how the creation of a research culture leads to the university's growth beyond just a learning institution. They also address challenges and propose ideas for solving existing problems on the way.

In the **Educators' Perspective** section, Marius Boboc and R.D. Nordgren present their views in *Modern and Post-Modern Teacher Education: Revealing Contrasts in Basic Educational Beliefs and Practice*. The authors examine the beliefs of one school of education's faculty members regarding education policy, teaching and learning, and curricula through the construct of postmodern and modern ideologies. A survey based on a theoretical framework using the

tenets of postmodernism and Pasi Sahlberg's "Finnish Way" provides insights into these faculty members' stance toward P–12 schooling.

Kevin Celuch, Bryan Bourdeau, and Jack Smothers in their article *Thinking Innovatively about Teaching Innovation and Ideation: Getting Students to Think Differently* describe a template for innovation/ideation exercises that integrates thinking from the entrepreneurial cognition literature with practical course design elements to systematically develop individuals' ideation capabilities. The proposed approach is appropriate for individuals teaching or facilitating in contexts aiming for breakthrough ideation in business, healthcare, computer science, and public administration products and services. The approach is driven by a need within industry and academe for curricula that develop and promote understanding of innovation processes, particularly regarding an entrepreneurial mindset. They include an industry review and academic perspectives; proposed innovation phases and associated rationales; pre and posttest beliefs, efficacy, and ideation outputs used for initial assessment; and brief discussion of the challenges and value-add of the proposed innovation.

The article *Job Satisfaction, Burnout and Work Engagement in Higher Education: A Survey of Research and Best Practices* by Cynthia Schubert-Irastorza and Dee L. Fabry, explores the evolution of research on job satisfaction, burnout, and work engagement, primarily in the helping professions, with specific focus on faculty in higher education. It includes a summary of research-based methods and techniques used for measuring job satisfaction, predicting and preventing burnout, and increasing work engagement.

Enid Acosta-Tello and Carol Shepherd discuss important issues in *Equal Access for All Learners: Differentiation Simplified*. The concept of equal access for all students to all the learning occurring in classrooms is not a new one; however, differentiated instruction remains difficult to implement because of its multi-faceted nature. Utilization of the "Three Phase Lesson" model allows teachers to identify prior knowledge the student must have mastered in order to be successful in learning the new concepts. This information enables instructors to work on reaching every individual student, which is the goal of differentiated instruction. Such individualized instruction also provides the opportunity to enhance and enrich instruction for those students who need an additional challenge.

The Elephant in the Room: Issues with Graduate Student Behavior and the Potential Link to Large Class Sizes by Brian Tilley investigates student behavior toward instructors and other students in an intensive Master of Arts in Counseling (MAC) program that was reported to degenerate over a five-month period. Class size was a potential cause. Research on the influence of class size and the uniqueness of non-traditional students is presented. Research tends to support decreased class sizes, though the issue has not been investigated in non-traditional learning environments. The response to the problem—dividing the student group into two cohorts and making a presentation to the students—is discussed. Data, including a decrease in student complaints, are presented as evidence of the positive effects of the class split.

In the **Teaching Subject Matter** section, Roberta C. Anderson and Gordon W. Romney offer *Student Experiential Learning of Cyber Security through Virtualization*. They explain that the Master of Science in Cyber Security and Information Assurance program was designed to provide experiential training through virtual laboratory exercises. The quality of service provided by the National University Information Security Lab Environment (ISLE) that provisions virtual computers to students was evaluated, and baseline performance statistics were captured. Agile teaching was employed using a Kali Linux system in penetration testing exercises in the evaluation. Kali proved stable, performed the tested functions well, and was recommended to be

used in future courses. Virtualization in both a cloud infrastructure and on local machines was shown to be most effective.

Olena Scafa in *Heuristically Oriented Systems of Problems in Teaching Mathematics* writes that the commonly accepted interpretation of a system of problems in mathematical education is a selection and sequence of problems that help develop all components of the students' mathematical background: (a) actual knowledge and skills required by the program, (b) mental operations and mental activity techniques, (c) the mathematical style of thinking, and (d) rational and productive ways of learning and cognition. The author introduces special heuristically oriented systems of problems that serve as an efficient tool of "light-hand" guiding the process of learning mathematics. The goal is to develop students' mathematical culture and build their heuristic skills.

Merging the Tower and the Cloud through Virtual Instruction: The New Academy of Distance Education by Gordon W. Romney and Baird W. Brueseke asserts that education is being reshaped by recent advances in technology including mobile devices, the ability of MOOCs to reach thousands of distance learners, and the widespread use of social media. Universities must confront challenging questions about how to maintain course completion revenue. In order to remain competitive, institutions of higher education need new tools and agile staff that can attract and retain students with innovative online teaching. The reported Virtual Instruction Cloud research delivers new virtualization technology, CLaaS, which provides both Connectivist and Constructivist theoretical support, and provenance and IP protection of content; preserves accreditation standards, and protects academic revenue streams.

The **Web-Based Learning** section includes two articles: *Embedding Social Media Tools in Online Learning Courses* by Steven Brownson, and *Is Flipped Learning Appropriate?* by Thomas J. Francl.

In the first article the author considers the diverse learning styles of 21st-century online students which require a deeper social connection and interactivity, which can produce increased levels of student satisfaction online and higher student retention rates. Embedding social media into distance-learning classes can raise the level of interaction in an online course through three methods: student/student, student/instructor, and student/content. Social learning and collaboration support higher retention rates and greater interaction.

The second author examines a new pedagogy that is more appropriate for student learning in our current technology environment. It contrasts today's typical course setting with a "flipped learning" approach. Traditionally, a lecture accompanied by clarifying questions and answers is reinforced by homework assignments. We question if this pedagogy is still appropriate in today's environment of high-speed Internet, iPhones, and tablet computers that can play movies. We can compete for students' attention with recorded lectures that can be accessed on any device, at any time, and anywhere. Class time can be utilized to discuss the material in much greater detail.

The section **Assessment and Evaluation** features *Formative and Summative Assessment in Online Education* by Dilani M. Perera-Diltz and Jeffry L. Moe. In this paper, the authors offer an overview of formative and summative assessment approaches suited to the online education environment. They argue that assessment is an integral part of both traditional and online education, especially when determining student learning outcomes. In the online learning environment, both formative and summative assessment practices require an understanding of the features and tools inherent in the electronic medium. Creating assessments for online education, either formative or summative, also requires the application of constructivist learning principles to our collective understanding of the educational process and related goals.

Toward a More Effective and Useful End-of-Course Evaluation Scheme authored by S.R. Subramanya suggests that the primary objective of end-of-course (EoC) evaluations is (should be) to improve the quality of teaching and student learning. Despite its being administered for more than 50 years and studied extensively, no single scheme or set of schemes has emerged that is considered fair, objective, and valid. At the core of the problem is the lack of mechanisms to accurately map the subjective (biased) answers to objective (fair) numerical quantities. This paper examines issues in the current EoC evaluation schemes, and proposes improvements. It also presents major issues and challenges in the implementation of the proposed improvements.

The last publication in this issue is a review of the *Innovative Educational Leadership Through a Cycle of Change* book by Larry Powell.

Note to the Author offers guidelines for authors submitting their papers to the *Journal of Research in Innovative Teaching*.

We invite scholars to submit their research for the eighth issue, to be published in 2015.

Peter Serdyukov
March 1, 2014

Research at National University

Growing National University Research Culture: Goals and Steps

Peter Serdyukov and Huda Makhluf

Abstract
In the past 14 years, since 2001, National University, primarily a learning institution, has witnessed steady growth in its research, evidenced in an abundance of publications and conference presentations by its faculty members. This effort is based on the belief that scholarship and research can boost student learning outcomes, in addition to increasing instructor's professional competency and the university's academic status. Transforming the university into a learning institution with an enhanced research agenda requires development of research culture grounded in a strong commitment of administration, staff, and full, associate, and adjunct faculty, plus integration of students in this equation. Giving students authentic research opportunities means mentoring to develop their intellectual skills, analytical inquiry, and experimentation. Herein, we describe how the creation of the research culture leads to the university's growth beyond just a learning institution. We also address challenges and propose ideas for solving existing problems.

Key Words
Learning institution, scholarship, research, research culture, scholarship of teaching and learning, teaching-research nexus

Research in Higher Education

A university is an academia, a place where a community of scholars is engaged in teaching and research. While the primary purpose of a university is to provide higher education to students, research is an inextricable part of academia. Research, however, is commonly divided into scholarship and research, per se, both being an integral part of the university's purpose. Scholarship, defined by Boyer (1990) as discovery, integration, service, application, and teaching, embraces research as its key component and other related activities, such as organizing scholarly events (conferences, workshops, and seminars), chairing symposia sessions, reviewing manuscripts, etc. While scholarship carries a more general meaning, research is specific and deals with inquiry, experimentation, observation, study, and analysis and recording of data, as well as publishing books, articles, and papers and presenting the findings at scientific forums. Scholarship is generally characteristic of every higher educational institution, yet research requires certain conditions to take root and grow.

Research is normally done by faculty members in university laboratories or off campus through collaborative projects. It can be done independent of teaching, but it can also be integrated into the instructional process through various means, such as student coursework, engagement in research done by their professors, and inclusion of faculty research resources and materials into the course.

A correlation has been established between the level of institutional research and the quality of education (Zaman, 2004). Research informs teaching in many ways. It is the interaction between teaching and research that drives universities. Research makes professors better teachers, while teaching makes them better researchers. Effective research can create a combined effect on the quality of teaching and learning: directly through involving students in research at the university, and/or through the study of instructional practices, which is known as scholarship of teaching and learning (Shulman, 2000; Huber & Morreale, 2002); and indirectly through

higher academic level of teaching by the research faculty. The benefit of scholarship can come from all these activities; however, the scholarship of teaching and learning may profoundly inform both institutional and individual practices, course development, teaching, and various academic initiatives (McDonald & Stockley, 2011).

Classic brick-and-mortar universities, both public and private, have typically been centers of research, but the current financial situation has caused a considerable reduction of funding for research (*Science Board,* 2012), thus lowering its scope and quality. Concurrently, proliferation of a business model of higher education and, especially, the relatively recent advent of online education, which has been enthusiastically embraced from the beginning primarily by private universities, has changed the situation with research in academia.

To differentiate from the research universities, many newly established private universities have been created as teaching institutions focused solely on profit. While acknowledging the purely educational purpose of such schools, we clearly recognize that this focus consequently impairs their educational quality (Romero & Del Rey, 2004). In this category of private higher education institutions, there is, nonetheless, a distinction between not-for-profit and for-profit schools. While the latter openly operate for profit, the former try to maintain their academic status by engaging in research.

Research Culture

The success of university scholarship and research depends on the institutional culture, which can be defined as the traditions, rituals, and values shared by the members of an organization (Hill 1999). A university culture is a combination of teaching and research cultures, both intertwined and feeding each other. Research in the university has its own culture, which exists and develops within the general institutional culture. We suggest 14 major identifiers of research culture:

1. Encouraging and supportive environment for faculty research
2. Appreciation and support of scholarship and research by the faculty members, faculty organizations, and administration
3. Measurable impact of research on the institution's growth and reputation
4. Utilization of faculty research to enhance instruction and quality of student learning outcomes
5. Faculty professionalism
6. Learning community and faculty collaboration, including adjunct (part-time) instructors, in the university scholarship and research
7. Student involvement in research and faculty mentorship of students
8. A variety of regular scholarly activities
9. Interaction and collaboration with the academic community outside the university (locally, nationally and internationally)
10. Institutional research strategy
11. Scholarship and research policies
12. Research infrastructure
13. Research funding
14. Research and scholarship reward system

Each of these factors deserves special attention.

In scholarship and research, the authors include both "hard" sciences requiring experimental base, laboratories, and equipment (physics, chemistry, biology, engineering), and "soft" sciences embracing humanities (social sciences, history, literature), education, journalism, and arts (fine arts, media studies, design).

National University Case

National University (NU) is the second-largest private, non-profit institution of higher education in California and the twelfth largest in the United States. It was established in 1971 and comprises a College of Arts and Sciences, together with five schools (Business, Education, Human and Health Sciences, Professional Studies, and Engineering, Technology and Media). We are a teaching institution, but we realize that to provide quality teaching, as well as to raise the university's status, we must actively engage in research.

History

In order to develop such a culture, the university community undertook certain steps in the past 12 years. In 2001–2002, the President's Research Commission, under the leadership of Dr. Gary Hoban, investigated the opportunities for scholarship and research and offered a number of recommendations. In 2004, based on these recommendations, the University Research Council (RC) was established. Following is a list of RC chairs and their terms:

Dr. Shekar Wiswanathan (SOET), 2004–2006
Dr. Peter Serdyukov (SOE), 2006–2008
Dr. Ismail Sebetan (COLS), 2008–2010
Dr. Joan Van Tassel (COLS), 2010–2012
Dr. Tyler Smith (SHHS), 2012–2013
Dr. Huda Makhluf (COLS), 2013–2014

The RC's primary goals were to coordinate research across the university and advise the Provost on scholarship and research. However, the RC soon went beyond its advisory mission, taking a more proactive stance. During these years the RC took a number of important initiatives, including:

1. Collecting and publishing faculty research (books, chapters, articles, and conference papers) in the annual *Directory of Faculty Scholarship and Research* (*Directory*), starting in 2005.
2. Convening faculty and student research conferences which, since 2007, have become one of the university's major annual events.
3. Publishing an annual *Journal of Research in Innovative Teaching* since 2007 (www.jrit-nu.org).

The *Directory*, published annually before the Fall Assembly, is a useful instrument to maintain research culture, demonstrating such faculty achievements in research and scholarship as the publication of books, chapters, articles, and papers; conference presentations; other scholarly activities; and scholarship of creative work. The Tables 1 and 2 and Figures 1 and 2 present statistics for the *Directory*, collected and processed by the IT Department.

According to Table 1, since the first publication of the *Directory* in 2005 until 2013, NU faculty members published 86 books and 585 articles, and presented 1,413 papers at research conferences, in addition to other scholarly achievements. We realize that this does not reflect the total research accomplished at NU, as quite a few faculty members do not submit their research to the *Directory*.

Table 1. Research Included into the *Faculty Scholarship Directory*.

Academic Year	Count by Publication Type						Grand Total
	Art	Article	Book	Chapter	Other	Paper	
2005–2006	4	67	16	18	95	213	413
2006–2007	8	69	17	18	90	173	375
2007–2008	9	102	12	26	94	215	458
2008–2009	11	71	13	23	111	258	487
2009–2010	3	67	10	12	106	223	421
2010–2011	8	83	9	18	76	164	358
2011–2012	1	77	4	20	38	98	238
2012–2013		49	5	7	25	69	155
Grand Total	**44**	**585**	**86**	**142**	**635**	**1,413**	**2,905**

Note: Published articles, books, chapters, and papers presented at conferences. "Art" refers to creative art scholarship; "other" indicates scholarship service, such as serving on research councils, reviewing manuscripts and conference submissions, and chairing conferences.

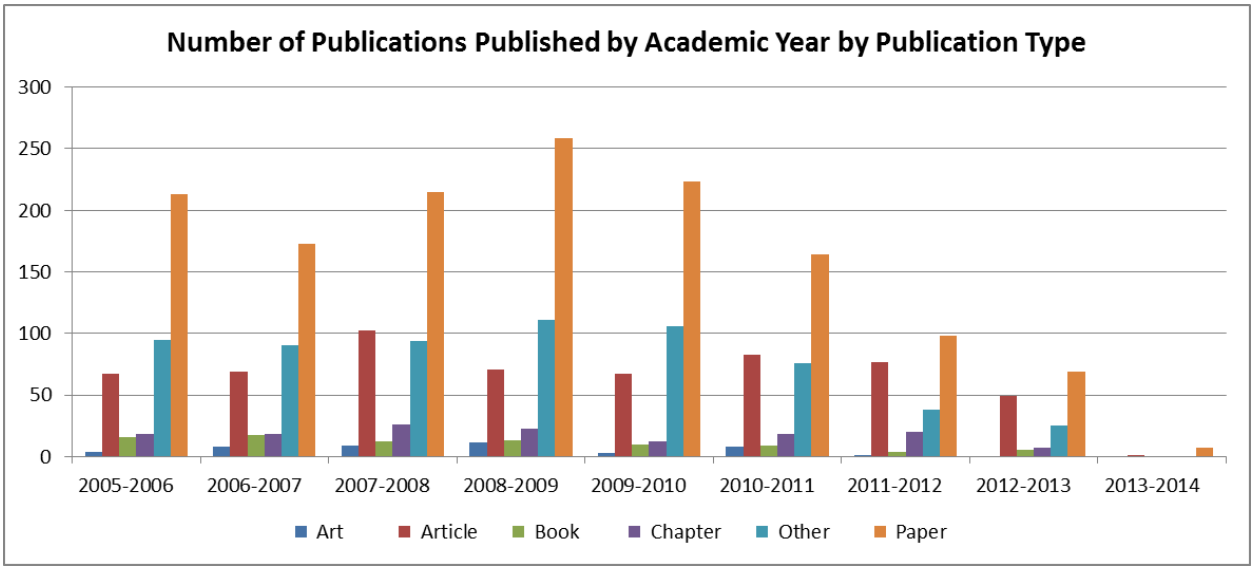

Figure 1. Number of publications by academic year.

As seen in Figure 1, faculty members annually submitted their research for publication in the *Directory*, which peaked in 2008–2009 but decreased thereafter. The *Directory* only recently started collecting submissions for 2013–2014, so the data reflected in Figures 1 and 2 for that year are not counted. We believe this change in the number of submissions to the *Directory* can

be explained by the RC's transition in 2010 from publishing a hard copy of the *Directory* to the online format. It might be desirable for the RC to resume hard-copy publication of the *Directory*, while keeping its electronic copy on the NU website. It is also necessary to offer incentives to faculty members to submit their research to the *Directory*. This could be done, for instance, by using this publication as an official document in the faculty reappointment, promotion, and merit process.

Table 2. *Number of Publications and Other Research Products by Schools.*

Academic Year	Count by College I.D.						Grand Total
	COLS	SOBM	SOE	SOET	SOHHS	SOMC	
2005–2006	125	91	114	70	5	9	414
2006–2007	119	36	152	44	8	17	376
2007–2008	159	50	166	54	9	21	459
2008–2009	121	57	199	67	34	12	490
2009–2010	108	40	186	65	11	11	421
2010–2011	111	27	131	63	23	4	359
2011–2012	93	35	63	22	22	3	238
2012–2013	66	19	21	30	15	4	155
Grand Total	**910**	**355**	**1,032**	**415**	**127**	**81**	**2,912**

Note: Some difference between the numbers in tables 1 and 2 can be explained by statistical error.

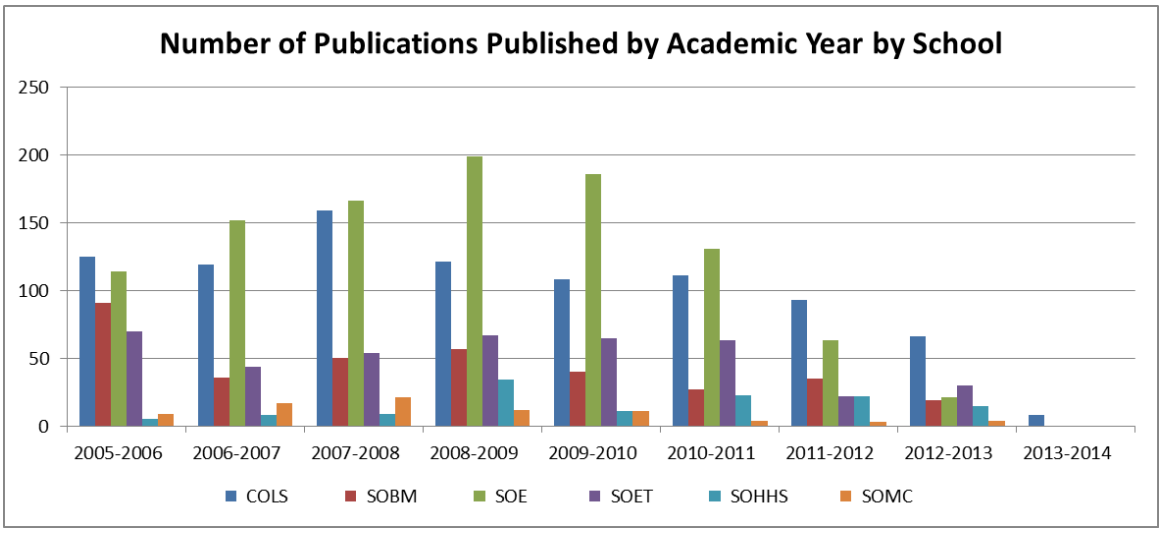

Figure 2. Research by NU schools.

From Table 2 one can see that the leader in research publications and conference presentations is School of Education (SOE), followed by College of Letters and Sciences (COLS).

The *Journal of Research in Innovative Teaching* in its first seven years published seven issues, within which appear 105 articles on various topics on teaching and learning, such as general education, institutional policies and leadership, teacher education, online education, instructional methodology, assessment, and teaching of specific subjects, e.g. psychology, mathematics, physics, business, engineering, and nursing. Statistics show that among authors are:

NU scholars.....61
NU scholars in collaboration with outside authors.....17
Authors from other U.S. institutions.....12
International authors (from six countries).....15
Total authors 201
Total NU faculty members who published in this journal.....78

The journal is hosted on the NU website (www.nu.edu), has its own site (www.jrit-nu.org), and is also distributed by EBSCO, which reports that the journal has been accessed by hundreds of universities and other users from all over the world over 12,000 times. This statistics demonstrates, first, that over 30% of the university faculty members published their research in the journal; second, that the journal has become a forum for scholars from NU, both nationally and internationally; and third, it has gained national and international attention.

Since 2007 the annual National University Faculty Scholarship and Research Conference has attracted hundreds of presentations and participation by the faculty members during the first day of the Fall Assembly completely devoted to this venue.

In addition to publications and conference presentations, many NU faculty members are engaged in grant work. However, according to Ms. Michelle Hills, Executive Director, Sponsored Programs and Grants, NU has not received grants for research. The grants to the University have been won for teacher training and professional development/certification, for student scholarships and support, and program grants to create centers for the provision of academic support for military veteran students.

Activities crucial to the development of the research culture have also included generous faculty development funds, sabbatical leaves, scholarship awards entailing teaching-load reduction or money for research, extensive leave time, and specific collaborative activities, such as conferences sponsored by the different schools.

Realizing the need to enhance research culture, NU schools started to create their own committees, a notable example of which is the School of Education (SOE) Scholarship and Research Committee established in 2012 and chaired by Dr. Wayne Padover. This Committee's charge is "to assist in setting a research agenda for the School and work with faculty to improve the quality of research and scholarship." The Committee is actively working in this direction, and one of its achievements was creation of a web-based portal, *Quest*, which has become a forum where SOE scholars make presentations to all SOE faculty members, share their research ideas, strategies, and methods. *Quest* also publishes current information on forthcoming scientific conferences. In addition, the Committee has established a subcommittee whose purpose is to attract and develop funded-research opportunities for SOE faculty working in collaboration with colleagues at NU, as well as with faculty across other institutions of higher education.

The Faculty Senate is also making a significant contribution to the growth of research culture through its Scholarship and Research Commission, which provides scholarly presentations,

lectures, and seminars for both novice and established scholars at the annual Senate Spring Symposium.

The university began preparation for doctoral programs, culminating in 2012 with the creation of the first doctoral program in nursing and its accreditation by the Western Association of Schools and Colleges. In addition, in 2012–2013 the Graduate Council formed an ad-hoc committee, which designed doctoral policies for all future doctoral programs.

To make doctoral culture practical at NU, we ought to start at the undergraduate level. It would behoove us to begin "feeding" the pipeline, so to speak, at the undergraduate level and extending it to the postgraduate levels, especially to those in the Master's programs. Providing opportunities for students to do research in their course assignments and to work one on one with faculty members will help develop currency, relevancy, and excitement and to personalize their educational journey. This will also lead to better learning outcomes, student retention, and higher graduation rates, which may eventually culminate in their desire to pursue doctoral degrees. In fact, Kuh (2008), in his document released by the Association of American Colleges and Universities, lists ten high-impact practices, of which at least four clearly underline the importance of student scholarly work:

1. First-year seminars and experiences
2. Common intellectual experiences
3. Learning communities
4. Writing-intensive courses
5. Collaborative assignments and projects
6. Undergraduate research
7. Diversity and global learning
8. Service learning, community-based learning
9. Internships
10. Capstone courses and projects

With this end in mind, some faculty at NU are starting to tackle some of the aforementioned challenges by seeking to develop an inquiry, research-based approach to teaching in the classroom at the undergraduate and post-graduate levels. This approach not only emphasizes the importance of the teaching-research nexus for faculty but also genuinely helps students appreciate characteristics and methodologies of research and scholarship, while highlighting the importance of collaboration and creative work.

New Initiatives

The current Research Council focuses on several new initiatives:

1. Creating new faculty community space for RC, which will house all the RC newsletters, student scholarship, conference photos, list of awards, and, most importantly, a new home for faculty scholarship with a searchable feature and tags. It is hoped this will enhance collaboration and a sense of research community at NU.
2. Linking *Quest,* the School of Education (SOE) newsletter on research and scholarship, to the RC newsletter and fostering collaboration with the SOE Scholarship and Research Committee, as well as prospective research groups from other schools.
3. Offering statistical analysis support to faculty in need of guidance in their respective research.

4. Providing a poster rating sheet and establishing an overall award at the student scholarship conference to support students' purchase of National Society membership, thus encouraging students' future participation and possible presentation at NU conferences.
5. Subscribing (in San Diego) to Seminars Around Town bulletin released by the Salk Institute that lists all seminars around town—at Scripps Research Institute, Burnham, La Jolla Institute, and University of California–San Diego.
6. Supporting the Scholar of the Year to display a short presentation on his or her awarded work.
7. Revitalizing the faculty lecture series.

Building an RC space in the faculty community is one of the short-term goals of the RC this year, in the hope that NU's research community will significantly grow; it will foster collaboration, increase visibility of research, and provide support to faculty regardless of discipline. In addition, it will highlight the importance of enhancing the existing support for research development and grant writing.

As California's second-largest private, nonprofit university, NU is positioned to make a huge impact on the community. One of the initiatives is to engage, through competitive funding and/or contribution from philanthropists, pre K–12 future science and math teachers in meaningful research-based projects. The impact can translate to profound changes in high school students to study in the fields of science, technology, engineering, and mathematics (STEM fields). Another initiative is to initiate research-based collaborative projects between SOE and the College of Letters and Sciences (COLS), covering math and sciences, which could potentially impact local communities and the local economy through an increase in STEM fields' enrollment overall. Generous gifts from philanthropists could enhance student-teacher scholarships and fellowships, as well as support conferences that showcase their research projects, skills, and competencies.

Research Funding Strategies

In the long term, creating doctoral programs to serve our students will be our ultimate goal. Hiring faculty with research projects and grant funding would be critical for the success of various doctorate programs. In the scientific field, securing "laboratory bench space" is an enormous task. Striving to ensure the presence of an infrastructure will be crucial in crafting research-based projects for our students.

Meanwhile, in the absence of such facilities, faculty members should build collaborations and secure internships with local institutions. Alumni currently employed in local companies may also act as bridges to facilitate such endeavors. As a result, our students will surely gain experience and marketability in the workforce.

Initial internal research funding strategies should be in place to "jump start" and maximize the chances for external funding. Typically, preliminary data collection, as well as the facilities and equipment, play a critical role in the rebuttal or acceptance of a proposal. Additionally, emphasis should be placed on collaborative efforts. Often times, co-authors and co-principal investigators fear that their contribution to the scholarly work is not equally rewarded. Hence, providing a forum where faculty could meet, think, and talk would spark new ideas, brainstorming, and the crafting of new research-based projects that could potentially yield interdisciplinary collaboration and future grant submissions. Hence we need to increase departmental and school venues that celebrate academic research excellence and success.

Long-Term Goals

At NU we have enjoyed a continuous growth of research culture validated by seminars, colloquia, and conferences sponsored by different schools and by the university; by the publications of the *Journal of Research in Innovative Teaching*, and *Faculty Scholarship Directory*; and by numerous books, articles, and conference presentations written by faculty members. We have done a good job, but we need to move forward.

We believe the goals for NU in strengthening research culture should be as follows:

1. Build a strong learning community to collaborate, share and learn from each other
2. Create opportunities and a material base for research
3. Increase faculty participation in research
4. Enhance the role of the departments in scholarship and research
5. Grow scholarship of teaching and learning
6. Create doctoral programs
7. Engage more students in research
8. Expand grant work
9. Raise the prominence of the faculty scholarship and research conference extending its reach beyond the university
10. Invite more outside scholars to NU to present, share, and collaborate with our faculty community, and to prompt our faculty to engage more in interdepartmental, interschool, national, and international research initiatives.

Challenges

Numerous challenges, however, exist on the way to a genuine research culture, among them:

1. Lack of research facilities (labs and equipment)
2. Slow dissemination of accomplished or in-process research within the university community
3. Insignificant integration of research in teaching and learning
4. Conflict of interests between the university and individual research agendas and, as a result, low level of collaboration among scholars
5. Preference of conference presentations which is not followed by solid publications in the form or articles, book chapters and books.
6. Insufficient faculty involvement in scholarly and research activities, such as *Faculty Scholarship Directory*, departmental and school research events, annual faculty research conference, and other venues.

To transform the institutional culture of a merely teaching institution to that of an academic teaching and research institution requires many scaffolds, such as enthusiasm of all individual faculty members; teamwork; more effective departmental strategies in building research agendas; a continuous, consistent effort by individual faculty members and faculty organizations (Senate, Graduate Council, Research Council); a growing variety of scholarly activities and events; and top-level and middle-level administration support. It also necessitates a central coordinating office, e.g., VP in Research.

Conclusion

The ultimate goal of all these activities at NU is to establish a university research culture, which would help build a scholarly environment featuring appreciation and support of faculty research, and institute a steady tradition of scholarship and research. Quoting Dr. Frederick Terman, father of Silicone Valley, who also served as Vice President at Stanford, when asked whether he wanted Stanford to be a teaching institution or a research institution, he answered that "it should be a learning institution." The university is a place to achieve higher education; therefore, the purpose of our university is to remain a quality higher "learning" institution, while growing its research culture. Thus, while highlighting a teaching-research nexus, we should keep our students at the center of all our endeavors.

Acknowledgments

The authors thank VP of Technology Mr. Christopher Krug and his staff for providing statistics for the *Directory of Faculty Scholarship and Research* and for his continuous support in publishing the *Journal of Research in Innovative Teaching*.

References

Boyer, E. (1990). *Scholarship reconsidered: Priorities for the professoriate*. Princeton, NJ: The Carnegie Foundation for the Advancement of Teaching.

Hill, R. (1999). Revisiting the term "research culture." *HERDSA Annual International Conference*, Melbourne, July 12–15, 1999.

Huber, M., & Morreale, S. (Eds.) (2002). *Disciplinary styles in the scholarship of teaching and learning: Exploring common ground.* Merrifield, VA: AAHE. Retrieved from http://eric.ed.gov/?id=ED478800

Kuh, G. (2008). *High-impact educational practices: What they are, who has access to them, and why they matter*. Washington DC: Association of American Colleges and Universities.

McDonald, J., & Stockley, D. (2011). *Pathways to the profession of educational development: New directions for teaching and learning*. Hoboken, NJ: John Wiley & Sons, Inc.

Romero, L., & Del Rey, E. (2004). *Competition between public and private universities: Quality, prices and exams*. Departamento de Economía. Economics working paper 04-64, Series 23. Universidad Carlos III de Madrid.

Science Board Concerned About Declines in Public Research University Funding (2012). Press Release, 12-176. Retrieved from http://www.nsf.gov/news/news_summ.jsp?cntn_id=125542

Shulman, L. (2000). From Minsk to Pinsk: Why a scholarship of teaching and learning? *The Journal of Scholarship of Teaching and Learning, 1*(1). Retrieved from https://www.fresnostate.edu/ academics/csalt/documents/ Shulman2000.pdf

Zaman, M. (2004). *Review of the academic evidence on the relationship between teaching and research in higher education*. London: Department for Education and Skills.

OECD–Institutional Management in Higher Education. (n.d.). *Learning our lesson: review of quality teaching in higher education.* Retrieved from http://www.oecd.org/edu/imhe/44058352.pdf

About the Authors

Peter Serdyukov
DPS, PhD, Professor
Department of Teacher Education, School of Education
National University
La Jolla, CA
pserdyuk@nu.edu

Research interests: scholarship of teaching and learning, teacher preparation, professional development, online learning, global education, instructional design

Huda Makhluf
PhD, Associate Professor
College of Letters and Sciences
National University
La Jolla, CA
hmakhluf@nu.edu
Research interests: novel learning and teaching approaches in the biological sciences, molecular mechanisms underlying Dengue Virus pathogenesis, microbial genomics

Educators' Perspectives

Modern and Post-Modern Teacher Education: Revealing Contrasts in Basic Educational Beliefs and Practice

Marius Boboc
R. D. Nordgren

Abstract
The authors examine the beliefs of one school of education's faculty members regarding education policy, teaching and learning, and curricula, through the construct of postmodern and modern ideologies. A survey based on a theoretical framework using the tenets of postmodernism and Pasi Sahlberg's "Finnish Way," provided insights into these faculty members' stance toward P–12 schooling. Survey data were analyzed against current accountability measures. Although findings suggest that a definite majority of faculty members agree with postmodern statements, some discrepancies exist that could impact the mission and work of the school.

Key Words
Teacher education, postmodernism, curriculum, instruction

Introduction

Postmodern teacher education programs educate teachers to embrace student-centered instruction/facilitation of learning, teacher-developed curriculum based on research and knowledge of students' needs, and a variety of assessments, including "authentic" assessment (Airasian, 2005). They foster an awareness of the various external factors that impact teaching and learning, as well as the entire schooling process. These factors are interpreted in the context of how they evolve over time by constant interactions with internal factors pertinent to individual schools or schools of education. In contrast, the modern teacher education program uses traditional approaches to professional training focused on the perceived status quo (e.g., teacher-directed instruction, prescribed curricula, basic/core knowledge, and frequent use and reliance upon standardized summative assessment of student learning). These programs demonstrate a reactive manner of dealing with change and trends in P–12 schooling.

In the education of teachers and other school professionals (i.e., administrators, counselors, and psychologists), a modernist approach emphasizes the utilization of teacher-centered instructional strategies, standardized curricula published by sources outside the school, and assessment systems that provide easily quantifiable data to be used to satisfy administrators who may use "data driven" instead of "data informed" management (Hargreaves & Fullan, 2012). The use of the verbs "train" and "educate" is important when contrasting modernism and post-modernism in regards to teacher education. In short, the former connotes a relatively simplistic transfer of knowledge and skills from an expert; the latter implies that a deeper understanding of the knowledge is gained by the learner, including the analysis of relevant information regarding this knowledge and the ability to intelligently evaluate its value and use.

Post-Modernism and School Reform

The accountability movement, at least since the publication of *A Nation at Risk* in 1983, has underscored an emphasis on increased knowledge acquisition that has to align with a marketable transfer of skills to various workplaces. Production has become "postmodernized" by eliminating the familiar path to economic progress demonstrated by leading developed countries, i.e.,

agriculture to industrial to post-industrial (Peters & Besley, 2006). However, education policies still attempt to use modernist approaches in managing educational settings when students and the world in which they live are postmodern. There is no more dominant metanarrative (Lyotard, 1984) to structure curriculum development. Moreover, in a knowledge economy (Trani & Holsworth, 2010), higher education institutions have undergone a transformation by developing curricula that emphasize skills sets sought after by employers, while promoting alternative content delivery methods, such as e-learning.

Cunningham and the Australia Department of Education, Training and Youth Affairs outlined several traits of what they labeled as "borderless education":

1. Globalization
2. New instructional technologies (more of which capitalize on virtual communities that use and produce knowledge)
3. Transferable best practices
4. Adaptability to new learning paradigms and content delivery modes
5. Increasing cost of education (for both the public at large and individual students)
6. Stricter certification or licensure requirements derived from redefining professionalism in various fields of activity
7. Generation Xers (Peters & Besley, 2006, p. 25)

Globalization may also contribute to the corporatization of schooling when laissez-faire capitalism becomes accepted by developed and developing economies in emulation of the U.S. This acceptance may lead to further erosion of labor's power, and an embracing of business-oriented strategies to improve schooling (Apple, 2001).

Current curriculum work is still derived from content and skills that are connected in a prescriptive manner (de Alba, Gonzalez-Gaudiano, Lankshear, & Peters, 2000). As far as teacher education is concerned, policy affects it in terms of curriculum as well as credentials offered upon graduation from such programs.

Based on this brief review of the literature regarding postmodernism and teacher education, the authors provide five tenets to act as guide for this study.

Tenets of Postmodernism in the Context of Education

1. **Customizing teaching and learning** according to individual needs and the context in which teaching and learning take place
2. **Focusing on creative learning** both in how students gains knowledge and in how teachers improve their professional practice
3. **Encouraging risk-taking** in both student learning and teaching practice, accommodated by the organizational and leadership structures within the school and school district.
4. **Learning from the past and owning innovations** in that both teaching and school leadership practice are based on the field of education and other social sciences rather than borrowed from business.
5. **Engaging in shared responsibility and trust** within the internal school community as well as to the greater community the school serves.

These tenets informed the authors when developing their theoretical framework shown in Appendix A. This is an adaptation of Sahlberg's (2012) Global Education Reform Movement (GERM) and Finnish Way contrast.

Methods and Context

The question that the survey administration was helping to answer is as follows:

> How do teacher educators' beliefs about teaching and schooling practices correspond to the five tenets of Post Modernism in the context of education?

The school of education in this study has approximately 9,000 students in 36 programs at the Bachelor's and Master's levels. It is one of six professional schools at a private university on the West Coast of the U.S. Surveys were sent out via university email to the 90 full-time faculty and 550 adjunct faculty employed by the school. An online survey administrator was used to complete 145 surveys. The survey consisted of 26 items, half of which were geared toward the postmodern and half toward and modern ideology toward education practices and policies; see Appendix B.

Findings

The survey items were categorized by the following themes: (a) standards or standardization, (b) curriculum, (c) student assessment, (d) management, and (e) resources. Table 1 shows the categories and the mean scores for each (categories are color-coded). Data indicated that the respondents were most favorable to a postmodern approach to management (1.37) and resources (1.38) and less emphatic for the postmodern approach toward curriculum (1.69), student assessment (1.61), and standards/standardization (2.02). These adjusted mean scores are used as the basis for the discussion section.

Table 1. *Item Analysis*

(1 = Strongly Agree,2 = Agree, 3 = Disagree, and 4 = Strongly Disagree;
items in red denote modern, while items in black denote postmodern)

				Agree		Somewhat Agree		Somewhat Disagree		Disagree	
Item	**Theme**	***N***	**Mean**	***n***	**%**	***n***	**%**	***n***	**%**	***n***	**%**
1	Standardization	145	1.43	98	68	34	23	10	7	3	2
4	Standardization	142	2.13	33	23	67	47	33	23	9	6
10	Standardization	142	1.72	55	39	76	54	11	8	2	1
2	Standardization	144	1.6	74	51	55	38	13	9	2	1
5	Standardization	145	1.76	54	37	75	52	13	9	3	2
6	Curriculum	143	1.76	61	43	58	41	21	15	3	2
9	Curriculum	143	1.96	34	24	81	57	25	17	2	1
3	Curriculum	145	1.28	107	74	36	25	1	1	1	1
7	Curriculum	142	1.51	78	55	55	39	9	6	0	0
8	Curriculum	142	1.52	79	56	54	38	10	7	0	0
11	Curriculum	144	1.72	50	35	63	44	27	19	3	2
12	Curriculum	143	1.49	79	55	58	41	4	3	1	1
13	Student assessment	142	2.6	12	8	48	34	67	47	15	11
14	Student assessment	142	3.06	2	1	24	17	79	56	37	26
21	Student assessment	144	2.31	24	17	64	44	47	33	11	8
25	Student assessment	144	2.4	14	10	60	42	63	44	4	3
16	Management	144	3.03	3	2	25	17	81	56	35	24
18	Management	143	3.21	2	1	12	8	84	59	46	32
19	Management	144	2.86	4	3	40	28	75	52	26	18
15	Management	142	1.58	72	51	64	45	5	4	3	2
17	Management	144	1.68	52	36	85	59	6	4	0	0
20	Management	145	1.93	40	28	76	52	26	18	2	1
22	Management	144	1.51	78	54	68	47	3	2	0	0
24	Resources	144	2.54	29	20	36	25	51	35	28	19
26	Resources	141	3.21	5	4	9	6	81	57	50	35
23	Resources	144	1.88	48	33	66	46	29	20	1	1

In general, the respondents leaned toward the postmodern ideology for education, as depicted in the theoretical framework found in Appendix A: postmodern non-adjusted mean: 2.45; modern non-adjusted mean: 1.68). Mean scores for the five themes suggested a general support

for a postmodern stance. From these scores, several items stood out as evidence of this support, while a few seemed to contradict other items' scores.

Two items of special interest were from the Curriculum theme:

7. *Teaching and learning should focus on deep, broad learning.*
8. *Teaching and learning should give equal value to all aspects of the growth of an individual's personality, moral character, creativity, knowledge, and skills.*

None of the participants disagreed with these statements, which lean toward a postmodern approach to education, and the vast majority (94) agreed or somewhat agreed. Also of interest were the following items, all of which are written to be agreed with by supporters of a modernist viewpoint; more than half of the respondents disagreed; therefore, those responses can be classified as pro-postmodern. These results are shown as follows:

18. *Business models should be mandated for schools and school districts by legislation and/or national programs.* (59 disagreed)
26. *Schools and districts that score well in achievement measures should receive fiscal rewards, whereas struggling schools and individuals should not.* (57 disagreed)
16. *The primary source of educational change should be management models brought to schools from the corporate world.* (56 disagreed)
14. *Standardized tests and externally administered tests are the most important way to measure learning.* (56 disagreed)
19. *It would benefit schools and local education systems to use the operational logic of private corporations.* (52 disagreed)

This apparent support for postmodern ideology in the way of education policy, teaching, and learning, could have implications for the curricula within the school's 37 programs, as is discussed in the following section.

Discussion

Although it appears that support for the postmodern approach exceeded that for modern, one would think that there might be a tension between the perspectives at the school of education. If some faculty members are diametrically opposed to the beliefs of others, then this could create profound disagreements in curricula and student assessment. For instance, curricula (defined here as "what is to be intentionally learned") are ideologically driven (Schiro, 2008). Modernists favor "truths" in that knowledge is set; therefore, curricula should be factual. Postmodernists are likely to be constructivists who advocate learning to be a process in which knowledge is filtered through the learner's experiences, as espoused by Lev Vygotsky (Wink & Putney, 2002). This postmodern belief would lead to more fluid curricula in which knowledge is constantly changing and is based on context rather than rigid "truths."

The Accountability Movement in education, spawned after the publication of *A Nation at Risk* (National Commission on Excellence in Education, 1983), uses a modern approach to education reform; market-driven (school choice/vouchers), prescribed curricula; and frequent, standardized tests of factual knowledge (Wagner, 2010; Wolk, 2011). Accountability is highly relevant in this discussion of modern and postmodern education principles. The five

categories/themes identified in the survey are discussed using the survey data against the tenets of Accountability.

Standards/standardization. This theme may have provided the most interesting data, overall, in that the modern statements (1, 4, and 10) were supported by a substantial majority (see below).

1. *Setting clear, high, and centrally prescribed performance expectations for all schools, teachers, and students will lead to improved quality and equity of outcomes.* (91 agreed or strongly agreed)
4. *Standardizing teaching and curriculum in order to have coherence and common criteria for measurement and data will improve education outcomes for all.* (70 agreed or strongly agreed)
10. *Setting a clear but flexible national framework for school-based curriculum planning will lead to improved quality and equity of outcomes.* (91 agreed or strongly agreed)

The authors hypothesize that this overall agreement could have been due to the general acceptance of standards-based curriculum, and standardized testing across both major political parties.

Item 4 is an example of this acceptance of standardization: *Standardizing teaching and curriculum in order to have coherence and common criteria for measurement and data will improve education outcomes for all***.** One would not expect someone who embraces the postmodern ideology to accept standardization of curriculum and teaching. As seen in this study's theoretical framework (Appendix A), postmodernism in education shuns rigid standardization in favor of flexibility and personalization (Sahlberg, 2012).

Curriculum. Accountability's favored approach to curricula focuses on factual knowledge that easily translates to a machine-scored test (Wolk, 2011) rather than what a postmodern advocate would prefer: demonstrated ability to analyze, synthesize, and evaluate existing knowledge and to created new knowledge (Wagner, 2008). The survey data suggested that the 140+ faculty who participated in this study leaned slightly toward the postmodern stance (1.69 mean for the theme). This is exemplified by Item 3, where 98 agreed or strongly agreed with this statement: *It is important that schools offer personal learning plans for those who have special educational needs.* Personalizing curricula as well as instruction is a common theme among postmodern schooling models such as Big Picture schools (http://www.bigpicture.org/schools/), Waldorf (http://www.whywaldorfworks.org/), and Sudbury Valley (http://www.sudval.org/); this is in contrast to Core Knowledge schools (http://www.coreknowledge.org/) espoused by Hirsch, who outlines the "core knowledge" model in his seminal piece, *Cultural Literacy: What Every American Needs to Know* (1988). This latter model has a strong, if not singular, focus on basic knowledge and skills as defined by Hirsch. The others support a deeper understanding of content that does not forget the oftentimes confounding variable of *context*; for example, each learner's experiences, learners' interactions with other learners and the teachers, and the physical state of learners when the lesson is to be learned. The learning process for the postmodern educator is more complicated than simply transferring information from teacher to student.

Student Assessment. The respondents aligned with a postmodern view of student assessment with the exception of Item 21. *School performance and raising student achievement should be tied to processes of promotion, inspection, and ultimately rewarding schools and teachers*. In

this instance, 61% agreed or strongly agreed with this statement; this may be another reflection of the effects of the accountability movement, which advocates a market mentality toward schooling (Apple, 2001; Wolk, 2011) that would not be accepted by the postmodern perspective on education. Essentially, measures of learning are turned into a commodity in order to both reward and punish those in the schooling cycle. How learning takes place is key to assessment as well as instruction: Is learning merely a transferring of knowledge from teacher to student? If one believes this to be so, then traditional tests may be valid forms of assessment. The postmodern educator would insist upon more "authentic" assessments that allow for the learner demonstrate or apply knowledge to a real-world situation. These types of assessment are not easily measured and can provide "messy" data, not clearly reported "hard" data such as are delivered through standardized testing. A market approach to education requires quantifiable data so that comparisons can be made between and among students, teachers, principals, schools, and school districts (Apple, 2001).

Management. The way schools and districts operate is contingent upon the management style and philosophy the leaders employ (Northouse, 2004). A modern style is more structured in its view of schooling, requiring a clear delineation among the levels of the organization. This is the foundation of a bureaucracy: many levels with explicit roles and responsibilities and chain of command. The following statement was supported by only 9 respondents:

18. *Business models should be mandated for schools and school districts by legislation and/or national programs*.

It could be that teacher education faculty believed a business model to be top-down and bureaucratic; therefore, they did not see this as beneficial in P–12 schooling. On the other hand, perhaps the respondents disliked the word "mandated," as they believed teachers and schools should be granted significant autonomy. This is a statement that needs further investigation through focused interviews. Yet, only 69 disagreed with Item 18 which states that schools would benefit by employing operational logic of private corporations. One area to be investigated is the labor environment of the state in which this institution is located, one that is highly unionized. Would these results be the same as in a "right to work" state?

Ninety-eight percent of respondents agreed or strongly agreed with the following statement:

22. *It is important that a culture of responsibility and trust is gradually built within the education system that values teacher and principal professionalism in judging what is best for students.*

Trust is often lacking in a bureaucracy that employs top-down management (Darley, 1998). Intrinsic motivation may also be lacking in such organizations, which may negatively impact creativity and morale (Pink, 2011).

Resources. Of significant interest in this thematic area were the data from the following statement:

24. *Merit-based pay for teachers and a loosening of collective bargaining's grip on teacher contracts will make low-achieving schools and districts better.*

While little support was generated for schools with high achievement getting more funding (Item 26, with only 10 strongly disagreeing or disagreeing), a surprising 65 agreed or strongly agreed to Item 24. The logic would be as follows: higher funding levels for schools would not increase

learning, but increasing payment to specific teachers would. Whereas collective bargaining distributes salaries across various levels and educational achievement of the teachers, merit pay would (more than likely) be based on student test scores. This appears to contradict the respondents' opinions about the validity of standardized tests as measured by Item 14, which was supported by only 18 of the respondents:

14. *Standardized tests and externally administered tests are the most important way to measure learning.*

The concern may not be with standardized tests that may be used to measure a teacher's value rather than a deep concern for the work of teachers unions in the state in which this university is situated, a state whose workforce is highly unionized relative to most other states, as noted earlier. According the 2013 PKD/Gallup poll of the general public, 58% believe test scores should not be used to evaluate teachers (Bushaw & Lopez, 2013). Item 14 will be further examined in the interview phase of this research project.

While a definite majority of faculty members appear to agree with postmodern statements, the one-third who do not may provide enough friction to be detrimental to the work of the school. Dissent is valued in higher education, but when a significant minority's beliefs run directly counter to those of the majority, the organization may suffer from those who may wish to undermine progress toward a vision that is not held by all. Senge (1990) reminds us that a vision is not simply an idea, but is a "force in people's hearts, a force with impressive power" (p. 206). The vision of P–12 schooling that one holds may dictate the curricula one teaches; as, even if teaching from an approved text or set of materials, the instructor has the power to determine what is included or not included and what is emphasized in these curricula. This vision may also dictate instruction, as the style of teaching can indicate one's vision (i.e., student focused or teacher focused), and it may determine assessment as well. Does the assessment allow for student interpretation, or is there one correct answer that is expected and accepted?

Next Steps

The authors are collecting survey data from a mid-sized public university in the Midwest to be compared to these survey data. In addition, follow-up interviews examining the identified items in the Discussion section will be conducted in fall 2013. The interview data will be analyzed for themes and compared with the survey data.

References

Airasian, P. W. (2005). *Classroom assessment: Concepts and applications* (5th ed.). Boston: McGraw-Hill.

de Alba, A., Gonzalez-Gaudiano, E., Lankshear, C., & Peters, M. (2000). *Curriculum in the postmodern condition*. New York: Peter Lang.

Apple, M. W. (2001). *Education the "right" way: Markets, standards, God, and inequality.* New York: RoutledgeFalmer.

Bushaw, W. J., & Lopez, S. J. (2013, September). Which way do we go? *Phi Delta Kappan, 95*(1): 8–25.

Darley, J. (1998). Trust in organizations: Frontiers of theory and research. *Business Ethics Quarterly, 8,* 319-35.

Darling-Hammond, L. (2010). *The flat world and education: How America's commitment to the equity will determine our future.* New York: Teachers College Press.

Hargreaves, A., & Fullan, M. (2012). *Professional capital: Transforming teaching in every school.* New York: Teachers College Press.

Hirsch, E. D. (1988). *Cultural literacy: What every American needs to know.* New York: Houghton Mifflin.

Lyotard, J. F. (1984). *The postmodern condition: A report on knowledge.* Minneapolis: University of Minnesota Press.

National Commission on Excellence in Education (1983). *A nation at risk: The imperative for education reform.* Washington, D.C.: U.S. Department of Education.

Northouse, P. G. (2004). *Leadership: Theory and practice* (3rd ed.). Thousand Oaks, CA: Sage.

Peters, M. A., & Besley, T. (2006). Building knowledge cultures: Education and Post Modern development in the age of knowledge capitalism. In *Subjectivity and truth: Foucault, education, and the culture of self* (Peters, M.A., & Besley, T.). Lanham, MD: Rowman & Littlefield Publishers, Inc.

Pink, D. H. (2011). *Drive: The surprising truth about what motivates us*. New York: Riverhead.

Sahlberg, P. (2012). *Finnish lessons: What can the world learn from educational change in Finland?* New York: Teachers College Press. (p. 103).

Schiro, M. S. (2008). *Curriculum theory: Conflicting visions and enduring concerns.* Thousand Oaks, CA: Sage.

Senge, P. M. (1990). *The fifth discipline: The art and practice of the learning organization.* New York: Doubleday.

Trani, E. P., & Holsworth, R. D. (2010). *The indispensable university: Higher education, economic development, and the knowledge economy.* Lanham, MD: Rowman & Littlefield Publishers, Inc.

Wagner, T. (2010). *The global achievement gap: Why even our best schools don't teach the new survival skills our children need—and what we can do about it.* New York: Perseus.

Wink, J., & Putney, L. G. (2002). *A vision of Vygotsky*. Boston: Allyn & Bacon.

Wolk, R. A. (2011). *Wasting minds: Why our education system is failing and what we can do about it*. Alexandria, VA: Association of Supervision and Curriculum Development.

Appendix A
Modern/Post-Modern Teacher Education Contrasts
(modified from Pasi Sahlberg's *Finnish Lessons*)

Modern Advocates in Theory and/or Practice	Postmodern Advocates in Theory and/or Practice
1. Standardizing teaching and learning a. Setting clear, high, and centrally prescribed performance expectations for all schools, teachers, and students to improve the quality and equity of outcomes. b. Standardizing teaching and curriculum in order to have coherence and common criteria for measurement and data.	**1. Customizing teaching and learning** a. Setting a clear but flexible national framework for school-based curriculum planning. b. Encouraging local and individual solutions to national goals in order to find best ways to create optimal learning and teaching opportunities for all. c. Offering personal learning plans for those who have special educational needs
2. Focus on literacy and numeracy a. Basic knowledge and skills in reading, writing, mathematics, and the natural sciences serve as prime targets of education reform. Normally instruction time of these subjects is increased.	**2. Focus on creative learning** a. Teaching and learning focus on deep, broad learning, giving equal value to all aspects of the growth of an individual's personality, moral character, creativity, knowledge, and skills.
3. Teaching prescribed curriculum a. Reaching higher standards as a criterion for success and good performances. b. Outcomes of teaching are predictable and prescribed in a common way. c. Results are often judged by standardized tests and externally administered tests.	**3. Encouraging risk-taking** a. School-based and teacher-owned curricula facilitate finding novel approaches to teaching and learning, and encourage risk-taking and uncertainty in leadership, teaching, and learning.

Modern Advocates in Theory and/or Practice	Postmodern Advocates in Theory and/or Practice
4. Borrowing market-oriented reform ideas a. Sources of educational change are management administration models brought to schools from the corporate world through legislation or national programs. b. Such borrowing leads to aligning schools and local education systems to operational logic of private corporations.	**4. Learning from the past and owning innovations** a. Teaching honors traditional pedagogical values, such as teacher's professional role and relationship with students. b. Main sources of school improvement are proven good educational practices from the past.
5. Test-based accountability and control a. School performance and raising student achievement are closely tied to processes of promotion, inspection, and ultimately rewarding schools and teachers. b. Winners normally gain fiscal rewards, whereas struggling schools and individuals are punished. Punishment often includes loose employment terms and merit-based pay for teachers.	**5. Shared responsibility and trust** a. Gradually building a culture of responsibility and trust within the education system that values teacher and principal professionalism in judging what is best for students. b. Targeting resources and support to schools and students who are at risk to fail or to be left behind. c. Sample-based student assessments.

Appendix B
Survey of Schools of Education Faculty Members' Beliefs about Educational Reform and the Work of Teachers

(Uses a 4-point scale in which 1 = strongly agree, 2 = agree, 3 = disagree, and 4 = strongly disagree; italicized items are geared toward modern beliefs.)

Directions: Select the answer that best expresses your views and beliefs.

1. *Setting clear, high, and centrally prescribed performance expectations for all schools, teachers, and students will lead to improved quality and equity of outcomes.*
2. Encouraging local and individual solutions to national goals is the best way to create optimal learning and teaching opportunities for all.
3. It is important that schools offer personal learning plans for those who have special educational needs.

4. *Standardizing teaching and curriculum in order to have coherence and common criteria for measurement and data will improve education outcomes for all.*
5. Setting a clear but flexible national framework for school-based curriculum planning will lead to improved quality and equity of outcomes.
6. *Basic knowledge and skills in reading, writing, mathematics, and the natural sciences should be the prime targets of education reform.*
7. Teaching and learning should focus on deep, broad learning.
8. Teaching and learning should give equal value to all aspects of the growth of an individual's personality, moral character, creativity, knowledge, and skills.
9. *Instruction time for reading, writing, mathematics, and the natural sciences should be the primary foci of classroom practice.*
10. *Reaching higher standards is an important criterion for success and good performances.*
11. It is important that curricula be school-based and teacher-owned curricula.
12. Curricula should facilitate finding novel approaches to teaching and learning.
13. *Outcomes of teaching are predictable and should be prescribed in a common way.*
14. *Standardized tests and externally administered tests are the most important way to measure learning.*
15. It is important that schools are encouraged to take risks in the areas of leadership, teaching, and learning.
16. *The primary source of educational change should be management models brought to schools from the corporate world.*
17. It is important that teaching honors traditional pedagogical values, such as teacher's professional role and relationship with students.
18. *Business models should be mandated for schools and school districts by legislation and/or national programs.*
19. *It would benefit schools and local education systems to use the operational logic of private corporations.*
20. The main sources of school improvement should be proven, good educational practices from the past as demonstrated by successful teachers.
21. *School performance and raising student achievement should be tied to processes of promotion, inspection, and ultimately rewarding schools and teachers.*
22. It is important that a culture of responsibility and trust is gradually built within the education system that values teacher and principal professionalism in judging what is best for students.
23. Resources and support should be targeted to schools and students who are at risk to fail or to be left behind.
24. *Merit-based pay for teachers and a loosening of collective bargaining's grip on teacher contracts will make low-achieving schools and districts better.*

25. Sample-based student assessments are the best assessments.
26. *Schools and districts that score well in achievement measures should receive fiscal rewards, whereas struggling schools and individuals should not.*

About the Authors

Marius Boboc
PhD, Associate Professor
College of Education
Cleveland State University
Cleveland, OH
m.boboc@csuohio.edu
Research interests: assessment and accreditation in higher education, online pedagogy, postmodern education

R. D. Nordgren
PhD, Professor
School of Education
National University
La Jolla, CA
rnordgren@nu.edu
Research interests: national school reforms, non-cognitive learning, postmodernism in teacher education

Thinking Innovatively about Teaching Innovation And Ideation: Getting Students to Think Differently

Kevin Celuch
Bryan Bourdeau
Jack Smothers

Abstract
This paper describes a template for innovation/ideation exercises that integrates thinking from the entrepreneurial cognition literature with practical course design elements to systematically develop individuals' ideation capabilities. The proposed approach is appropriate for individuals teaching or facilitating in contexts aiming for breakthrough ideation in business, healthcare, computer-science, and public-administration products and services. The approach is driven by a need within industry and academe for curricula that develop and promote understanding of innovation processes, particularly regarding an entrepreneurial mindset. Included are an industry review and academic perspectives; proposed innovation phases and associated rationales; pre and posttest beliefs, efficacy, and ideation outputs used for initial assessment; and brief discussion on the challenges and value-add of the proposed innovation.

Key Words
Innovation, ideation, teaching, entrepreneurial cognition

Introduction

Innovation in the workplace has been a critical competency able to generate a competitive advantage for many decades (Tidd, Bessant, & Pavitt, 2005; Barsh, Capozzi, & Davidson, 2008). As a result, understanding and promoting innovation processes has been identified by business and educational leaders as an imperative likely to impact the future of organizations (AACSB, 2010; The Chronicle of Higher Education, 2013). However, organizations have been cautioned as to limitations associated with incomplete views of innovation linked to current thinking in innovation and education (Tidd, Bessant, & Pavitt, 2005; Lorange, 2010). Thus, our understanding of how to train or teach others to innovate remains nascent with regard to effective teaching models and curricula. As educators train the workforce of tomorrow, it is crucial that we understand the situational processes that can engender the creation of innovative ideas to solve complex workplace issues (Davis, 2000; Isaksen, Aerts, & Isaksen, 2009).

Individual innovativeness has traditionally been viewed as a trait, rather than a learnable competency, which is likely due to the lack of effective training on innovation skills. As a result, only individuals with natural predispositions to think creatively or take risks, such as the Steve Jobses of the world, have been sought after for this valuable ability. Yet, recent evidence supports the contention that creativity in the context of business innovation is predominantly a learned behavior (Dyer, Gregersen, & Christensen, 2009). Furthermore, our workplaces and educational institutions have inhibited the creation of innovations through rigid rules that penalize failure and cultures that reward the status quo. Thus, while the market demands innovation, most current organizational structures and methods of operation are designed to squelch it, albeit unintentionally.

Consistent with the work of Dyer, et al. (2009), we maintain that innovativeness is a skill that can be taught, but it does take a substantial amount of rethinking the educational experience. Thus our thinking is consistent with the work of Sarasvarthy (2001), who noted successful entrepreneurs often exhibit effectual reasoning; that is, using means to imagine possible new

ends. This approach is in sharp contrast to causal reasoning, selecting among means to achieve a pre-determined goal, which is typically taught as part of traditional business curricula. Therefore, the purpose of this study is to examine the course and curricula design elements that create an environment where unique and valuable innovations can emerge. This research addresses how courses can help students develop their ideation capabilities, the ability to generate new ideas. Such capabilities allow students to better understand and contribute to innovation initiatives in their future professional careers.

To accomplish this purpose, we first review the largest problem associated with innovation, namely, coming up with a good idea. Second, we integrate literature on entrepreneurial cognition with practical course design elements to show how the training environment can be designed to systematically develop students' ideation capabilities. We then empirically examine students' innovation competencies with a pretest-posttest design, and discuss the results. Finally, the value-added, challenges, and adaptability of this instruction method for teaching innovation is discussed in the concluding remarks.

The Importance of the Innovation Process to Curriculum Objectives

Understanding and promoting innovation processes has been identified by the Association to Advance Collegiate Schools of Business, or AACSB (2010,as an imperative likely to impact the future of business, and business education. Indeed, organizations have been cautioned as to limitations associated with incomplete views of innovation tied to extant linear models, due to the costs and risks associated with innovation (Tidd, Bessant, & Pavitt, 2005). Similarly, business education has been criticized for teaching within "silos" that overemphasize linear thinking (Lorange, 2010).

One movement that holds the potential to help address this problem is the entrepreneurial revolution of the last 20 years, which has transformed both industry and academe (Kuratko, 2005). An important outcome of this entrepreneurial revolution is research on entrepreneurial cognition, which includes all facets of cognition that are relevant to entrepreneurial processes, such as opportunity recognition, decision making, and complex problem solving in the context of venture creation (e.g., Baron & Ward, 2004; Krueger, 2004; Mitchell et al., 2002).

One area of the entrepreneurial cognition literature that is pertinent to the current study is research on the entrepreneurial perspective or mindset that can be developed by individuals and applied in various contexts (Kuratko, 2005; Krueger, 2007). At the core of the entrepreneurial mindset resides opportunity recognition, which is an orientation toward identifying and acting on options for venture creation. Conceiving more potential opportunities increases the likelihood of finding the best ones to develop. Thus, the entrepreneurship literature addresses relevant issues as to the "cognitive infrastructure" that would enable the identification of new opportunities by individuals (Krueger, 2000).

Similarly, the innovation process is analogous to a funnel with the wide mouth representing early idea generation which should be widened to include a greater quantity of ideas (Terwiesch & Ulrich, 2009). The funnel gradually tapers as ideas are eliminated through feasibility analysis and product development to identify the ideas with the greatest potential, until final commercialization, where the funnel ends. In addition to maximizing the quantity of ideas, evidence also suggests practices that can break the cognitive inertia often associated with ideation (Reinig & Briggs, 2008) and that increase the variability in ideas strengthens the overall quality of ideas (Terwiesch & Ulrich, 2009).

There is emerging agreement that critical experiences involving deliberate practices that change deep beliefs facilitate the development of an entrepreneurial mindset (Krueger, 2007). In this conception, learning moves beyond mere facts to metacognitive capabilities related to awareness of changes in cognitions, the so-called "learning how to learn." It is through such mechanisms that entrepreneurs understand how they "connect the dots" in self-directed learning. However, there is less agreement as to what should be practiced and how practices should be structured to enhance an entrepreneurial mindset (Krueger, 2007), particularly as related to experiences in the classroom. Thus, we draw inference from the entrepreneurial cognition literature to design practical course management elements, with the intention of systematically developing students' ideation capabilities.

Rationale and Outline of the Innovation Phases

The importance of developing a "cognitive infrastructure" and moving students from "novice" to "expert" scripts has been recognized as important for students to learn how to think entrepreneurially (Krueger, 2007). Metacognition is an awareness of thinking and using self-reflection to change thinking. This type of higher-order thinking has been found to be related to entrepreneurial expertise (Mitchell, 2005; Baron & Henry, 2006). Therefore, helping students develop the mental architecture for the entrepreneurial mindset is of critical importance to developing the skills of innovative thinking.

Critical thinking (or thinking about thinking) appears in many reviews of skills required of business school graduates (Celuch & Slama, 1998). Indeed, examples of the integration of critical thinking pedagogy into education can be found that span the use of specific tools and techniques to curriculum revision (cf. Celuch & Slama, 2000; Wee, Kek, & Kelley, 2003; Roy & Macchiette, 2005; Klebba & Hamilton, 2007; Aitken & Deaker, 2007). However, there is a dearth of understanding in the extant business educational literature on the application of critical thinking pedagogy to the development of an innovative entrepreneurial mindset. As such, appropriately adapted innovation and ideation exercises are primary mechanisms through which metacognitive abilities can be developed and refined.

To initiate the development of metacognition in the educational context, two class periods (approximately 3 hours) are spent introducing critical thinking and its importance to students. The approach sensitizes students to the elements of critical thinking, which can include purpose of the thinking, key question or problem being considered, assumptions, points of view, information/evidence, concepts, implications/consequences, and inferences or interpretations/conclusions and how awareness of the system can be used to add depth and breadth to one's thinking (Celuch, Kozlenkova, & Black, 2010). Students are then required to relate various critical thinking elements to their own experience and then journal about their understanding of the process in this context. As this phase introduces students to the concept of critical thinking and engages them in the process through elaboration and self-reflection and serves as the scaffolding for later idea generation, it is referred to as the *background phase*. Two examples of the critical thinking elements are presented below.

1. Students are encouraged to think of an assumption (or "given") associated with a product or service. They must then remove or reverse the assumption and think of what this might mean for future product/service possibilities. For example, an assumption associated with

restaurants is that they serve food. What if a restaurant did not serve food? Students are instructed to journal a reflection on the new service's value proposition.

2. Students are to go a bookstore and scan magazines that they would normally not choose to read (or, alternatively, engage in an activity they have not done before). They are then instructed to journal a reflection on their "typical" point of view and how they might broaden their point of view from the new sources of information (or new experience).

Following the background phase, the process then focuses on the development of an entrepreneurial mindset and is referred to as the *entrepreneurial engagement phase*. This phase involves using key critical thinking elements in immersion activities that provide further opportunities for deliberate practice with entrepreneurial and innovation cognitions. Immersion activities are assignments that engage students in active learning by structuring the course objectives around experiential tasks. The benefits of experiential learning have long been recognized (Kolb, 1984; Cantor, 1997). Experiential-active learning has been found to crystallize understanding and promote higher-level learning much more effectively than such passive forms of learning as lectures or reading a text. Furthermore, the subject of entrepreneurship and innovation is more effectively learned through hands-on experiences as students engage in solving problems and creating products instead of memorizing specialized content. This type of learning contrasts sharply with more conventional passive learning (Wagner, 2012). Thus, immersion in innovation activities is the ideal course design for maximizing learning outcomes.

Following are three assignments that demonstrate types of experiential activities that can be used to elaborate and reinforce learning from the background phase to show how the approach can be adapted to "real world" client assignments.

1. Working with an existing patent, students are asked to employ assumption reversals to broaden their ideation potential. In this exercise, beliefs that may never surface and/or be questioned are made explicit, reversed, and then used as departure points for potentially new ideas. For example, one assumption might be that the complete patent must be used in the development of a new idea. Reversing or removing the assumption would involve using only a part of the patent and then developing potential ideas from only one aspect of the patent. The ideation process can now continue with alternative aspects of the patent.

2. Again, working with an existing patent, students are asked to ideate based on randomly generated concepts, visuals, and/or video sequences as a means of expanding their point of view. The concepts (visuals and/or videos) are displayed on cards (or presentation software) that are shuffled (or arrayed randomly) and then drawn (or presented) as a means of introducing randomness to the process. Students are given 3 or 4 minutes to write down as many ideas as possible on large sheets of newsprint. The process is then repeated multiple times. Students are then asked to connect and develop new ideas from the multiple iterations of associations.

3. In the interest of extending points of view, students are randomly provided with two mega-trends (e.g., aging boomers, sustainability concerns, rising healthcare costs, etc.), the intersection of which serves as the basis for idea development. Another mega-trend is randomly added to expand the thinking as ideas must now broaden to incorporate the added trend.

Note that the use of multi-sensory stimulation is in keeping with the work of Mayer (1997). This research identified a clear "multi-media effect" in which participants exposed to coordinated visual and verbal stimuli generated a median of over 50% more creative solutions on problem-solving transfer tests than participants exposed to only one modality. This effect was observed across multiple studies and in one case resulted in over 75% more creative solutions generated (Mayer, 1997). Thus the positive outcomes associated with this supra-additive integration of stimuli appear greater than the sum of the parts (Medina, 2008).

After engaging in these types of assignments, students are instructed to journal reflections on their positive and negative experiences with the process. That is, what was confusing, freeing, frustrating, fun, time wasting, insightful, etc., regarding their involvement in the ideation exercise. Exercises like the ones described earlier are used over the entire course of a semester. While the background phase assignments and journaling are completed individually, the majority of entrepreneurial engagement assignments are completed in small groups during class. Thus, students experience much less lecture than the typical class and instead experience a more continuous process of ideation and connecting associations in groups, and reflecting individually on their thinking in groups.

With regard to the role of the professors, whom we refer to as coaches, we typically circulate around the room while students are engaged in ideation, and, through monitoring the process, develop a much better feel for student thinking that allows us to be better "real time" coaches. In addition, we randomly collect a sample of student journals at various points during the semester and provide feedback on reflections emphasizing that the students should strive for depth rather than merely "reporting" on activities. Reflection on one's experiences is vital for the elaboration process, as it facilitates the organization and crystallization of understanding into cognitive categories related to experiential or active learning.

The coaching-and-feedback model is an ideal fit for teaching innovation, as it seeks to help students understand their own personal talents and thought processes, rather than imparting previously structured learning from a textbook to students, as one would find in a more conventional, lecture-style course. Furthermore, if we desire students to create something new, leaning on experience or research limits thinking, as it causes the mind to replicate rather than create. In contrast, focusing on the innovation process itself forces students to find their own unique solutions to problems. The result for students is a more complete understanding of the innovation process, and a more holistic understanding of themselves.

In summary, the intent of these innovation phases is to provide a "nutrient rich" environment for growing an entrepreneurial perspective with particular respect to ideation. This approach marries the entrepreneurial cognition literature with consistent practice that makes explicit the point of the thinking, as it also provides for reflective elaboration of experimental ideation. To analyze the impact of this approach on student learning, the next section describes our assessment process and measurement of learning outcomes.

Assessment

Participating in this assessment were 24 and 22 students enrolled in the spring and fall sections of the upper division innovation/ideation class. Individuals in the classes experienced the pedagogy described above. The assessments utilized a pretest (administered at the beginning of the semester)-posttest (administered at the end of the semester) design.

The questionnaire contained multiple items associated with an ideation-evaluation measure assessed via 10-item scales (Basadur, 2002) as well as an ideation self-efficacy measure assessed via 7-item scales adapted from Celuch et al. (2010) (Cronbach's alpha .83 and .81 for the spring and fall classes). Justification for use of the ideation measure relates to the prominence of deep beliefs as the foundation of entrepreneurial attitudes and intentions (Krueger, 2007). Thus the Basadur measure consisted of discrete beliefs related to ideation. Self-efficacy was measured due to the central role of efficacy perceptions in the development of a self-identity and related behavior associated with innovation and critical thinking (Krueger, 2007; Celuch et al., 2010). The same measures were used for the spring and fall classes. It was expected that consistent practice and experience with the approach outlined earlier would significantly enhance specific ideation-related beliefs, ideation self-efficacy, and the uniqueness of ideation output.

Results

Tables 1 and 2 present pretest and posttest means and *p*-values for the paired sample *t*-tests for the measures for the spring and fall classes. Note that, as expected, posttest means were consistently significantly higher (or lower, depending on item wording) for a shift in beliefs away from self-censoring and prejudging during ideation and more towards greater openness in the ideation process.

Table 1. *Means and* p-*values for Pre and Posttest Ideation Beliefs for Spring Semester*

Item	Group Means		
	Pretest	**Posttest**	***p*-value**
I should do some pre-judgment of my ideas before telling them to others.	7.00	5.95	.006
One new idea is worth ten old ones.	4.62	5.86	.066
Quality is a lot more important than quantity in generating ideas.	6.95	3.95	.000
I think everyone should say whatever pops into their head whenever possible.	3.90	4.95	.002
I wish people would think about whether or not an idea is practical before they open their mouths.	5.14	3.67	.001

Further, perceptions relating to ideation self-efficacy were also significantly strengthened. Beyond quantitative assessments, a key question related to the level of uniqueness of the student-developed ideas. In terms of ideation output for the spring semester, eight groups of students engaged in the earlier-outlined exercises and generated many possible alternatives to already existing idea patents. Each group then selected its final idea to be pitched to a client interested in

technology development and transfer. The client had already brainstormed possible commercialization avenues for the patents that served as a baseline for comparison.

Table 2. *Means and* p-*values for Pre and Posttest Ideation Beliefs for Fall Semester*

	Group Means		
Item	**Pretest**	**Posttest**	***p*-value**
I should do some pre-judgment of my ideas before telling them to others.	7.27	5.82	.002
One new idea is worth ten old ones.	6.59	7.50	.038
Quality is a lot more important than quantity in generating ideas.	7.64	6.56	.035
I think everyone should say whatever pops into their head whenever possible.	4.49	5.32	.100
I wish people would think about whether or not an idea is practical before they open their mouths.	4.68	3.73	.050

Table 3. *Means and* p-*value for Pre and Posttest Ideation Self-Efficacy for Spring Semester*

	Group Means		
Item	**Pretest**	**Posttest**	***p*-value**
Ideation self-efficacy	5.07	5.96	.002

Of note is the finding that none of the eight student-developed ideas were represented in already-existing client brainstorming lists, which contained more than 30 product ideas. So in terms of idea uniqueness, the present approach exceeded conventional brainstorming techniques in that none of the student ideas overlapped ideas already generated by the client. Similar results were observed for the fall semester ideation output, which was compared to benchmark ideation from the client.

Table 4. *Means and* p*-value for Pre and Posttest Ideation Self-Efficacy for Fall Semester*

Item	Group Means		
	Pretest	**Posttest**	***p*-value**
Ideation self-efficacy	5.63	6.04	.004

Discussion

The proposed innovation phases are designed to address industry and academic imperatives to understand the innovation process and develop an evidence-based approach for teaching innovation skills. This method transcends tools and techniques, as it is oriented toward metacognitive thinking and the development of an entrepreneurial mindset that can extend lifelong learning. As a result, the entrepreneurial mindset that is generated is not limited to the classroom, as it would be useful to individuals working in various organizational contexts. Initial assessment results relating to changes in ideation beliefs and efficacy, as well as idea uniqueness, suggest that the approach holds the potential to positively impact aspects of an entrepreneurial mindset and with further refinement and empirical support could contribute to evolving entrepreneurial cognition and innovation literature.

Challenges and Adaptability of the Innovation

As with any new approach, implementation issues can always be identified. For the proposed innovation, students often struggle with randomly driven ideation. We are so conditioned to linear thinking that it is often difficult for individuals to get started and tolerate initial confusion, as they cannot see the "end game" when participating in such exercises. The aforementioned design elements help address this issue. First, we believe orienting the ideation within a broader critical-thinking system is important, as it provides students with a metacognitive "anchor" from which to increase their tolerance for ambiguity. It does this by showing how the critical thinking elements can be used to enhance generative (creative) capacity and how they can then be used in the more "traditional" way to enhance evaluative capacity during future feasibility analysis related to ideas. This is accomplished during the entrepreneurial engagement phase described above. We also employ deliberate coaching and encouragement during these exercises.

A primary strength of this teaching method is that although we employ the approach as part of an innovation/ideation class, the exercises can be used in virtually any course or training environment that requires ideation, such as product/service development or improvements. The approach has also been applied in 5-week formats as well as for employees within an organization and for individuals in the nonprofit sector (from different organizations) taking the same workshop. This approach is particularly advantageous for the corporate environment; the greatest return on innovation efforts can be captured by improving idea generation, as this stage is relatively inexpensive compared to subsequent product-development stages.

In closing, industry and academe highlight the need for curricula that develop and promote understanding of innovation processes. The uniqueness of the proposed innovation phases relates

to the extent to which critical thinking and reflection serve as "cornerstone" and "capstone" aspects of the ideation process. Although many classes and companies use some form of brainstorming, ideation is one of the least-well-understood aspects of innovation. Not surprisingly, there is a dearth of research which explicitly delineates the process by connecting it to extant entrepreneurial cognition literature, so that ideation is a means to contribute to students' entrepreneurial mindset. Thus, while "teaching" someone to be the next Steve Jobs is impossible, creating an environment that facilitates innovative thinking through experiential learning can dramatically help individuals understand the innovation process and develop the valuable mindset and skillset of an experimental innovator.

References

Aitken, R., & Deaker, L. (2007). Critical learning and reflective practice: An exploratory study using tape recorded journals. *Marketing Education Review, 17,* 1–5.

Association to Advance Collegiate Schools of Business (2010). *Business schools on an innovation mission: Report of the AACSB International Task Force on Business School Innovation.* Tampa, FL: AACSB International, 1–43. Retrieved from http://www.aacsb.edu/resources/innovation/business-schools-on-an-innovation-mission.pdf

Baron R. A., & Henry, R. A. (2006). Why do some entrepreneurs achieve extraordinary success? Insights from cognitive science research on exceptional performance. Paper presented at the Babson Research Conference, Bloomington, Indiana.

Baron, R. A., & Ward, T. B. (2004). Expanding entrepreneurial cognition's toolbox: Potential contributions from the field of cognitive science. *Entrepreneurship Theory and Practice*, *28*(6), 553–574.

Barsh, J., Capozzi, M. M., & Davidson, J. (2008). Leadership and innovation. *The McKinsey Quarterly, 1,* 37–47.

Basadur, M. (2002). *Basadur ideation-evaluation preference scale.* Basadur Applied Creativity Skill-Building Workshops. www.basadur.com.

Cantor, J.A. (1997). *Experiential learning in higher education: Linking classroom and community.* Washington, DC: The George Washington University Graduate School of Education and Human Development.

Celuch, K., & Slama, M. (1998). Critical thinking as an integrative theme for teaching lifelong learning skills in marketing. *Marketing Education Review, 8*(3), 1–12.

Celuch, K., & Slama. M. (2000). Student perceptions of a marketing course taught with the critical thinking approach. *Marketing Education Review*, 10(1), 57–64.

Celuch, K., Kozlenkova, I., & Black, G. (2010). An exploration of self-efficacy as a mediator of skill beliefs and student self identity as a critical thinker. *Marketing Education Review, 20,* 257–266.

The Chronicle of Higher Education (2013). Attitudes on innovation: How college leaders and faculty see the key issues facing higher education. *The Chronicle of Higher Education Report,* Washington, DC, 1–16.

Davis, T. (2000). Global innovation and growth survey. London, UK: PricewaterhouseCoopers.

Dyer, J. H., Gregersen, H. B., & Christensen, C. M. (2009). The innovator's DNA. *Harvard Business Review, 87*(12), 60–67.

Isaksen, S. G., Aerts, W. S., & Isaksen, E. J. (2009, spring). Creating more innovative workplaces: Linking problem-solving style and organizational climate. A CRU Technical Report. The Creative Problem Solving Group, Inc., *17*(2), 1–24.

Klebba, J. M., & Hamilton, J. G. (2007). Structured case analysis: Developing critical thinking skills in a marketing case course. *Journal of Marketing Education, 29,* 132–139.

Kolb, D. A. (1984). *Experiential learning as the source of learning and development*. Upper Saddle River, NJ: Prentice Hall, Inc.

Krueger, N. F. (2000). The cognitive infrastructure of opportunity emergence. *Entrepreneurship Theory and Practice, 24*(3), 5–23.

Krueger, N. F., (2004). The cognitive psychology of entrepreneurship. In R. A. Baron & T. B. Ward (Eds.), . Expanding entrepreneurial cognition's toolbox: Potential contributions from the field of cognitive science (pp. 105–140). *Entrepreneurship Theory and Practice, 28*(6),

Krueger, N. F. (2007). What lies beneath? Experiential essence of entrepreneurial thinking. *Entrepreneurship Theory and Practice, 31*(1), 123–138.

Kuratko, D. F. (2005). The emergence of entrepreneurship education: Development, trends, and challenges. *Entrepreneurship Theory and Practice*, 29(5), 577–597.
Lorange, P. (2010, January/February). A new model for management education. *BizEd, 9*(1), 38–41
Mayer, R. E. (1997). Multimedia learning: Are we asking the right questions? *Educational Psychology, 32*(1), 1–19.
Medina, J. B. (2008). *Brain rules: 12 principles for surviving and thriving at work, home, and school*. Seattle: Pear Press.
Mitchell, R. K. (2005). Tuning up the global value creation engine: The road to excellence in international entrepreneurship education. In J. A. Katz & D. Shepard (Eds.), *Advances in entrepreneurship, firm emergence and growth: Vol. 8.Cognitive approaches to entrepreneurship research* (pp.185–248). Greenwich, CT: JAI Press.
Mitchell, R. K., Smith, J. B., Morse, E. A., Seawright, K. K., Peredo, A. M., & McKenzie, B. (2002). Are entrepreneurial cognitions universal? Assessing entrepreneurial cognitions across cultures. *Entrepreneurship Theory & Practice, 26*(4), 9–32.
Reinig, B. A., & Briggs, R. O. (2008). On the relationship between idea-quantity and idea-quality during ideation. *Group Decisions and Negotiation, 17,* 403–442.
Roy, A., &. Macchiette, B. (2005). Debating the issues: A tool for augmenting critical thinking skills of marketing students. *Journal of Marketing Education*, 27, 264–276.
Sarasvarthy, S. D. (2001). What makes entrepreneurs entrepreneurial? White paper. Seattle, WA: University of Washington, 1–9.
Terwiesch, C., & Ulrich, K. T. (2009). *Innovation tournaments: Creating and selecting exceptional opportunities.* Boston: Harvard Business Press.
Tidd, J., Bessant, J., & Pavitt, K. (2005). *Managing innovation: Integrating technological, market, and organizational change*. 3rd ed. Hoboken, NJ: Wiley.
Wagner, T. (2012, April 13). Educating the next Steve Jobs. *The Wall Street Journal.* Retrieved from http://online.wsj.com/article/SB10001424052702304444604577337790086673050.html
Wee, L., Kek, M., & Kelley, C. (2003). Transforming the marketing curriculum using problem-based learning: A case study. *Journal of Marketing Education, 25*,150–162.

About the Authors

Kevin Celuch
Ph.D., Blair Chair of Business Science and Professor of Marketing
University of Southern Indiana
Evansville, IN
kceluch@usi.edu
Research interests: entrepreneurial and consumer cognition, critical thinking pedagogy, business-to-business and business-to- consumer relational strategies.

Bryan Bourdeau
MBA, Instructor of Management
University of Southern Indiana
Evansville, IN
bbourdeau@usi.edu
Research interest: entrepreneurial cognition.

Jack Smothers
PhD, Assistant Professor of Management
University of Southern Indiana
Evansville, IN
jesmothers@usi.edu
Research interests: entrepreneurship, innovation, business history, leadership, critical thinking, business education.

Job Satisfaction, Burnout and Work Engagement in Higher Education: A Survey of Research and Best Practices

Cynthia Schubert-Irastorza
Dee L. Fabry

Abstract
This study explores the evolution of research on job satisfaction, burnout, and work engagement, primarily in the helping professions, with specific focus on faculty in higher education. It includes a summary of research-based methods and techniques used for measuring job satisfaction, predicting and preventing burnout, and increasing work engagement. Lessons learned, suggested directions, and professional development activities designed to optimize faculty engagement and promote faculty well-being are discussed.

Key Words:
Job satisfaction, burnout, work engagement, staff development, higher education faculty

Introduction

This study presents an overview of the literature related to determining the job satisfaction, occupational burnout, and work-engagement levels of individuals who are employed in the helping professions, particularly higher education faculty members. Research on these concepts has moved from an early focus on job satisfaction (1911–1960s) through burnout (1974–present) and on to work engagement (2000s). Current thinking focuses on such positive aspects of work engagement as resiliency and flourishing (Seligman, 2011), which is a decidedly different direction. In keeping with the tenets of positive psychology (Seligman & Csikszentmihalyi, 2000), the purpose of this article is to investigate methods for creating more positive work environments and fostering faculty wellbeing in the academic department. Citing specific studies and findings, the present authors compare the instruments and determinants used to measure the work-related attitudes of academics. They offer lessons learned from the research and outline a plan to engage faculty in the self-assessment of their job satisfaction, to create positive growth plans, and to create a community of support. This data will provide a baseline for continued monitoring of work attitudes and evaluating the impact of future staff development activities on faculty job satisfaction, work engagement, and well-being for both new hires and seasoned faculty within the academic department.

Research and Findings

Job Satisfaction

Job satisfaction has been an important area of investigation for organizational psychologists, academic researchers, and human resource professionals since the early 1900s. Beginning with Taylor's (1911) studies of scientific management, which focused on increasing worker productivity, researchers have been intrigued by the basic concept of job satisfaction, which is based on the idea that people work for reasons other than pay. During the past 50 years, many researchers have tried to determine what factors influence worker behavior and how that behavior impacts job performance (Cabrita & Perista, 2006; Judge, Thorensen, Bono, & Patton, 2001; Smith, Kendall, & Hulin, 1969; Spector, 1997).

Opinions currently differ over the existence of a direct link between increased job satisfaction and increased productivity. However, multiple studies have claimed that satisfied workers are generally happier, enjoy better health, suffer fewer accidents and injuries, and are less likely to seek other employment than unsatisfied workers (Craney, Smith, & Stone, 1992; Oshagbemi, 2013; Schokkkaert, Ootegem & Verhofstad, 2009; van Saane, Sluiter, Verbeck & Frings-Dresen, 2003). There is consensus that satisfied workers provide economic advantages to their employers by decreasing absenteeism, reducing medical expenses, cutting turnover, and minimizing the need for new-employee training expenses. Oshagbemi (2013), author of *Job Satisfaction in Higher Education*, a frequently cited study of job satisfaction among University faculty, suggested that employer concern with employee job satisfaction should be a moral responsibility, not only in academia, but in the general workplace.

While there is no consensus on how to measure and monitor job satisfaction, Spector's (1997) description of job satisfaction as an attitudinal value that indicates how people feel about their job is a generally accepted definition. More detailed definitions of job satisfaction offered by Moorman (1993) and Rose (2001) suggested that job satisfaction is a bi-dimensional concept consisting of intrinsic (affective) and extrinsic (cognitive) satisfaction dimensions. Intrinsic job satisfaction is the one-dimensional emotional feeling individuals have about their job as a whole, which reflects the degree of pleasure and enjoyment they experience in the workplace. Examples of extrinsic rewards are opportunities to be innovative or creative, finding joy in learning new skills, or the excitement of discovery. Extrinsic satisfaction focuses on such multiple work-related factors as the work itself, pay and working conditions, and the behavior of supervisors and co-workers. Individual job holders determine whether these factors are satisfactory or unsatisfactory in terms of their expectations and/or in comparison with other jobs. As Oshagbemi (2013) noted, "An individual's needs may be fulfilled, but any feeling of satisfaction will still depend on whether he sees his position as comparing satisfactorily with others" (p. 4).

There is on-going discussion on the subject of developing valid, reliable, and responsive assessment instruments that measure job satisfaction and job quality. Cabrita and Perista (2006) emphasized the need for researchers to consider both intrinsic and extrinsic determinants when developing instruments to measure worker satisfaction. They pointed out that extrinsic sources of satisfaction are difficult to quantify because they depend primarily upon the individual characteristics of the person, such as the ability to take initiative, be creative, or get along well with others. Cabrita and Perista also noted that the measurement of extrinsic indicators needs to allow for individual differences, such as age, gender, abilities, values, educational levels, and personality. Schokkaert et al. (2009) rejected the customary objective/subjective approaches to measuring job satisfaction and quality and suggested an alternative evaluation model known as the equivalent income indicator. The authors claimed this new model "respects individual preferences but corrects for the effects of expectations and aspirations" (p. 23).

Multiple scales already exist to measure job satisfaction. Van Saane et al. (2003) conducted an extensive meta-analysis of 35 existing job satisfaction scales to determine their validity, reliability, and responsiveness using the 11 most frequently mentioned work-related factors:

- Work content (nature of the job)
- Autonomy (individual control, decision making)
- Growth and development opportunities (training, mentorship)

- Financial rewards (pay, benefits, job security)
- Promotion opportunities (upward mobility)
- Supervision (behavior and relationships)
- Communication (internal and external)
- Co-workers (behavior and relationships)
- Meaningfulness (perceptions of significance and value)
- Workload (time and resources)
- Work demands (requirements and expectations)

The most well-known and frequently employed of these instruments is the Job Descriptive Index (JDI), which was initially developed by Smith (Smith et al., 1969) at Cornell University and revised in 1987 (Smith et al.) and again in 1997 (Kihm, Smith, & Irwin). The JDI was most recently updated for use with the U.S. workforce in 2008 by the JDI Research Group at Bowling Green University (Lake, Gopalkrishnan, Sliter, & Withrow, 2006). The instrument is available for use in scholarly research, free of charge. The JDI measures five cognitive factors that the researchers believe influence job satisfaction: pay; promotion and promotion opportunities; coworker behavior; supervisor behavior; and the nature of the work itself, including physical conditions and the working facility. The JDI has been extensively reviewed for validity and reliability, translated into multiple languages, and used in subject-related studies conducted by researchers in a variety of countries around the world, most frequently in Europe. A number of scales related to the JDI scale measure various aspects of the work experience, such as stress levels and general relationships with management. These instruments are referred to as the JDI family of scales. Faculty members from the JDI Research Group at Bowling Green University note:

> The Stress in General (SIG) measures feelings of job stress and the Trust in Management (TIM) measures the perceived trustworthiness and integrity of management. Depending on the specifics of a given research project, we often recommend that users administer multiple scales to participants in order to capture a complete picture of satisfaction and related variables. (Lake et al., 2006, para. 2)

Oshagbemi (2013) relates that he used the JDI scales as the basis for the extensive research study on job satisfaction among higher education faculty that he conducted in 1999 in England with 566 randomly selected university teachers. The questionnaire that Oshagbemi developed was specific to the work functions of academics, included both intrinsic and extrinsic measures, factored in allowances for individual differences, and contained three sections:

- Section A—demographic data relating to age, gender, length of service in present university, rank, and discipline.
- Section B—rating of factors believed to affect job satisfaction or dissatisfaction, including teaching, research, administrative and managerial duties (also referred to as service), present pay, promotions, supervisors' behavior, co-workers' behavior, and physical conditions/working facilities.

- Section C—personal responses to determine how academics feel about their work situation, whether they are satisfied and like or dislike their jobs, and how they feel about changing jobs.

Oshagbemi's (2013) findings indicated that the academic participants in his study were generally satisfied with their work and received the most job satisfaction from two of the three primary functions of their work: teaching, scholarship, and administrative function or service. Teaching was rated as the most satisfying of the three core job functions, followed by scholarship; managerial and administrative duties (also known as "service") was rated least satisfying. Almost 80% of the study respondents were satisfied with their teaching duties and 65% were satisfied with their scholarship responsibilities, but only 40% of the respondents found satisfaction from their administrative and managerial duties. The highest rates of dissatisfaction were related to pay and promotions, which Oshagbemi suggested were areas that needed to be addressed by the institutional administration. Study data showed that general job satisfaction levels for academics increased with age, rank, and length of time in service at the same institution. Interestingly, study results indicated that older academics found the most satisfaction in teaching and administration/management duties. At the same time, the older academics showed less satisfaction from scholarship.

Additional findings from Oshagbemi (2013) suggested that gender did not relate significantly to levels of job satisfaction in this study, and the majority of survey respondents indicated experiencing satisfaction in their interactions with both supervisors and colleagues. Oshagbemi recommended that additional colleges and universities investigate the job satisfaction levels of their faculty, welcomed no-charge use of his survey instrument, and requested feedback regarding results from diverse higher education institutions.

The authors of the present study plan to accept this invitation and initiate the process for conducting an anonymous departmental or school-wide survey related to job satisfaction, modeled on the work done by Oshagbemi (2013), Leiter and Maslach (2003), and Baaker and Demerouti (2008). The present authors' institution is currently experiencing a significant administrative and organizational change, and this would be an ideal time to establish baseline data for measuring faculty job satisfaction. Early expectations are that the results of this survey would differ from Oshagbemi's (2013) work in that the age and gender distribution is different, with a preponderance of older females in the department under investigation. Based on informal conversations and daily interactions with full-time faculty, the authors predict that there will be dissatisfaction related to workload and service demands. However, it is expected that satisfaction scores on supervisors' behavior and co-workers' behavior will be reasonably high.

Burnout

The term "burnout" was coined by New York psychiatrist Freudenberger (1974), who used the term to describe a condition experienced by people in the helping professions that is characterized by overwork resulting in exhaustion and fatigue. Freudenberger noted that burnout was particularly prevalent among people working in the helping professions—doctors, nurses, teachers, social workers, counselors, lawyers, and law enforcement workers. Freudenberger described the 12 stages of burnout, which start with unrealistic expectations of achievement leading to a constantly increasing attempt to work harder and do better, leading to over-absorption in work and increasing neglect of self, along with distancing from friends and family, resulting in decreased work performance and potentially leading to serious health issues and/or a final collapse.

As noted by Schaufeli, Leiter and Maslach (2008) in their extensive review of 35 years of burnout research, "Burnout is a well-established academic subject on which thousands of publications have appeared and about which numerous congresses and symposia are held. We estimate that currently over 6,000 books, chapters, dissertations and journal articles have been published on burnout" (p. 204). Over the years, numerous researchers have attempted to identify the causes, measure the symptoms, and suggest possible cures for individuals suffering from burnout, (Kyriacou, 2001; Crosmer, 2008; Maslach & Leiter, 2008; Maslack & Jackson, 1981; McCann & Holt, 2009; Skaalvik & Sklaalvik, 2010). An interesting 10-year longitudinal interview study of burnout in the helping professions was conducted by Chernis (1995), who concluded that the idealistic young workers in the study who avoided or overcame burnout had the following shared experiences and the following traits: finding meaning and significance in their work, enjoyment of intellectual challenges, the ability to adapt to circumstances and/or be flexible enough to change jobs when necessary, the ability to cultivate special interests, and the urge to be creative.

Maslach, currently serving as a professor of psychology at the University of California in Berkley, California, has maintained leadership in the field of burnout studies for more than 30 years. As originators of the well-known and highly respected Maslach Burnout Inventory (MBI) scale, Maslach and Jackson (1981) initially defined burnout as "a syndrome of emotional exhaustion and cynicism that occurs frequently among individuals who do 'people work' of some kind" (p. 99). In their first major study of burnout, Maslach and Jackson suggested that burnout manifests in three major dimensions: (a) emotional exhaustion, which can lead to severely reduced performance and serious mental and physical health issues, (b) distancing or depersonalization, which results in cynicism or lack of empathy toward clients, patients, customers, students, etc., and (c) a lack of self-efficacy, not feeling competent in the job, which leads to a dangerous downward spiral of losing self-confidence and motivation. Maslach and Jackson's early studies were conducted with human service professionals and focused on determining both the frequency and intensity of these feelings to measure degree of burnout. Continuing the early work with burnout analysis, Maslach, Jackson, and Leiter (1996) developed their first burnout inventory manual and subsequently provided a growing body of researchers with information on how organizations cause stress and what to do about it (Maslach, Jackson, & Leiter, 1997).

A second scale, known as the Areas of Worklife Scale (AWS), was developed by Leiter and Maslach in 2003 and is frequently used in combination with the MBI. A similar scale for educators, known as the Educator's Scale (ES), is used for educational professionals. Both the MBI-AWS and MBI-ES, referred to as the MBI family of scales, are based on the idea that burnout occurs when individuals feel a conflict or disconnect from their work in one or more of the following six areas;

- Work life—balance between job demands and worker capacity, avoiding overload.
- Control—degree of autonomy and participation in job-related decision making.
- Reward—financial, institutional, or social compensation, intrinsic and extrinsic rewards.
- Community—overall quality of social interaction and relationships in the workplace.
- Fairness—individual perceptions that work-related decisions are fair and equitable.
- Values—match between organizational goals and objectives and individual values.

Influenced by the positive psychology movement described by Seligman and Csikszentmihalyi (2000), Maslach and colleagues have shifted their focus from the identification and analysis of burnout to a more positive and preventative approach. This new approach views burnout as the erosion of engagement and assumes the existence of a continuum with burnout and engagement as two opposite poles. This view implies that the opposite of emotional exhaustion is energy, the opposite of distancing is involvement, and the opposite of inefficacy is self-efficacy and self-confidence (Maslach, 2003, 2011; Maslach & Leiter, 2008; Maslach, Leiter, & Schaufeli, 2009; Maslach, Leiter, & Jackson, 2012).

As reflected in Schaufeli et al. (2008), educational researchers have broadened their burnout research scope to include occupational groups outside of the helping professions, and many are using the original MBI-AWS and MBI-ES scales to predict and, hopefully, prevent an escalation of burnout symptoms by developing appropriate interventions at the individual, social, and organizational levels. As noted by Maslach (2011), "Preventing burnout can be accomplished by a focus on building engagement and utilizing organizational assessments that include tools for early detection" (p. 44).

In a two-year longitudinal study, Maslach and Leiter (2008) demonstrated how the MBI and the AWS can be used by organizations to predict and prevent burnout. Their study of 466 organizational employees indicated that employees of this organization who initially tested "at risk" for burnout were significantly more likely to experience full burnout if they expressed a disconnect or "tipping point" in the area of "fairness." As Maslach (2011) noted, "Although most people predict that workload will be the primary factor for burnout, it usually is not—other areas, such as fairness, or control or workplace community, often turn out to be the major points of strain in an organization" (p. 46). Maslach urges institutions, organizations, and units to conduct "regular employee checkups" to identify potential burnout and develop customized interventions that encourage engagement.

The most recent study of burnout in higher education faculty in the United States (U.S.) was conducted by then doctoral student Crosmer (2008). Using modified versions of the MBI-ES scales as a base, Dr. Crosmer's study involved 411 university faculty members in the U.S. Results indicated that university faculty members suffer a similar level of burnout as the average working population. Young, tenure-track faculty demonstrated the highest levels of burnout, with males suffering more from depersonalization and cynicism and females scoring the highest for emotional exhaustion. As would be expected, tenured faculty showed the highest levels of satisfaction and self-efficacy compared to tenure-track and non-tenure-track faculty. Survey respondents indicated that the major causes of burnout were budget cuts and lack of support from administrators, work overload, poorly prepared students, high self-expectations, unclear institutional expectations, bureaucratic rules, and poor pay.

An extensive literature review of studies related to burnout among university teaching staff by Watts and Robinson (2011) confirmed Cosmer's (2008) findings about age being a factor in burnout, with younger faculty being more vulnerable, males showing higher levels of depersonalization, and females having higher levels of emotional exhaustion. Primary causes of burnout in the Watts and Robinson (2011) study were listed as work overload and exposure to high numbers of students, particularly the advisement of postgraduate students as well as research demands, time pressure, and diminished collegiality.

The rapid growth of online teaching is prompting researchers to explore the burnout levels of online higher education teachers. So far, results seem inconclusive. A study by Hogan and McKnight (2007) using the MBI-ES indicated that online instructors received average scores on

emotional exhaustion, with high scores on depersonalization and a low degree of self-efficacy. However, this study has been somewhat discredited because of the low number of participants (76). A contradictory study by McCann and Holt (2009) using the same MBI-ES scales suggested that online instructors are less stressed than their face-to-face counterparts. McCann and Holt also noted that improvements in technology, as well as experienced gained in the online environment, are further reducing stressors for online faculty. Unfortunately, this study also suffered from an even smaller number of respondents (65). It is expected that research on burnout experienced by online faculty will grow along with the proliferation of online and distance education.

The present authors suggest that while faculty in their department may not be suffering the potentially severe consequences of advanced burnout, they may be "at risk" or somewhat "crispy around the edges" and less engaged then they might be otherwise. Declining enrollments, increased workloads, and shrinking budgets engender worry and insecurity, along with the kind of stress and anxiety that leads toward burnout, exhaustion, and lack of self-efficacy, rather than toward energy, involvement, and self-confidence. In the spirit of continuous program improvement and in accordance with the tenets of positive psychology, the authors plan to follow Maslach's (2011) advice to conduct regular institutional checkups to identify potential burnout and develop customized interventions that encourage work engagement, as outlined in the section on future directions.

Work Engagement

The most recent developments in the burnout/job satisfaction/work-engagement–related research are work-engagement studies that represent a somewhat different approach to the investigation of workplace attitudes. Work-engagement research embodies the positive psychology focus on creating health and wellbeing, rather than curing illness or fixing dysfunction (Seligman & Csikszentmihalyi, 2000; Seligman, 2002, 2011; Wallis, 2005). Work-engagement studies conducted by Baaker & Demerouti (2008) view job engagement as the positive opposite of burnout, but see it as a separate entity from the Leiter and Maslach (2003) burnout/engagement continuum. Demerouti and Bakker (2011) describe the Job Demand-Resource (JD-R) model as "a framework that can be used by organizations to improve employee health and motivation, whilst simultaneously improving various organizational outcomes" (p. 1).

Schaufeli, Bakker, and Salanova (2006) saw work engagement as a positive, work-related state characterized by vigor, dedication, and absorption. According to Schaufeli et al., when workers are fully engaged in their work, they show high levels of positive energy, determination, and dedication to getting the job done, along with resilience in case of setbacks or delays. Engaged workers are focused and enthusiastic about the work, take pride in the job, and are absorbed by and satisfied with the work, often finding it difficult to leave or disengage from the job. Baaker (2011) noted the difference between job satisfaction and work engagement saying, "Work engagement is different from job satisfaction in that it combines high work pleasure (dedication) with high activation (vigor and absorption); job satisfaction is typically a more passive form of employee wellbeing" (p. 265).

The benefits of worker engagement have been documented by multiple researchers who agree that engaged workers demonstrate higher job performance and are significantly less likely to suffer from burnout than non-engaged workers. They enjoy better health, feel more confident and more competent, tend to create their own resources, and transfer their enthusiasm and engagement to others through a cross-over effect (Baaker, 2009, 2011; Baaker and Demerouti,

2008; Schaufeli & Baaker 2003; Hakenen, Baaker & Schaufeli, 2006). In other words, work engagement provides benefits to both employees and to the organizations for which they work.

The model of work engagement referred to as the Job Demands-Resources (JD-R) model, developed by Baaker and Demerouti (2008), suggests that work engagement is driven by the interaction of job demands and resources. Resources are seen as a combination of job resources and personal resources. Job resources are considered to be the support of colleagues and supervisors, performance feedback, skill variety, autonomy, and opportunities for training and professional growth. Personal resources are described as self-efficacy, self-esteem (within the work context), and optimism, all of which lead to resiliency in the work situation. Results from a study of technical workers in Denmark conducted by Xanthopoulou, Bakker, Demerouti, & Schaufeli (2007) suggested that not only are job resources and personal resources related to work engagement, but favorable combinations of work and personal resources can create a cycle of positive reinforcement that helps employees develop additional resources that further allow them to cope with increased work demands while maintaining a successful adaptation to their work environments over time.

According to the JD-R model, positive interactions between job demands and resources lead to engagement and job satisfaction by generating a cycle of positive reinforcement. For example, a worker does a job well and receives positive feedback and admiration from co-workers. The worker then feels more competent, gains self-esteem by a job well done, and increases both job and personal resources. Negative interactions between job demands and resources can create a negative cycle that leads to job strain, disengagement, and burnout. For example, overburdened and overworked employees faced with a shortage of time or materials and a lack of autonomy in the workplace may suffer physical or mental strain that can weaken their vigor, dim their dedication, and decrease absorption. Bakker and Leiter (2010) noted that individual traits such as extroversion, conscientiousness, and emotional stability align strongly with personal resources.

Even though job demands differ greatly depending on the various occupations and industries involved, researchers from around the globe have conducted numerous studies to measure how various job-demand factors affect, and are affected by, specific combinations of work and personal resources. A study conducted by Barkhuizen, Rothmann, and van de Vijver (2013) with 560 university faculty members in South Africa illustrated how personal resources can mitigate a lack of work resources. Results of the study indicated that dispositional optimism had a direct influence on participant perceptions about job resources, which in turn influenced their levels of work engagement, burnout, and ill health. Another study of Dutch teachers by Baaker & Bal (2010) demonstrated how work resources impact both job performance and work engagement. In this case, new teachers who received regular feedback from a supervisor showed increased work engagement and improved performance, along with increased levels of work-related self-esteem.

The primary scale to measure work engagement scale is the 17-question Utrecht Work Engagement Scale (UWES), which was shortened to 9 questions by Shaufeli et al. in 2006. Both of the UWES scales measure self-reported levels of vigor, dedication, and absorption. Available in 20 languages for non-commercial use at www.schaufeli.co, both the long and short versions of the UWES have been extensively documented for reliability and validity in multiple studies involving a wide variety of occupations and organizations throughout the world. Researchers studying work engagement are invited to use the UWES and other related scales and report results for on-going research. Findings from the UWES scales have also been compared to, or used in combination with, the MBI family of scales, as well as the JDI family of scales, and

show general agreement and confirmation of results across most areas (Schaufeli, Leiter, and Maslach, 2008).

The present authors are gratified to find a wealth of information in the form of well-researched and thoroughly tested assessment instruments for measuring job satisfaction, levels of burnout, and degrees of work engagement. As mentioned before, the current administrative and organizational changes occurring at the institutional level, as well as at the school and department levels, present an ideal climate for uniting faculty in a collaborative effort to consider and measure current job satisfaction and work-engagement levels with the goal of developing and implementing interventions to improve them. The authors plan to use these excellent resources with a group of department volunteers to establish baseline data for the continued measurement of work engagement at one and two years after the new changes have been implemented.

Relationship between Research Studies

The three concepts of job satisfaction, burnout prevention, and work engagement are all related, but each has a unique perspective on individual attitudes and responses to issues, events, and relationships that emerge in the work situation. The research and findings from job satisfaction studies provide us with a useful list of measureable factors that can be employed to determine individuals' positive or negative attitudes toward their job (Lake et al., 2006). The job-satisfaction message implies, "How can we improve your work performance?"

Burnout studies have evolved from analyzing the symptoms, causes, and classifications of burnout to a more positive and preventative vision of how society, organizations, and individuals can help individuals mitigate or avoid burnout through early intervention and increased emphasis on work engagement (Maslach, 2003). The transition in burnout research could be described as going from "What is wrong with you?" to "How can we help you?"

Studies on work engagement emphasize the importance of developing a positive balance between job demands and resources that will help workers optimize their potential for vigor, dedication, and absorption in the job (Bakker, 2009). The overall message of work engagement is "How can we help you do (and be) your best?"

In general, work-related research suggests that specific factors such as age, gender, rank, length of service, and individual personality influence the job satisfaction, burnout, and work-engagement potential of academics. It seems that younger, tenure-track faculty are at higher risk for exhaustion, depersonalization, and burnout than tenured or non-tenure-track faculty (Oshagbemi, 2013). For faculty members in higher education, specific job stressors exist, such as workload, large classes, difficult student behavior, conflicts with colleagues or supervisors, low salaries, lack of promotion opportunities, and unclear institutional expectations (Crosmer, 2008; Watts & Robertson, 2011). There are also specific work-related resources that promote work engagement among academics, such as intellectual challenge, autonomy, professional growth, and promotion opportunities, along with support from colleagues and supervisors (Chernis, 1995, Oshagbemi, 2013). Academics can learn to cultivate for themselves such personal resources as self-efficacy, self-confidence, resilience, and optimism (Seligman, 1990; Xanthopoulou, Bakker, Demerouti, & Schaufeli, 2007, 2009). In agreement with Demerouti and Bakker (2011), the authors of this study suggest that helping higher education faculty develop their personal resources is an area currently in need of investigation.

Table 1 lists the criteria used to investigate job-related attitudes in three separate measures: the JDI (for job satisfaction), the MBI family of scales (for burnout and work engagement), and the UTWS (for work engagement). It is particularly noteworthy that while each of these scales features different determinants, all of them mention the importance of rewards, pay, promotion, and growth opportunities; and all mention the importance of community, such as on-the-job relationships with co-workers and supervisors.

Table 1. *Comparative Measures/Determinants of Job Satisfaction, Burnout, and Work Engagement*

Job Satisfaction ***Job Development Inventory (JDI)***	**Burnout-Engagement** ***Maslach Burnout Inventory (MBI)***	**Work Engagement** ***Utrecht Work Engagement Scale (UTWES)***
Determinants of satisfaction Nature of job (for academics only): Teaching Scholarship Administrative/supervisory duties Pay and benefits Promotion opportunities Supervisor behavior Co-worker behavior Working conditions/facilities	Levels of: Exhaustion/energy Cynicism/involvement Inefficacy/efficacy Areas of Work Life Scale (AWS) Educators Scale (ES) Discontent/disconnect with: Work life Work load Control/autonomy Rewards, pay, benefits, educational opportunities Community/work relationships Fairness/equity Values	Levels of: Vigor Dedication Absorption Job demands Nature of work Job resources Interaction with colleagues Support from supervisors Performance feedback Skill variety Autonomy Opportunities for training and professional growth Personal resources Self-efficacy (belief in own competence) Self-confidence (work related) Optimism Hope Resilience

The most important finding from this research study was realizing the powerful impact that positive psychology has had on research in the field of organizational psychology and work related attitude studies. Under the influence of positive psychology, the traditional focus of psychology on illness, disease, and dysfunction has shifted to the promotion of health, wellbeing and optimal performance (Seligman, 2002, 2011). This approach provides an inspiring example for educational leaders. Instead of directing attention to what faculty members are doing wrong

in their teaching, scholarship, and administrative roles, it would seem advisable to use the tools available to encourage work engagement, increase job satisfaction, and improve job performance in the academic department.

Future Directions

The field of positive psychology certainly lends itself to ongoing study in higher education disciplines. Higher education is under greater scrutiny today than ever before. The quality of teaching and learning at institutions of higher learning is drawing increasing attention on a global level, especially within the context of the current economic realities (Devlin, 2007). This in turn creates more stressful work environments.

Researchers involved in job-satisfaction, burnout, and work-engagement studies seem to agree that certain personality traits or personal resources, such as self-efficacy, self-esteem, both general and workplace related, resilience, and optimism, have a significant influence on work performance. In some studies, personal resources have been shown to increase productivity and boost innovation; in other cases, personal resources have served to buffer the effects of increased job demands or unfavorable working conditions. While the availability and distribution of work resources is primarily an organizational issue and function, the development of personal resources can be an individual decision.

The authors of this study propose to create opportunities within their department for faculty to participate in work-engagement research focused on the tenets of positive psychology. The Teacher Education Department currently consists of 47 full-time faculty members. Faculty volunteers will complete an active reflection journal over a period of time that integrates scores from the JDI, the MBI/AWS, and the UWES scales to determine their baseline and on-going data regarding job satisfaction, burnout and work engagement levels. The same and/or additional volunteers will take the Seligman optimism tests. Identifying personal strengths, these participants will select from a variety of Seligman's field-tested interventions, such as making a gratitude visit, performing acts of altruism or kindness, and keeping a gratitude journal (Seligman, 2011). A space in the Faculty Learning Community will provide an area for online interaction in synchronous and asynchronous chats and blogs. The positive community of faculty learners will share their experiences and findings, while the authors will continue to research the impact of interventions on work engagement. As Wallis (2005) states, "There's little risk in trying some extra gratitude and kindness, and the results—should they materialize—are their own reward" (p. 8).

References

Baaker, A. B. (2009). Building engagement in the workplace. In R. J. Burke & C. L. Cooper (Eds.), *The peak performing organization* (pp. 50–72). Oxon, UK: Routledge.

Baaker, A. B. (2011). An evidence-based model of work engagement. *Current Directions in Psychological Science, 20*(4), 265–269.

Baaker, A. B., & Bal, P. M. (2010). Weekly work engagement and performance: A study among starting teachers. *Journal of Occupational and Organizational Psychology, 83,* 189–206.

Baaker, A. B., & Demerouti, E. (2008). Towards a model of work engagement. *Career Development International, 13,* 209-223.

Bakker, A. B., & Leiter, M. P. (2010). Where to go from here: Integration and future research on work engagement. In A. B. Bakker & M. P. Leiter (Eds.), *Work engagement: A handbook of essential theory and research* (pp. 181–196). New York: Psychology Press.

Barkhuizen, N., Rothmann, S., & van de Vijver, F. J. R. (2013). Burnout and work engagement of academics in higher education institutions: Effects of dispositional optimism. *Stress and Health*. DOI: 10.1002/smi.2520

Cabrita, J., & Perista, H. (2006). *Measuring job satisfaction in surveys: Comparative analytical report*. European Foundation for the Improvement of Living and Working Conditions. Retrieved July 14, 2013, from http://www.eurofound.europa.eu/ewco/reports/TN0608TR01/TN0608TR01.pdf

Chernis, G. (1995). *Beyond burnout: Helping teachers, nurses, therapists and lawyers recover from stress and disillusionment*. New York: Routledge.

Craney, C. J., Smith, P. C., & Stone, E. F. (1992). *Job satisfaction: How people feel about their jobs and how it affects their performance*. New York: Lexington Books.

Crosmer, J. (2008). *Professional burnout among U. S. full-time university faculty: Implications for worksite health*. (Doctoral dissertation). Retrieved from ProQuest Dissertations. (3367226).

Demerouti, E., & Bakker, A. (2011). The Job Demands–Resources model: Challenges for future research. *SA Journal of Industrial Psychology, 37*(2), 9 pages. Retrieved August 1, 2013, from http://www.sajip.co.za/index.php/sajip/article/view/974/1038

Devlin, M. (2007, August). *Improving teaching in tertiary education: Institutional and individual influences*. Keynote address presented at Excellence in Education and Training Convention, Singapore Polytechnic, Singapore.

Freudenberger, H. J. (1974). Staff burn-out. *Journal of Social Issues, 30*(1), 159–165.

Hakanen, J. J., Bakker, A. B., & Schaufeli, W. B. (2006). Burnout and work engagement among teachers. *Journal of School Psychology, 43,* 495-513.

Hogan, R. L., & McKnight, M. A. (2007). Exploring burnout among university online instructors: An initial investigation, *The Internet and Higher Education*, *10*(2), 117–124.

Judge, T. A., Thorensen, C. J., Bono, J. E., & Patton, G. K. (2001). The job satisfaction-job performance relationship: A qualitative and quantitative review. *Psychological Bulletin, 127*(3), 376–407.

Kihm, J. A., Smith, P. C., & Irwin, J. L. (1997). Update for users of the JDI: New national norms for the Job Descriptive Index. *The Industrial-Organizational Psychologist, 35*, 90–91.

Kyriacou, C. (2001). Teacher stress: Directions for future research. *Educational Review, 53*(1), 27–35. DOI: 10.1080/00131910120033628

Lake, C. J., Gopalkrishnan, P., Sliter, M. T., & Withrow, S. (2006). *The Job Descriptive Index: Newly updated and available for download*. Society for Industrial & Organizational Psychology, Inc. Retrieved August 2, 2013, from http://www.siop.org/tip/july10/06jdi.aspx

Leiter, M. P., & Maslach, C. (2004). Areas of worklife: A structured approach to organizational predictors of job burnout. In P. Perrewé & D. C. Ganster (Eds.), *Research in occupational stress and well-being: .Emotional and physiological processes and positive intervention strategies, 13* (pp. 91–134). Oxford, UK: JAI Press/Elsevier.

Maslach, C. (2003). Job burnout: New directions in research and intervention. *Current Directions in Psychological Science, 12*(3), 189–192.

Maslach, C. (2011). Burnout and engagement in the workplace: New perspectives. *The European Health Psychologist, 13*(3), 44–47.

Maslach, C., & Jackson, S. (1981). The measurement of experienced burnout. *Journal of Occupational Behaviour, 2*, 99–113.

Maslach, C., Jackson, S. E., & Leiter, M. P. (1996). *Maslach burnout inventory manual*. Mountain View, CA: Consulting Psychologist Press.

Maslach, C., Jackson, S. E., & Leiter, M. P. (1997). *The truth about burnout: How organizations cause personal stress and what to do about it.* San Francisco, CA: Jossey-Bass.

Maslach, C., & Leiter, M. P. (2008). Early predictors of job burnout and engagement. *Journal of Applied Psychology, 93*, 498–512.

Maslach, C., Leiter, M. P., & Jackson, S. E. (2012). Making a significant difference with burnout interventions: Researcher and practitioner collaboration. *Journal of Organizational Behavior, 33*(2), 296–300.

Maslach, C., Leiter, M. P., & Schaufeli, W. B. (2009). Measuring burnout. In C. L. Cooper & S. Cartwright (Eds.). *The Oxford handbook of organizational well-being* (pp. 86–108). Oxford UK: Oxford University Press.

McCann, J., & Holt, R. (2009). An exploration of burnout among online university professors. *Journal of Distance Education, 23*(3), 97–110.

Moorman, R. H. (1993). The influence of cognitive and affective based job satisfaction measures on the relationship between satisfaction and organizational citizenship behavior. *Human Relations, 46*(6), 759–776.
Oshagbemi, T. (2013). *Job satisfaction in higher educatio*n. London: Trafford Publishing.
Rose, M. (2001). *Disparate measures in the workplace. Quantifying overall job satisfaction.* Paper presented at the 2001 BHPS Research Conference, Colchester. Retrieved July 4, 2013, from http://www.iser.essex.ac.uk/bhps/2001/docs/pdf/papers/rose.pdf
Schaufeli, W. B., & Bakker, A. B. (2003). *Test manual for the Utrecht Work Engagement Scale*. Unpublished manuscript, Utrecht University, the Netherlands. Retrieved July 16, 2013, from http://www.schaufeli.com
Schaufeli, W. B., Bakker, A. B., & Salanova, M. (2006). The measurement of work engagement with a short questionnaire: A cross-national study. *Educational and Psychological Measurement, 66*(4), 701–716.
Schaufeli, W. B., Leiter, M. P., & Maslach, C. (2008). Burnout: 35 years of research and practice. *Career Development International, 14*(3), 204–220.
Schokkaert, E., Verhofstad, E., & Van Ootegem, L. (2009). Measuring job quality and job satisfaction, *Working Papers of Faculty of Economics and Business Administration*, Ghent University, Belgium 09/620, Ghent University, Faculty of Economics and Business Administration.
Seligman, M. E. P. (1990). *Learned optimism: How to change your mind and your life*. New York: Atria Books. Reprint edition (2012, February 7).
Seligman, M. E. P. (2002). *Authentic happiness.* New York: Atria Books.
Seligman, M. E. P. (2011). *Flourish. A visionary new understanding of happiness and well-being.* New York: Atria Books. Reprint edition (2012, February 7).
Seligman, M. E. P., & Csikszentmihalyi, M. (2000). Positive psychology: An introduction. *American Psychologist, 55*(1), 5–14.
Skaalvik, E. M., & Skaalvik, S. (2010). Teacher self-efficacy and teacher burnout: A study of relations. *Teaching and Teacher Education, 26*, 1059–1069.
Smith, P. C., Balzer, W. K., Brannick, M., Chia, W., Eggleston, S., Gibson, W., et al. (1987). The revised JDI: A facelift for an old friend. *The Industrial-Organizational Psychologist, 24*(4), 31–33.
Smith, P. C., Kendall, L. M., & Hulin, C. L. (1969). *The measurement of satisfaction in work and retirement.* Chicago, IL: Rand McNally.
Spector, P. E. (1997). *Job satisfaction: Application assessment, causes and consequences.* Thousand Oaks, CA; Sage Publications.
Taylor, F. W. (1911). *The principles of scientific management*, New York, NY: Harper & Brothers.
van Saane, N., Sluiter, J. K., Verbeek, J. H. A. M., & Frings-Dresen, M. H. W. (2003). Reliability and validity of instruments measuring job satisfaction: A systematic review. *Occupational Medicine, 53*(3), 191–200.
Wallis, C. (2005, January 9). The new science of happiness. *Time.* Retrieved July 20, 2013, from www.time.com/time/magazine/article/0,9171,1015832,00.html
Watts, J., & Robertson, N. (2011). Burnout in university teaching staff: A systematic literature review. *Educational Research, 53*(1), 33–50.
Xanthopoulou, D., Bakker, A. B., Demerouti, E., & Schaufeli, W. B. (2007). The role of personal resources in the job demands-resources model. *International Journal of Stress Management.* 14(2), 121–141. DOI: 10.1037/1072-5245.14.2.121
Xanthopoulou, D., Bakker, A. B., Demerouti, E., & Schaufeli, W. B. (2009). Reciprocal relationships between job resources, personal resources, and work engagement. *Journal of Vocational Behavior, 74*(3), 235–244.

About the Authors

Cynthia Schubert-Irastorza
EdD, Professor
School of Education
National University
La Jolla, CA
cschubert@nu.edu
Research interests: faculty development, adult education, best practices for online education, creativity in education and positive psychology

Dee L. Fabry,
PhD, Associate Professor
School of Education
National University
La Jolla, CA
dfabry@nu.edu,
Research interests: **e**ffective online teaching, increasing pedagogical knowledge and skills, using assessment to inform program change

Equal Access for All Learners: Differentiation Simplified

Enid Acosta-Tello
Carol Shepherd

Abstract
The concept of equal access for all students to all the learning occurring in classrooms is not new; however, the utilization of differentiated instruction remains difficult to implement because of its multi-faceted nature. Utilization of the "Three Phase Lesson" model allows teachers to identify prior knowledge the student must have mastered in order to be successful in learning the new concepts. This information enables instructors to truly work on reaching every individual student, which is the goal of differentiated instruction. Such individualized instruction also provides the opportunity to enhance and enrich instruction for those students needing additional challenge.

Keywords
Differentiated learning, adult learners, equal access, mastery, student success

Introduction

When instruction is delivered, the expectation is that learning will occur. When learning does not occur, the teacher typically modifies the method of delivery or the content of the lesson in order to meet student needs (Camille & Wolfe, 2004). This modification is known as differentiating instruction. Differentiation implies that, based on the assessment of a student's learning, a teacher changes the manner in which the instruction is presented in order to optimize the individual's learning (Heacox, 2002). In order to meet the needs of the students, therefore, differentiating instruction needs to become an automatic strategy utilized during the lesson-planning process (Romano, 2012). Though it is acknowledged that multiple factors may be involved in influencing a person's learning (Tomlinson, 2001), teachers typically approach a student's lack of understanding from an academic perspective. The academic perspective assumes that if an individual is not learning it is because the person is unable to understand, assimilate, utilize, and/or adapt the instruction being presented. When learning does not occur, some type of intervention is warranted. This intervention may be as simple as reteaching the same material in the same way to the same student, or as complex as providing specialized, individualized instruction based on extensive assessment, or any variation along this continuum.

Inherent within any type of intervention is the need to assess, re-plan, and reteach, all of which require additional time on the part of the teacher. Time is a realistic factor limiting a teacher's ability to provide all required instruction in general, and to differentiate instruction specifically. A pilot research study, conducted by one of the researchers of this paper and utilizing observations and interviews, indicated that teachers understand the need for differentiating their instruction, but are unclear as to how to accomplish differentiation on a daily basis. Oftentimes, making these changes results in rewriting lesson plans or continually re-forming student groups (Wilson, 2009). Instructors therefore continue to rely on methods of differentiation proven effective in the past: three-group rotation; one-on-one follow-up remediation at a later time; and learning centers. These methods provide the teacher the time to (a) initially assess students, (b) access students as they interact with the material, (c) conduct ongoing, informal assessment, (d) diagnose student work, and (e) appropriately design and assign classroom work and individualized remediation (Acosta-Tello, 2005). However these methods do not provide a vehicle whereby the instructors may incorporate differentiating instruction directly into their initial teaching of concepts. There remains a need to identify a

methodology, a strategy, a template whereby educators may plan, present, and organize differentiated instruction for all learners of all ages at all levels.

Three Phase Lesson

The Three Phase Lesson is a practical strategy that provides teachers the opportunity to analyze their lessons at the planning stage and allows them to identify methods of remediation and enhancement while the initial planning is being done. In other words, while the lesson is initially being written, the instructor highlights what may be problematic or simplistic for students, and identifies appropriate accommodations while the lesson is still at the planning stage. Differentiated instruction, therefore, ceases to be a separate procedure addressed when learning does not occur, or for acceleration when learning occurs faster than anticipated, but becomes an inherent component of instruction and curriculum that is identified initially during the planning stage.

The Three Phase Lesson Explained

Every lesson, from the teaching of colors at the preschool level to the application of algebraic multiplicity of eigenvalues at the university level, is based on the assumption that the individual brings previously learned concepts to the instruction. However, students come to school with differing skills, abilities, and experiences. If an individual has not mastered the basic concepts upon which a new lesson is based, instruction either is poorly or partially learned, or not learned at all. When it becomes evident that such learning has not occurred, the next logical step should be to determine if the individual is lacking the basic concepts/skills upon which the lesson is based, and then teach and/or reinforce those concepts. Once these basic concepts are mastered, the new instruction becomes a logical progression of learning for the student. When the instructional foundation is solid, building up from the foundation is possible and reliable. Since teachers logically review and reemphasize new instruction after its initial delivery in order to solidify its learning, the individual who had gaps in basic concepts now has the opportunity to "catch up" and attach the new learning to what has now been mastered.

In the Three Phase Lesson, instructors are asked to consider the foundational assumptions inherent in their instruction when they present new concepts. Teachers identify the prior knowledge, the basic skills which the student must have mastered in order to be able to learn the new concepts. Instructors are asked to be as specific as possible in identifying these underlying concepts and then to identify tasks/activities that provide instruction and practice in these basic skills. This analysis requires a certain level of creative and critical thinking on the part of the educator (Romano, 2012). Any student who is unsuccessful in acquiring the new concepts will receive further instruction in identified, required prior knowledge. The teacher therefore differentiates instruction by addressing identified foundational areas first. Differentiating instruction becomes a simpler task to accomplish, since it is part of the original lesson design and not something to which an instructor must return to at a later time.

The Three Phase Lesson is a way to write a lesson plan so that all students and their needs are addressed. Planning is the key and covers all phases of need at the initial writing. The three phases of the lesson are the "Core Lesson," the "Basic Lesson," and the "Enrichment Lesson." Inherent within this design are the following educational tenets: high standards are held for all students; all students can learn; and learning is developmental.

The Core Lesson instruction is given to the entire class so that all students are presented with the objectives of the lesson and its corresponding instruction and equal access to instruction is available to all individuals. The Basic Lesson allows students to receive additional input if they have either demonstrated a need for intervention by their inability to fully grasp the lesson or they lack success in accomplishing tasks directly related to the instruction. It provides opportunities for review, remediation, and/or reteaching immediately (or as soon as possible) after the presentation of the new concepts. During the Enrichment Lesson, challenging tasks are set forth for the students and can be assigned to specific individuals or can be made available on a voluntary basis. This Three Phase Lesson is visually presented in Table 1.

Table 1. *General Chart for Three Phase Lesson*

Objective:		
Basic Lesson	**Core Lesson**	**Enrichment Lesson**
	Prior knowledge required: • • Concepts to master: • •	
Basic tasks: • •	Core tasks: • •	Enrichment tasks: • •

Steps to Writing a Three Phase Lesson Plan

The writing of the Three Phase Lesson plan begins by stating the objective. Once the objective is identified, the first section to be addressed would be the Concepts to Master section in the very center of the chart. The instructor needs to specifically identify the concepts for the student is expected to master. Once these are listed, the next step is not planning the tasks, but determining the prior knowledge that the student needs to have mastered in order to be able to successfully understand, use, and apply the new concepts being presented. The teacher must determine what prior skills are essential for the understanding and mastery of the new concepts. This prior-knowledge list may be used at the beginning of the lesson to activate prior learning by reviewing "old" concepts.

The next section to be addressed would be the Core Tasks. These are the tasks/activities in which the instructor engages students in order to provide practice of the new instruction and in which students demonstrate the ability to understand and use it. While these tasks address the objective and demonstrate student understanding and mastery, they should be sufficiently diverse and specific in nature so that if the learners show that they have not understood the new material, the task would provide some indication of which of the prior knowledge skills is lacking.

Once these two sections are addressed, the instructor would focus attention on the Basic Tasks, tasks in which to engage students if they demonstrate they are unable to grasp the new

material. Since the teacher has identified all of the prior knowledge necessary for the new material to be learned, the Basic Tasks would then consist of activities that would provide instruction in and practice of any and all of the necessary foundational skills. Direct instruction in these skills and the student's successful internalization of this learning will provide the learner with the foundational mastery necessary for learning the new material. Students are identified as members of this sub-group by the teacher; however, it is recommended that this small group instruction be preceded by an open invitation to all students in the class who feel they might benefit from further detailed instruction. This invitation gives permission to any student in the class to join the group, and oftentimes students the teacher did not realize needed extra instruction will come and join. Once the group instruction has begun, volunteers may realize they have grasped the teaching and often dismiss themselves to go to work with the rest of the class; or the teacher may compliment the students on their accomplishments and guide them to work away from this smaller group. Instruction in this small group needs to be systematic, reinstructing the learners in the prior foundational skills necessary for mastery of the new material. The instructor may work through the tasks quickly, determining who is in need of which reinforcement, making links as appropriate to the new instruction. Since this instruction follows immediately or soon after the core instruction, the connection between the basic and core tasks is highlighted and children learn to use and apply both the basic and new concepts. This instruction is an excellent example of applying Vygotsky's Zone of Proximal Development (ZPD), widely practiced by educators.

The final section to be addressed is Enrichment Tasks. Enrichment should not just be more of the same. Enrichment activities should ask learners who have mastered the concepts to utilize this new knowledge at higher levels of thinking, applying, comparing, and creating with this new understanding. These enrichment tasks should be designed to challenge the individual and should be available to all students. These tasks ask the student to stretch and reconfigure the new learning and thereby expand previous knowledge and strengthen mastery.

Example of the Three Phase Lesson

A completed Three Phase Lesson for a lesson at the graduate level follows in Table 2. This objective is taken from a foundations class in teacher education on guiding students to analyze the legal, political, and philosophical underpinning of American Education.

Table 2. *Three Phase Lesson Chart for a Lesson on the Analysis of the Legal, Political, and Philosophical Underpinnings of American Education*

Objective: Students will analyze the legal, political, and philosophical underpinnings of American Education.		
Basic Lesson	**Core Lesson**	**Enrichment Lesson**
	Prior knowledge required: • Ability to conduct research • Ability to analyze concepts and ideas as opposed to summarization of concepts and ideas found in research and textbooks • Ability to differentiate between legal, political and philosophical concepts • Possession of some knowledge of American educational history or have the ability to acquire this knowledge • Understanding of the role of cultural diversity and multiculturalism in American education • Understanding of inclusion and its place in American educational history **Concepts to master**: • Demonstrate an understanding of the influence of the law on American education throughout history • Demonstrate an understanding of the influence of politics on American educational history • Demonstrate an understanding of the influence of different philosophies (internal, external and foreign) on American education throughout history • Demonstrate the ability to compare, contrast, and analyze these singular influences	
Basic tasks: • Make available resources on how to conduct research • Make available supplementary material on American educational history (videos, articles, links to sites with reliable information) • Break down assignments into their component parts, so that the candidate is able to identify and articulate each portion of the assignment before combining all aspects into one cohesive paper • Make available writing resources	**Core tasks**: ***During instruction*** • Identify the major persons who influenced American education • Identify how the concept of equality has changed over the centuries in America • Articulate how testing has changed over time in America • Identify the political influences on curricular content in America ***Independently*** • The candidates will describe their own philosophical approach to teaching based on major legal, political, historical events and policies that informs candidates' philosophy of teaching • Conduct a teacher interview asking questions related to the learning objective	**Enrichment tasks**: • Compare and contrast how the influences on American education differ from political age to political age • Provide reasons for these differences and identify how the influences might have been minimized/maximized • Compare and contrast how American education has progressed differently from education in other countries and provide reasons why

Based on the objective of the analysis of the underpinnings of American education, the teacher identified several concepts (Concepts to Master) that needed to be taught and mastered within this one objective. It is important to realize that most objectives are multifaceted and the instructor's success in teaching the objective relies on addressing each concept both separately and jointly. These new concepts are based on specific foundational concepts (Prior Knowledge) that the student needs to have mastered prior to the lesson in order to fully understand the interplay of the law, politics, and educational philosophy and their influence on American education. The teacher then listed several tasks (Core Tasks) that needed to be defined, understood, and addressed during direct instruction, all of which would provide opportunities to observe the students and determine how much they have understood the new concept and if they were able to synthesize and make judgments based on them. The instructor also identified separate independent tasks the students should be able to accomplish if they adequately learned what was taught.

The Basic Tasks address the prior knowledge previously identified. At the higher education level, the instructor may not stop to teach the students each of these concepts or skills; however, the instructor will have resources readily available that could be utilized to teach these separate concepts or skills to students (videos on how to conduct research effectively; names of resource personnel available to aid students in acquiring such skills/knowledge; writing centers; Internet resources; and sample works, to name a few). At the more primary levels, these Basic Tasks would probably be conducted in small groups or one-on-one with the teacher's specifically targeting student needs. The teacher would not have to engage in all the tasks if the students show understanding of the concepts being addressed; however, since planning for this phase of the lesson would have occurred prior to the lesson presentation, all materials and/or resources to engage in these tasks would be readily available, so time is not wasted by the instructor's searching later for the one more item that would help the individual learn, nor is the learner wasting valuable learning time waiting for guidance in acquiring/applying the resources to meet this need. The Enrichment Tasks all require use and application of the new learning. They are challenging, yet directly related to the objective and the new learning.

Conclusion

Learning is developmental, a process in which new learning is built upon and attached to what has previously been learned. When individuals are unable to understand new concepts or are unable to assimilate new instruction, the instructor should first determine if this inability stems from a student's inadequate or missing foundational skills upon which the new learning is predicated. In the Three Phase Lesson, teachers actively identify prior knowledge necessary for learning the new concepts and equip themselves by planning tasks for reinforcing or teaching the basic concepts while preparing to teach the new material. When this preparation is done, then differentiating instruction is not an additional task, an added step to providing instruction, but becomes a part of initial planning and instructional delivery. Once automatically incorporated, the process would save time and allow instructors to be prepared to provide for the learning needs of all their students.

Although the focus of this paper is on the Three Phase Lesson at the college level, the template and the process work equally well for subjects at all levels, from teaching reading at the elementary level to teaching mathematics at the high school level. With such a tool in their arsenal of aids to support student learning, educators can be more effective in less time, thus

simplifying differentiated instruction. This process is an excellent example of best practices for educators.

References

Acosta-Tello, E. (2005). Unpublished paper presented at the Hawaii International Conference on Education.

Camilli, G., & Wolfe, P. (2004). Research on reading: A cautionary tale. *Educational Leadership, 61*(6), 26-29.

Cunningham, P., & Hall, D. (1994). *Making words.* Torrance, CA: Good Apple.

Heacox, D. (2002). *Differentiating instruction in the regular classroom.* Minneapolis, MN: Free Spirit Publishing.

Romano, M. (2012). Accommodating differences. *The Science Teacher, 79*(4), 14-14. Retrieved from ProQuest database on February 27, 2012.

Tomlinson, C. (2001). *How to differentiate instruction in mixed-ability classrooms* (2nd ed.). Alexandria, VA: Association for Supervision and Curriculum Development.

Wilson, S. (2009). Differentiated instruction: How are design, essential questions in learning, assessment, and instruction part of it? *New England Reading Association Journal, 44*(2), 68-75. Retrieved from ProQuest database on February 27, 2012.

About the Authors

Enid Acosta-Tello
EdD, Associate Professor
School of Education
National University
Costa Mesa, CA
eacostat@nu.edu
Research interests: diversified instruction, reaching every student, time management

Carol M. Shepherd
EdD, Professor
School of Education
National University
Rancho Cordova, CA
cshepher@nu.edu
Research interests: diversified instruction through technology, instructional gaming, mentoring

The Elephant in the Room: Issues with Graduate Student Behavior and the Potential Link to Large Class Sizes

Brian Tilley

Abstract
Student behavior toward instructors and other students in an intensive Master of Arts in Counseling (MAC) program was reported to degenerate over a 5-month period. A potential cause was the size of the classes. Research on the influence of class size and uniqueness of non-traditional students is presented. Research tends to support decreased class sizes, though the issue has not been investigated in non-traditional learning environments. The response to the problem, dividing the student group into two cohorts and making a presentation to the students, is discussed. Data, including a decrease in student complaints, are presented as evidence of the positive effects of the class split.

Keywords: class size, counseling, graduate students, accelerated learning, adult learners

Introduction

During a 5-month period, there was a noticeable increase in student complaints about instructors and other students in the Master of Arts in Counseling (MAC) program at a Western, non-traditional university. In the 5 months, some concerns about how the students were interacting with one another, such as a lack of courtesy when another student is speaking, were reported by instructors. An investigation, detailed in a later section of this paper, was undertaken to examine the possible reasons for the increased student complaints and issues with student interactions, hereafter referred to as the student dynamic.

The increased complaints and concerns from instructors were concurrent with rising class sizes. In a review of the research on the effects of class size on student learning, a qualitative approach, as recommended by Englehart (2007, 2011) in prior studies, has been adopted in describing the unique program, the problem, the response to the problem, and the role of class size. Other notes on how and why the data were collected, specifically the non-experimental approach, are included in the Method section.

Effects of Class Size on Students

Research on the role of class size in student experience has yielded mixed results, mainly because of the lack of agreement in the literature about how to measure its effects (Englehart, 2007). Results are mixed regarding the effects of class size on teacher evaluations, with some (Elmore & Pohlmann, 1978) stating that smaller classes yield more positive reviews and others reporting no significant effect (Blackhart, Peruche, DeWall, & Joiner, 2006) or a negative effect of smaller class size (Gilmore, Swerdlik, & Beehr, 1980). While Fenollar, Román, and Cuestas (2007) concluded that class size is not a factor in student motivation, they reported a significant negative correlation between class sizes and academic performance. This finding held true for performance on the psychology licensing examination (Yu, et al., 1997). Instructors have demonstrated a preference for smaller classes for reasons related to providing support and motivation for students (Blatchford, 2005; Buskist & Wylie, 1998). There are findings linking larger class sizes to increased occurrences of student incivility (Alberts, Hazen, & Theobald, 2010) and lower ratings in an online course (Russell & Curtis, 2013).

A reasonable question to ask is, why consider class sizes at all? Universities worldwide have large lecture halls in which no student problems are noted. Online and onsite courses at the

institution where these problems were observed, with similar enrollment to the class sizes observed in the 5 months relevant to this paper, have occurred without incident. It is clear that researchers are finding and recommending ways of offering larger classes without sacrificing quality of education or student experience (e.g., Adams, 2011; Cathcart & Neale, 2012; Exeter et al., 2010; Gose, 2012). However, there is the possibility of an interaction between large class sizes and other factors that create a particularly problematic combination.

Before further considering the relevance of the class size, it is important to discuss the type of courses in the MAC program. Much of the program is made up of courses that rely heavily on experiential work among the students as practice and training for conducting psychotherapy sessions. This requirement increases the importance of student dynamic as well as instructor contact and feedback. Usually, only experienced and highly rated faculty are assigned to teach in the MAC program. (Such was the case in the 5 months relevant to this paper; this notion is discussed in further detail in the section on the investigative process.)

The research finding perhaps most relevant to the type of program discussed in this paper was that scores on the psychology licensing exam were negatively correlated with increases in class size (Yu et al., 1997). The MAC program is a graduate training program in which the vast majority of students state professional licensure as their goal. Given the research and the circumstances of the problems described in prior sections, class size seems to be an important variable in examining the situation described in this paper. What has not been established in the research is the effect of class size on non-traditional programs.

Educational Approaches in Non-Traditional Programs

The MAC program comprises one-month, intensive night classes that meet twice a week. As a result, students complete one course every four weeks. The five months relative to this paper encompass five separate courses with, for the most part, the same student group. The Western university offering the MAC program has a substantial non-traditional student population and consists of multiple satellite campuses. Non-traditional students have been found to differ from traditional students in several ways, including use of technology and desire for flexibility (Conceição, 2007; Hansman, 2009; Nagel, Maniam, & Leavell, 2011; Park & Hee, 2009; Richards, 2008; Ross-Gordon, 2011; Wlodkowski, 2003), application of life experience in the classroom (e.g., Boyd, 2004; Okezie, 2003), socio-cultural factors (Prins, 2009), responsibilities outside the classroom (Giancola, Giancola, & Borchert, 2009; Meehan & Negy, 2003; Tones, Fraser, Edler, & White, 2009), and personal needs (e.g., Gary, Kling, & Dodd, 2004; Graham, 1999; Njumbwa, 2008). Research indicates that the accelerated format and student population of non-traditional programs require alternate educational approaches (e.g., Grinnell, 1989; Kiely, Sandmann, & Truluck, 2004; Ross-Gordon, 2003; Wlodkowski, 2003).

The greater extent and increased stakes of external demands on non-traditional students makes them more prone to higher stress levels than traditional students (e.g., Giancola, et al., 2009; Meehan & Negy, 2003; Tones et al., 2009). The adjustment in returning to school after an enrollment gap, including a need for validation for making such a major life change and dealing with contradictions to the student's current identity, can also create challenges for non-traditional students (Kasworm, 2008). Given the uniqueness of non-traditional students and accelerated programs as documented by the research, conclusions about the influence of class size should include data from non-traditional educational environments and non-traditional student samples.

Non-Traditional Educational Setting for the Study

At the time of the study, there was no seasonal student cohort such as the fall and spring start dates offered at most college campuses. (The MAC program at the location described in the paper has since moved to such a system.) Due to this admission system, new students were entering the program almost every month. As a result, a given class might have students near the beginning of their graduate program as well as students nearing completion. Such a system, although different than the standard approach to graduate education, had not produced the student and instructor complaints detailed in the following sections prior to the relevant 5 months in the study.

The author is a regional lead MAC faculty. One of the major functions of the regional lead role is the review of evaluations of students and instructors for MAC program classes held on the campus. The role also includes evaluating students for entrance and continued enrollment in the MAC program. Students are encouraged to discuss issues with fellow students with said students before approaching the regional lead. For issues with instructors, students should attempt to discuss these issues with the instructor; students are also encouraged to use the course/instructor evaluation form to record their concerns. The form is provided for students in all courses at the university.

Complaints Registered with the Regional Lead Faculty

Over a period of 5 months, November 2008 through March 2009, student complaints to the regional lead faculty about instructors and the behavior of other students noticeably increased. The rate of complaints about instructors was a departure from the usual pattern of documenting concerns in the course/instructor evaluation form and rarely pursuing further action. Complaints about fellow students were also rare prior to the relevant 5-month period. Although students are not asked to document concerns about fellow students in the course/instructor evaluation form, they have approached the regional lead with these issues. Total student complaints about instructors or other students averaged 2.6 per month from November 2008 through March 2009, compared to 0.6 per month in the preceding 5-month period.

Complaints about Student Behavior

Two full-time faculty members approached the lead about the concerns they had about student behavior in the classroom. Both faculty members held over two decades of academic experience. One had worked with MAC students for most of the time spent in academia. Neither reported having seen students behaving in such a manner. One example of problematic behavior was multiple students' questioning the grading of a course after the grading had been explained in the syllabus and by the instructor. These questions were described by the instructor who was involved as "not constructive." Students also were reported to have denied the accuracy of an instructor's responses to a number of student inquiries, including those regarding course content and applied knowledge.

The instructors reported attempting to engage the students in classroom discussion, but such discussions had not been productive. The faculty expressed concern that the discussions and the overall behavior were not in line with expected student conduct. Each instructor added without prompting that the classes were too large to allow them to fully track the development of every student. Each hypothesized that the size of the class might be a factor in reported problems among the students.

During this period, students began to complain about the actions of other students. Sometimes the complaints took place during class, usually during structured discussion times. In other instances, the complaints were made directly to the regional lead. The theme of most complaints was that other students were "taking over" class time to negotiate grades or ask questions already answered in lecture. Concern was also expressed by students, in addition to the concern documented from instructors, about a general rift growing between students who were active participants in class and those who were less so.

Student Complaints about Instructors

Verbal, instructor-related complaints, versus a complaint lodged in the written evaluations, are tracked throughout the school year. MAC students rarely lodge a complaint in person. They almost always elect to do so using the course/instructor evaluation forms handed out during the last week of class. From November 2008 through March 2009, in-person complaints noticeably increased. For purposes of comparison, six student complaints about instructors were presented in person to the regional lead from November 2008 through March 2009, whereas in the preceding 5 months, there had been only two.

Based on the preceding information, two major questions arose: Where did these issues come from, and how could they be addressed? Given the curious increase in student and faculty complaints and the desire to ensure a supportive and effective learning environment, the regional lead faculty found it necessary to (a) investigate the possible causes for the problems and (b) implement a targeted solution. The following study is a description of the regional lead's investigation into the sudden rise in complaints. The regional lead was hesitant to predict any potential causes before moving forward; doing so may have biased the efforts in uncovering and addressing the problems. To that end, the study is not a typical, null-versus-experimental test. The steps taken and the process of elimination in determining the most likely cause of the problems are presented in the Method section. The implementation of a solution and an evaluation of the effectiveness of the solution are presented in the Results section.

Method

The desire for a solution to the problems presented by students and instructors aligned with the lack of qualitative studies on class size, especially using non-traditional student samples, to create the reason for the study. The Method section contains a rationale for how the study was conducted, information about the student group, and a description of the process of investigating the issues that led to the conclusion that they were linked to class size.

Rationale for Approach

For several reasons, a non-experimental approach was taken to examining the issue. One reason is the trend was such that action needed to be taken before a thorough data collection and analysis process could be reasonably completed. The student complaints had been increasing over the 5 months, and the regional lead was concerned that the problems in student dynamic could potentially develop into a long-term issue if not addressed in a timely fashion. Therefore, the experience of students and maintaining the quality of educational environment were considered the most important factors in evaluating possible solutions.

A second reason is that students could not be intentionally split into different class groups in order to experimentally determine, for example, whether it was a specific student or set of students who were the root of the problems in the classroom. Although the student group was split, the split was done along enrollment dates to maintain a semblance of a cohort within each section of the classes. The large classes during the 5 months were made up of students who had been admitted into the MAC program over the course of 18 months. A median enrollment date was chosen and the group was split into two classes, one made of students who enrolled before it and one made of students who enrolled after it. In addition, the complaints about the students did not consistently target one specific student or set of students; even if it had been prudent to split the group to isolate "problem" students—it would not have been fair or ethical to potentially affect the educational experience of a group of students by intentionally placing a negative influence or influences in their class—such a grouping could not be determined using the information presented by students and instructors.

A third factor is that the instructor could not be assigned randomly, or even intentionally, in order to experimentally determine whether the problems were due to instructor-related factors. Most instructors are not available every month. Not every instructor has content expertise in every course. Some of the best-reviewed and most popular adjunct instructors teach only one or two courses in the MAC program, in a topic (e.g. relationship trauma) for which they have decades of experience. Much like the concerns about splitting students described above, there is an ethical issue with assigning an instructor who is thought to be problematic to one set of students because, effectively, administration would be knowingly assigning an instructor who could negatively affect those students' educational experience and preparation. Concerns thought to be directly related to an instructor are usually handled by the department chair and the regional lead using a review process that takes into account prior courses and involves close monitoring of the instructor's next assignment. Such a process was not enacted with the instructors of the courses from the 5-month period because their individual prior records did not raise concerns.

Given the preceding reasons, the only intervention introduced by the regional lead was to split the classes and hold an informational meeting with the students. (The meeting is described in the Response subsection of the Results.) The intervention was based on conclusions discussed in greater depth in the rest of the Method section. The initial data collected from the 5-month period are non-intrusive. The complaints from students and statements made by instructors about student behavior and student dynamics were not solicited by the regional lead. The student evaluations of the instructors during the 5 months, and their prior evaluations, were accessible to the regional lead through a university data-management system and available because of the regional lead's role in evaluating adjunct faculty. Full time faculty are evaluated by the department chair; information about their prior records was obtained with faculty permission.

In order to determine what was occurring in the classroom, the 5-month period in question was compared to the period preceding it. The entrance into the program of students who could have negatively affected the classroom dynamics was considered as a factor. The possibilities of instructor-centric problems and an increase in class sizes were also examined. Finally, for purposes of a control setting for comparison, the situation at this campus was also compared to the situation in the same program at another university campus location in the same county.

Student Demographic Information

A total of 40 students were enrolled in classes at the location of the study over the 5-month period from November 2008 to March 2009. Enrollment varied in each of the five courses

offered in the 5-month period: not every student needed every class offered during the 5 months so some students took a month off during the 5-month period. The largest class of the five courses offered consisted of 35 students. Of the 40 students, 37 (92.5%) were women. The ethnicity of the students was distributed as follows: White/Caucasian-American 77.5% (n = 31), Mexican-American 10% (n = 4), Black/African-American 9.7% (n = 3), and Persian-American 5% (n = 2). The average age of the students was 37.1 years. The range of student ages was 22 to 56 years of age.

Investigation Process

Once it became clear to the regional lead that the complaints from students and feedback from instructors were not an aberration and appeared to be a pattern, an investigation was conducted. The investigation included contact with the students and with the instructors in order to determine the potential sources of the problems; a comparison with a control campus was included. The investigative process is described in the following subsections.

The possibility of instructor-related problems. The instructors against whom the complaints were filed had rarely evoked the strong, negative responses that occurred in the relevant 5 months. Of the four instructors over that period (one instructor taught twice), two were the professors noted in the previous section, each with decades of experience and strong ratings by students on the course evaluation form. The other two were adjunct professors, one of whom had been employed by the university for 7 years with a strong record of student ratings in the teacher/course evaluations. The other adjunct professor, despite having been with the university for only the preceding 18 months, also held a strong record. For purposes of instructor evaluation, the university considers a "strong" rating an average score at or above 4.25 out of 5 on the Assessment of Teaching portion of the teacher/course evaluation form used at the university. Though the validity of such forms has been called into question (e.g., Freeman & Dobbins, 2011; Kember, Leung, & Kwan, 2002; Richardson, 2005) it was the only standard method available to track student ratings of a course or instructors during the period discussed here.

As a result, the first of the potential causes to be debunked or eliminated from consideration was that the problems were a direct result of the instructors themselves. The instructors from this time had not received prior significant complaints. As noted above, the instructors during the period had a track record of positive assessment scores from students. The adjunct instructors in particular had years of experience with larger class sizes, usually within the undergraduate Psychology program, and in those courses they had received positive instructor reviews. Finally, four of the students approaching the regional lead during the 5 months stated without prompting that the instructors were not the issue.

The possibility of specific student-related problems. Meetings were scheduled with the instructors from the previous 5 months. During the meetings, the regional lead sought feedback on the newer students who had entered the program. Given that the regional lead evaluates the appropriateness of the students upon enrollment, there was a possibility that the admission of problematic students, and thus the issues discussed earlier in this paper, would be attributable to a number of mistakes of judgment on the part of the regional lead. Complaints about student behavior did not come from students admitted during or directly prior to the 5-month period, nor were the newer students the subject of the complaints. The faculty who were consulted stated

that, individually, the students during the 5-month period did not seem significantly different from the typical MAC student.

The result of the meetings was the conclusion that the problems were not likely to be due to individual students. The consulted faculty each stated that the problems could not be due to the admission of inappropriate students into the MAC program at that location. Both faculty added that, given the regional lead had been in the position for four years, it seemed unlikely that mistakes of judgment or lack of understanding of admission criteria on the part of the regional lead would surface during the 5-month period; there had been no evidence of these types of problems in the preceding years.

Comparison with a control campus. The issues of rising student complaints about instructors, student complaints about other students, and instructor complaints about student behavior, as described in the preceding sections, were documented using the teacher/course assessment form and by the regional lead, who kept record of direct complaints lodged by students and instructors. In order to assess whether the issues were due to the program itself, the complaint records were compared with the records at another campus offering the MAC program. In the discussion that follows, the campus discussed in the introduction is referred to as the experimental campus, and the campus used for comparison is referred to as the control campus. The campus used for comparison was located within the same county and had the same regional lead. The same 5 months, November 2008 through March 2009, during which the complaint numbers increased at the experimental campus, were used for comparison at the control campus.

The instructors for the period from November 2008 to March 2009 at the control campus were contacted. No instructors reported the type of difficulties with students or intra-student dynamics as had been reported at the experimental campus. In addition, only one instructor-related complaint and no student-related complaints had been proffered by students at the control campus during the 5 months. Instructors at the control site averaged an evaluation score of 4.38 from November 2008 through March 2009. The main difference between the MAC program at the experimental campus and the program running at the control site in terms of infrastructure was that the classes at the control site averaged 24 students, compared to the average class size of 30.2 students at the experimental site.

The possibility of class size in causing reported problems. A program that had once been in the mid-teens for enrollment had, over 18 months, expanded to a program with enrollment in the upper 30s. The classes during the 5 months in question averaged 30.2 students, compared to 27 in the preceding 5 months and 21.4 in the 5 months prior to that. The instructors were not noticeably different, the students remained mostly the same, and the program itself did not change in type of course offered. The growth of student enrollment was the only salient factor that was concurrent with a noticeable decline in civility in student interactions with instructors and each other.

Results

After reviewing the known correlates to the increase in complaints, the conclusion was reached that an increased class size was the major influence on the problems reported from November through March (See Figure 1.).

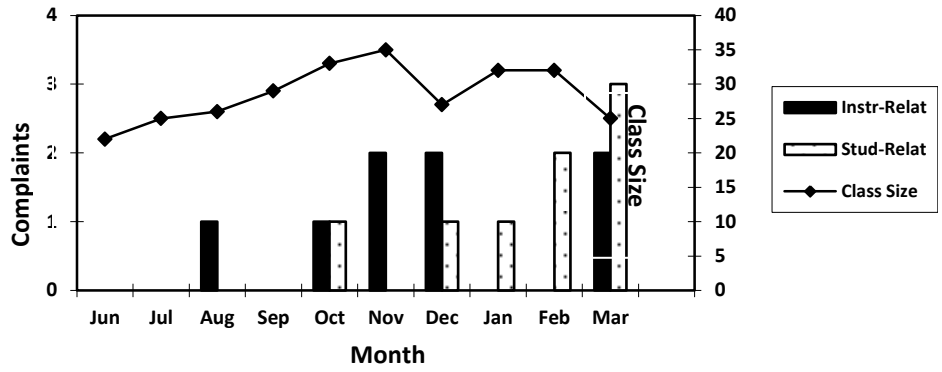

Figure 1. The number of student complaints by months and class sizes for the 10 months ending March 2009.

The numbers on the left in Figure 1 correspond to number of student complaints. The bars display the number (by height) and type (by color) of complaint for each month in the figure. Class size for each month is tracked by the line; the numbers on the right correspond to the class size for each month. The complaints and class size are shown from June 2008 to March 2009. Class size peaked at 35 students in November 2008.

According to Figure 1, the enrollment steadily grew concurrent to what amounts to a "breaking point" in student-instructor and student-student relationships when class size peaked at 35 students in November 2008. There appears to have been a carryover effect from the rise in enrollment given that, even when the class size dipped to 25 in March 2009, complaints continued to rise.

Response

Several actions were considered in response to the problems with students. It was clear that a class split would be needed immediately, based on the conclusions discussed in the prior sections of the paper. The students were divided into two separate sections, neither larger than 18 students. A program-wide meeting was held to discuss the situation because research supports a "mutual dialogue" approach to working with adult learners (Okezie, 2003, p. 117). In addition, MAC students had responded best when changes were discussed with them rather than seeming to be handed down without respect for their reactions.

On the first night of class in April, both sections began class in the same room. The meeting lasted one hour. After the reported issues with student behavior, with other students, and with instructors, students were reminded that it is acceptable to succumb to stress in graduate school. The comment was made to assure the students they were not being judged: the meeting was about moving forward by addressing what was thought to be the root of the problem. The comment also served to address and normalize the stress commonly found in non-traditional students, especially in a program in which students are heavily invested, like the MAC (e.g., Giancola et al., 2009; Meehan & Negy, 2003; Tones et al., 2009).

The students were told that the response to the changes over the prior 5 months had been to implement a class split that would guarantee class sizes of fewer than 25 students. Students also were asked to examine their own roles in the problems and be agents of change. The final 15 minutes of the meeting were open to discussion before class meetings resumed in separate

rooms. The majority of the comments after the presentation reflected support for the class split. No negative reactions were proffered. (It is possible that students with negative views withheld reaction.) One student, minutes after the meeting ended, approached the regional lead and expressed thanks for saying "what needed to be said."

In the months following the meeting, several students approached the regional lead in support of the meeting and the class split. Three students remarked in the written course evaluations for April 2009 that the class split was a great idea. Student complaint numbers before and after the class split are compared in Figure 2. In the 5 months following the class split, complaints per month averaged 0.08 compared to the 2.6 in the 5 prior months. Given the results of the investigation and the drop in student and instructor reports of problems following the class split, the regional lead concluded that increased class size was an important factor in, if not the most likely reason for, the problems.

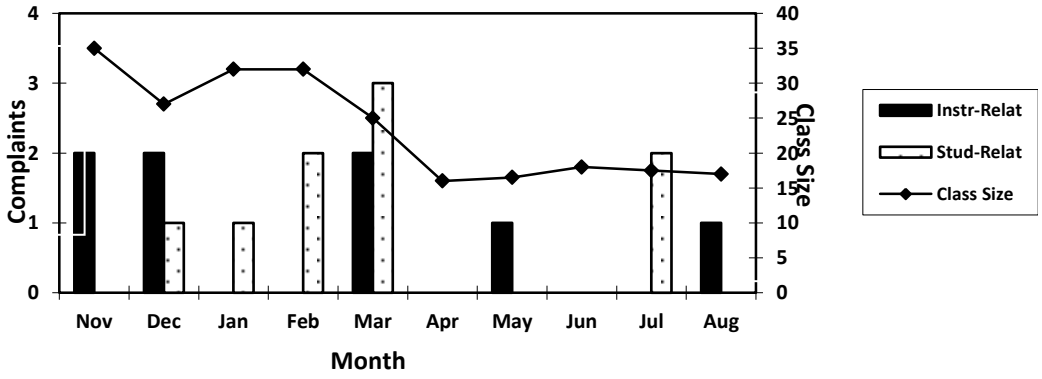

Figure 2. The number of student complaints by months and class sizes for the 10 months ending August 2009.

The numbers on the left correspond to number of student complaints. The bars display the number (by height) and type (by color) of complaint for each month in the figure. Class size for each month is tracked by the line; the numbers on the right correspond to the class size for each month. The figure displays class sizes and complaints from November 2008 to August 2009. The MAC student enrollment was split into two classes in April 2009. Following the split, class sizes are shown on the figure as an average between the two classes.

Discussion

After investigating a number of possible solutions, it was decided that class size was the major variable influencing an increase in complaints about student and instructor behavior. Research has shown that smaller class sizes are often preferable, depending on the measuring construct (Blatchford, 2005; Buskist & Wylie, 1998; Elmore & Pohlmann, 1978; Fenollar et al., 2007). Smaller class sizes are recommended for programs like the MAC, which prepare students for licensure as therapists (Yu et al., 1997). Since the class split in April 2009, class sizes have remained below 30. Students have been asked to contact the regional lead sooner with issues

regarding instructors or other students, rather than letting the issues intensify over time. The decreased class sizes have coincided with not only decreased complaints (see Figure 2) but also a noticeably more positive classroom atmosphere, according to reports from both students and instructors.

Limitations

The study conducted herein was not ideal in several areas, mainly due to the lack of a true experimental design. As a result, other uninvestigated factors could have produced the reduction in complaints. The problems witnessed by the regional lead were not expected, so data preceding the problems were limited. More rigorous and consistent data collection, perhaps via questions added to the end-of-class evaluations already completed by instructors and students, could address this concern. A related concern is the lack of a true outcome measure, such as the licensing examination used by Yu et al. (1997). Scores for the Marriage and Family Therapist licensing examination could not be used in this study for a number of reasons. Years often pass between completing study and taking the exam. Teasing out the effects of the 5 months mentioned throughout the paper could prove difficult, given that students had been enrolled at least 5 months prior to the split, remained enrolled for up to an additional 13 months to complete the MAC program, and completed at least two years of internship work in the field following graduation.

Any time research is conducted in the field rather than in a controlled situation and the researcher is limited in the type of manipulations that can be introduced, the possibility exists of the unexpected or unaccounted influence of confounding factors. In the Results section it is noted that as part of the solution a meeting was held with students to discuss the situation leading to the class split. It is possible that the meeting itself was a strong enough intervention to reduce some of the behaviors reported by students and instructors. Such a possibility was ruled out because the reduction in complaints as described in the Results remained persistent despite the entrance into the program of new students, who had not been present at the meeting and would have heard of it only second-hand. Even in such a case, the new students would be beneficiaries of reduced class size from the time of their entry into the program, so whatever effects might have occurred based on hearing what happened at the meeting would be difficult to differentiate from the effects of having smaller class sizes.

It is possible that the makeup of the student group could have played a role in both the problems reported to the regional lead and the effectiveness of the solution. The student group was overwhelmingly female and White. However, the presence of 3 men in comparison to 37 women in the student group could have influenced the findings. It is not known how the differential could have influenced variables like student dynamics and frequency of reported issues, so further research may be required in order to discern whether the same effects would have been seen in a student group with a ratio of women to men that was more reflective of the general population. It should be noted, however, that the makeup of the classes over the 5 months was not an aberration in the MAC program. Classes often contain no men; women have not made up less than two thirds of any MAC class at the location, dating back at least to 2005.

Another drawback related to experimental design is the lack of a control group at the same campus. Giving some students smaller classes while leaving others in larger classes was not possible, given the limitations of the sample. It was also not recommendable because not reducing the class size of students in the control group could have negatively affected the

students' academic experience. One solution would be to conduct an experimental version of the study in multiple locations; this would increase the access to students in a variety of situations. However, as noted in the Method section, the random assignment necessary for a true experimental study carries the possibility that the students in larger classes may experience issues of quality of education and potentially harmful student dynamics. Knowing the potential deleterious effects of such assignment and carrying it out despite this knowledge is an ethical concern.

Recommendations

Future research on the impact of class size in non-traditional environments could include experimental designs and larger sample sizes to increase the power of the researcher to draw conclusions about causality, provided that ethical concerns with such an approach are sufficiently addressed. Larger samples would also allow the researcher greater latitude in determining treatment versus control groups and access to participants whose reactions might affect conclusions about the influence of class size. It is possible that the differential between men and women in the student group had some effect on the presentation of problems, or the success of the meeting and class split, or both. Future studies are needed in order to determine what effects, if any, are likely when the ratio of one sex to the other is as disproportionate as it was in this student group. Finally, future researchers could also concentrate on ways of determining the measureable effects of a period of time spent in larger classes versus the effects of consistent smaller classes.

Overall, it was clear that in this instance a large class size was not working with this student group. Student satisfaction with courses and instructors and overall tolerance for other students increased in a meaningful way in the months following the split. It is recommended, then, that class sizes—especially those for non-traditional graduate students who already may be under high levels of stress, due to a variety of reasons—be monitored and considered a potential factor in student satisfaction with not only the course and the instructor but the relationships among themselves.

References

Adams, C. (2011). The big class. *Instructor, 121*(1), 41–42.

Alberts, H. C., Hazen, H. D., & Theobald, R. B. (2010). Classroom incivilities: The challenge of interactions between college students and instructors in the US. *Journal of Geography in Higher Education, 34*(3), 439–462.

Blackhart, G. C., Peruche, B. M., DeWall, C. N., & Joiner, T. E. (2006). Factors influencing teaching evaluations in higher education. *Teaching of Psychology, 33*(1), 37–39.

Blatchford, P. (2005). A multi-method approach to the study of school class size differences. *International Journal of Social Research Methodology, 8*(3), 195–205.

Boyd, D. (2004). Effective teaching in accelerated learning programs. *Adult Learning, 15*(1/2), 40–43.

Bustkist, W., & Wylie, D. (1998). A method for enhancing student interest in large introductory classes. *Teaching of Psychology, 25*(3), 203–205.

Cathcart, A., & Neale, L. (2012). Using technology to facilitate grading in large classes. *Marketing Education Review, 22*(1), 11–14.

Conceição, S. C. O. (2007). Understanding the environment for online teaching. *New Directions for Adult and Continuing Education, 113*(4), 5–11.

Elmore, P. B., & Pohlmann, J. T. (1978). Effect of teacher, student, and class characteristics on the evaluation of college instructors. *Journal of Educational Psychology, 70*(2), 187–192.

Englehart, J. M. (2007). The centrality of context in learning from further class size research. *Educational Psychology Review, 19*(4), 455–467.
Englehart, J. M. (2011). Why class size effects cannot stand alone: Insights from a qualitative exploration. *Learning Environments Research, 14*(2), 109–121.
Exeter, D. J., Ameratunga, S., Ratima, M., Morton, S., Dickson, M., Hsu, D., & Jackson, R. (2010). Student engagement in very large class sizes: The teachers' perspective. *Studies in Higher Education, 35*(7), 761–775.
Fenollar, P., Román, S., & Cuestas, P. (2007). University students' academic performance: An integrative conceptual framework and empirical analysis. *British Journal of Educational Psychology, 77*, 873–891.
Freeman, R., & Dobbins, K. (2011). Are we serious about enhancing courses? Using the principles of assessment for learning to enhance course evaluation. *Assessment & Evaluation in Higher Education, 38*(2), 142–151.
Gary, J., Kling, B., & Dodd, B. (2004). A program for counseling and campus support services for African American and Latino adult learners. *Journal of College Counseling, 7*(1), 18–23.
Giancola, J. K., Giancola, M. J., & Borchert, D. (2009). Dealing with the stress of college: A model for adult students. *Adult Education Quarterly, 59*(3), 246–263.
Gilmore, D. C., Swerdlik, M. E., & Beehr, T. A. (1980). Effects of class size and college major on student ratings of psychology courses. *Teaching of Psychology, 7*(4), 210–214.
Gose, B. (2012). Four massive open online courses and how they work. *Chronicle of Higher Education, 59*(6), 8.
Graham, S. (1999). Adult students' academic and intellectual development in college. *Adult Education Quarterly, 49*(3), 147–161.
Grinnell, T. (1989). Accelerated learning not for everyone. *Training & Development Journal, 43*(7), 4–5.
Hansman, C. A. (2009). Ethical issues in mentoring adults in higher education. *New Directions for Adult and Continuing Education, 123*(2), 53–63.
Kasworm, C. E. (2008). Emotional challenges of adult learners in higher education. *New Directions for Adult and Continuing Education, 120*(1), 27–34.
Kember, D., Leung, D. Y. P., & Kwan, K. P. (2002). Does the use of student feedback questionnaires improve the overall quality of teaching? *Assessment & Evaluation in Higher Education, 27*(5), 411–425.
Kiely, R., Sandmann, L.R., & Truluck, J. (2004). Adult learning theory and the pursuit of adult degrees. *New Directions for Adult and Continuing Education, 103*, 17-30.
Meehan, D.-C.-M., & Negy, C. (2003). Undergraduate students' adaptation to college: Does being married make a difference? *Journal of College Student Development, 44*(5), 670–690.
Nagel, S. L., Maniam, B., & Leavell, H. (2011). Pros and cons of online education for educators and students. *International Journal of Business Research, 11*(6), 136–142.
Njumbwa, S. (2008). The undergraduate research experience of adult learners in an accelerated degree completion program. *The Journal of Continuing Higher Education, 56*(3), 49–60.
Okezie, C. (2003). Of deconstruction and reconstruction: Confronting the challenges of the adult learner. *Negro Educational Review, 54*(3/4), 115–119.
Park, J., & Hee, J. (2009). Factors influencing adult learners' decision to drop out or persist in online learning. *Journal of Educational Technology & Society, 12*(4), 207–217.
Prins, E. (2009). Examining interpersonal dynamics among adult learners through the lens of place. *International Journal of Lifelong Education, 28*(1), 91–106.
Richards, J. (2008). The benefits of an accelerated learning format in teacher education programs. *Journal of Research in Innovative Teaching, 1*(1), 73–81.
Richardson, J. T. E. (2005). Instruments for obtaining student feedback: A review of the literature. *Assessment & Evaluation in Higher Education, 30*(4), 387–415.
Ross-Gordon, J. (2003, Summer). Adult learners in the classroom. *New Directions for Adult & Continuing Education, 102*, 43–52.
Ross-Gordon, J. M. (2011). Research on adult learners: Supporting the needs of a student population that is no longer nontraditional. *Association of American Colleges & Universities Peer Review, 13*(1), 26–29.
Russel, V., & Curtis, W. (2013). Comparing a large- and small-scale online language course: An examination of teacher and learner perceptions. *The Internet and Higher Education, 16*, 1–13.
Tones, M., Fraser, J., Edler, R., & White, K. M. (2009). Supporting mature-aged students from a low socioeconomic background. *Higher Education, 58*(4), 505–529.
Wlodkowski, R. J. (2003). Accelerated learning in colleges and universities. *New Directions for Adult & Continuing Education, 97*(5) 5–15.

Yu, L. M., Rinaldi, S. A., Templer, D. I., Colbert, L. A., Siscoe, K., & Van Patten, K. (1997). Score on the Examination for Professional Practice in Psychology as a function of attributes of clinical psychology graduate programs. *Psychological Science, 8*(5), 347–350.

About the Author

Brian Tilley
PhD, Associate Professor, Regional Lead MAC Faculty
National University
San Diego, CA
btilley@nu.edu
Research interests: non-traditional student groups, teaching of psychology, online instruction, political psychology, cultural influences on voter behavior, cultural influences on party identification

Teaching Subject Matter

Student Experiential Learning of Cyber Security through Virtualization

Roberta C. Anderson
Gordon W. Romney

Abstract
An MS Cyber Security and Information Assurance program was designed to provide experiential training through virtual laboratory exercises. The quality of service provided by the National University Information Security Lab Environment (ISLE) that provisions virtual computers to students was evaluated, and baseline performance statistics were captured. Agile teaching was employed by using a Kali Linux system in penetration testing exercises in the evaluation. Kali proved stable, performed the tested functions well, and was recommended to be used in future courses. Virtualization in both a cloud infrastructure and on local machines was shown to be most effective.

Key Words
Agile, cyber security, experiential learning, hypervisors, online learning, virtual education labs, virtualization

Introduction

National University's (NU) Master of Science in Cyber Security and Information Assurance (MS CSIA) program is among the few leading Cyber Security programs in the world that offer hands-on, experiential security learning through virtual laboratory exercises. This is critical to Cyber Security (CYB) education and learning because it has been demonstrated for over a decade that CYB can truly be learned only by hands-on exercises (Romney, 2004). This is all the more significant because the US security systems standards are set by the intergovernmental Committee on National Security Systems (CNSS) that is considering revising the 4011 through 4016 standards to include hands-on learning objectives. NU's MS CSIA program currently meets the CNSS 4011 and 4012 standards (CNSS, n.d.). The hands-on learning outcomes that are included in the MS CSIA curriculum anticipate the new, 2014 requirements for the NSA/DHS Center of Academic Excellence. Maintaining the delivery of quality virtual laboratory exercises is essential for NU to meet the expectations of the best candidate students. This paper demonstrates a first approach to monitor quality control of a virtual education laboratory in order to continue providing the best possible Infrastructure as a Service (IaaS) and Computer Lab as a Service (CLasS^{TM}) (iNetwork, 2013) in the NU MS CSIA program.

During a critical transition 3-month period spanning March through May 2013, students in the MS CSIA program of the School of Engineering, Technology and Media (SETM) at National University used virtual environments, along with online lectures, to facilitate learning. Students were encouraged to use both an NU-provided, cloud-hosted virtual infrastructure (SETM Cloud Infrastructure, or SCI), as well local hypervisors, personally loaded on a student computer (VMware workstation and Oracle VirtualBox). A hypervisor allows multiple operating systems to run concurrently on a host machine. For example, a student may have a laptop computer loaded with a Microsoft Windows 7 operating system that runs a hypervisor application Oracle VirtualBox that, in turn, has Kali Linux running as a virtual machine. This period was a transition period to a higher technological capacity level that included two versions of university-provided virtual infrastructures, both using VMware vSphere ESXi: Version One, the Virtual Education Lab (VEL); and Version Two, the Information Security Lab Environment (ISLE). A more extensive description of the two virtual laboratory environments is described in a paper by the authors (Anderson & Romney, 2013). This virtual, hands-on training, along with demanding curricula accredited by the Western Association of Schools and Colleges (WASC) and the CNSS

standards, allows National University to be a leader in online education (NationalUniversity.edu, n.d.). Additionally, the NU CSIA initiative, including MS CSIA, has been designated an NSA/DHS Center of Academic Excellence in Information Assurance Education (CNSS, n.d.) the first in the greater San Diego area.

The authors evaluate and present the value achieved by introducing student experiential learning to cyber security programs and students. The use cases from CYB 600, 601, and 602 (March through May 2013) took place at NU, where the MS CSIA program offers a one-course-per-month format. The teaching model has also been adapted to introduce agility into National University's pedagogy (Romney, 2009). The students learned about hypervisors, penetration testing software, ethical hacking tools, RADIUS server implementation, Intrusion Detection Systems, and Secure Socket Layer (SSL) encryption. Data from CYB 602, Threat Mitigation Policy/Audit, in March 2013, was used to support the findings in this paper. Using virtual environments, the students were able to use leading-edge technology in order to support the specific unique educational needs of the courses (VMware.org, n.d.). Student satisfaction was measured by hypervisor comparison as well as project feedback.

In May 2013, online CYB 602, with its specific range of topics dealing with mitigating threat vectors, provided both a remote virtual lab and local student platform comparison opportunity to establish a beginning baseline of the new ISLE virtual infrastructure. With 23 enrolled students in the cohort, it provided an optimum class size for testing both ISLE and local machine performance parameters. Local machine performance provides the ideal benchmark, as there are no loading or access bandwidth variables to deal with. The student, then given a variety of virtual machine configurations in the ISLE, can capture individual performance metrics to compare to the student's own local machine metrics. One other variable was kept to a minimum (not zero, the ideal) in May: the ISLE loading from other concurrent CYB students in other courses. Five other concurrent CYB courses were offered in May: CYB 603, with 19 onsite students; CYB 612, with 5 online students; CYB 613, with 7 onsite students; CYB 632, with 9 online students; and CYB 633, with 7 onsite students. Of these, only CYB 612 and 632, for a total of 14 students, actually used virtual machines in ISLE.

Virtualization Overview

According to the National Institute of Standards and Technology (NIST), virtualization is the simulation of software and/or hardware solutions. The working environment itself is called a virtual machine, or VM (NIST.gov, 2011). These virtual environments facilitate operational efficiency, testing environments, better control of organization security, and portable encapsulation (NIST.gov, 2011). However, they also provide desktop educational solutions. As the industry virtual leader VMware puts it, "Students have unique educational needs which require cutting-edge technology" (VMware.com, n.d., *VMware High Availability*). Virtualization is a means of providing this technology without having to increase costs or to be physically present at an institution of higher learning. Virtualization is also at the core of cloud technology.

Full Virtualization Types

There are two types of full virtualization: bare metal, or native, and hosted. The difference between the two is basically where the hypervisor is layered in the architecture. Bare metal virtualization maintains a structure in which the hardware is loaded directly with a hypervisor. That hypervisor is then loaded with a guest operating system with desired applications. Hosted

virtualization, on the other hand, maintains a structure in which hardware has an underlying host operating system loaded such as Windows, Linux, or OS-X, which then gets a hypervisor loaded onto it, and a guest system loaded on top of that (NIST.gov, 2011). See Figure 1.

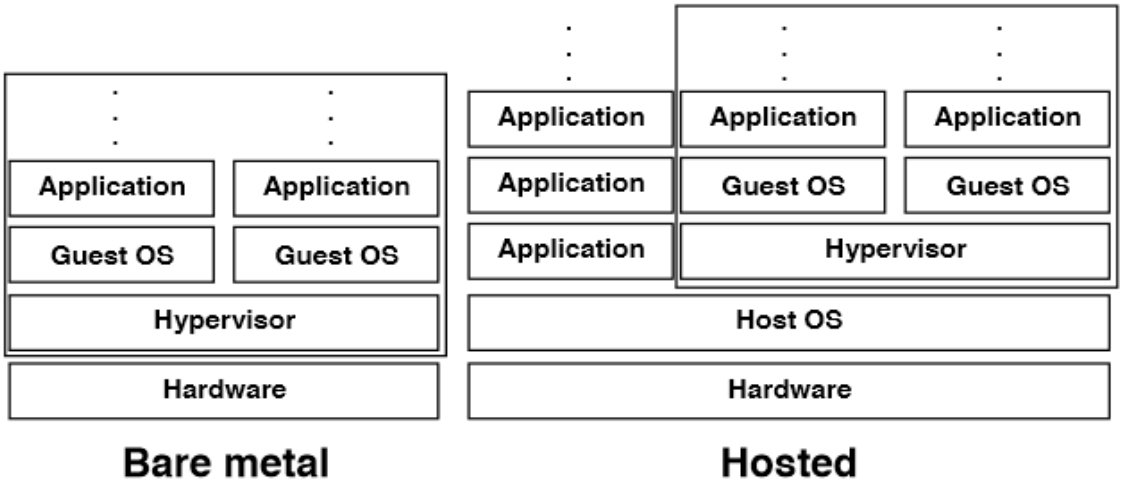

Figure 1. Full virtualization architectures. (NIST.gov)

The VEL and ISLE are examples of bare metal implementations (NIST.gov, 2011). The infrastructure hardware is loaded with vSphere ESXi Server, which then has individual virtual machines (VMs) loaded per cohort requirement. Individual student laptops were loaded in a hosted configuration. Students each had their underlying operating system loaded (Windows 7, Windows 8, MAC OSX, etc.), and then installed a hypervisor on top of it. The students in this evaluation used either VMware Workstation or Oracle VirtualBox. Inside that hypervisor, students then loaded VMs with testing software (Kali Linux, BackTrack 5, Windows unpatched OS, Fedora, etc.).

Virtual Components

Virtual systems have the same components as physical systems. They all have CPUs, memory, storage, storage controllers, and Ethernet controllers, and they use a keyboard and a mouse (NIST.gov, 2011). What is different, however, is the concept of "host" operating system and "guest" operating system. A host operating system is one in which the virtual environment is loaded onto a pre-existing operating system. For example, in CYB 602, students used a chosen hypervisor, such as Oracle VirtualBox, to load Kali Linux and BackTrack 5 onto their personal computers (hosts), making Kali Linux and BackTrack the "guest" systems. The host is the physical machine, and the guest is the virtual machine.

NU Virtual Lab Environments

National University CYB students had access to two different university-provided cloud infrastructures, both bare metal. During the first three months, students used the VEL. This was

Version One of the environment, using a combination of VMware and vSphere products providing the following services: creation of multiple academic strings for multiple classes, ability to store work across platforms, and professor ability to enroll students and create accounts. Discretionary Access Controls (DACs) were used by the implementation of Active Directory (AD). Both topologies used a tree structure that used Datacenter topologies. Inside each Datacenter were clusters of physical machines that contained the performing virtual machines (VMware.com, n.d., *Physical Topology*). Instructors also had access to predefined operating system templates through the template library. Here they had the ability to create a custom student research environment in an instant. Sample templates were Microsoft Windows Server 2008 R2 (64-bit), Microsoft Windows XP, Microsoft Windows 7, Ubuntu, Fedora, Microsoft SQL Server, and various other platforms.

During the third month, students also used an enhanced version of the university-provided virtual environment, Version Two, the ISLE. This had the same combination of VMware and vSphere products and services, in addition to some enhancements that were implemented after receiving feedback on Version One.

Virtual Education Lab

The Virtual Education Lab (VEL), administered by SETM staff and an industry collaborator (iNetwork, San Diego, California), provided the following capabilities: having second generation firewall protection, using multi-factor authentication protocol support for user authentication, utilizing state-of-the-art threat prevention and identification, URL filtering, zoning to support multi-purpose enclaves, and a DMZ for Internet facing servers. It also had a fault-tolerant administrative configuration for servers to ensure highly available virtual machines for the students. In addition, it had support for multiple ISP connections and secure sandboxes for class projects.

The backbone infrastructure of the VEL consisted of eight Brocade FastIron 48 port Ethernet switches and two new, second generation, Palo Alto 2050 Networks firewalls that managed network traffic flows, filtered URL access, and provided enclave management. The infrastructure also used high speed pathways between processors to separate data and command-and-control functions (PaloAltoNetworks.com, n.d.) with a 50 Mbps throughput. The VEL used 11 servers and could support up to 10 different class strings and a maximum of 26 students per string. User data was stored on a Storage Area Network (SAN) that was configured with a 15 TB array, using RAID 6 across all 15 hard disks with a single hot spare. This ensured both redundancy and future growth potential.

In order to access the VEL, students had to become familiar with the concept of Virtual Private Networks (VPNs). They also had to install VMware VI Client and import and install authentication certificates provided by the university. The NetConnect client was used to access the Palo Alto Networks SSL VPN portal that provided secure downloads of data.

Information Security Lab Environment

The Information Security Lab Environment (ISLE) is Version Two of the NU cloud infrastructure. This developed when the NU/IT department took administrative control of the SCI. Its architecture facilitated the same capabilities as the VEL, in addition to including virtual WiFi support through a Digi 14-port controller and the Anywhere USB product. Anywhere USB enabled hub connectivity of USB peripheral devices to PCs over a Local Area Network (LAN) connection (Digi.com, n.d.). This technology was used for associating IP addresses with one of

the 14 available ports, as well as respectively assigned Network Interface Cards (NICs) that allow connection with the Internet.

The ISLE also implemented VMware High Availability (HA), which is an automatic detection mechanism that detects server failures and restarts virtual machines on different physical servers. This functionality protects applications and creates minimal interruption for students (VMware.com, *VMware High Availability*, n.d.). With higher availability also came increased throughput; the ISLE's connection speed was increased by 100% to 100 Mbps. The ISLE infrastructure consists of four host machines/servers and a 20 TB SAN configured with a 10 GB network interface. As of the date of this paper, the number of virtual appliances, servers, and routers available on ISLE was inventoried at 770, in comparison to the 300 maximum under the VEL.

Local Hypervisors

While the market provides various hypervisors for a hosted configuration, the cohort chose one of two free options, Oracle VirtualBox, or VMware Workstation. The local hypervisor was not mandated during the course, which gave students the opportunity to experiment based upon curiosity and/or prior experience or real-world needs. Of the 19 students surveyed, 6 used Oracle VirtualBox and 13 used VMware Workstation. Students who chose to use Oracle VirtualBox were assisted by a thorough user guide provided by Oracle, the *Oracle VM VirtualBox User Manual* (dlc.sun.com, n.d.). One of the authors (Anderson) personally found Oracle VirtualBox easier to use than Microsoft VMware WorkStation.

Virtual Environment Comparison (ISLE vs. Local Machines)

Comparison data for virtual environment, ISLE versus local machines, was collected from the cohort in CYB 602. The data was then analyzed and used to compare the usability and efficiency of the ISLE versus personally loaded hypervisors. As stated earlier, hypervisors on personal local machines were either Oracle VirtualBox or VMware Workstation. There appeared to be no major differences between the two locally running hypervisors in performance, just with setup and networking ease.

Evaluation Parameters

The objective of the experiment in CYB 602 was to evaluate performance and personal experience observations via measurable actions carried out in the ISLE, as well as on the students' personal hypervisors, and then compare the two. This took place over a 4-day period. The specific actions logged were system startup, reboot, wakeup, total time after login to get started, application startup, and shutdown. Three Linux environments—Kali, Backtrack 5 and Fedora—and a single Windows 7 environment were compared. Fedora Linux was not sampled in the local-machine test. See Tables 1 and 2.

Table 1. *ISLE VM Performance 4-Day Comparison Average of Multiple Students (seconds)*

Day 1					
ISLE Specs in Seconds					
	Start	Reboot	Sleeping (10 min) -> Wakeup	Time after log in	Total VMs on
Kali VM	30.5	46.8	2	9.4	26
Backtrack 5 R3	49.2	72.9	8	28.4	25
Fedora	90.4	130.5	18.4	134.9	26
Windows 7	58.2	67.3	4.6	6.2	27
Day 2					
ISLE Specs in Seconds					
	Start	Reboot	Sleeping (10 min) -> Wakeup	Time after log in	Total VMs on
Kali VM	53	67.3	6	11.9	29
Backtrack 5 R3	53.6	65.6	6.4	19.5	27
Fedora	80.4	160.5	14.7	165.2	30
Windows 7	50.9	127.9	5.4	3.9	31
Day 3					
ISLE Specs in Seconds					
	Start	Reboot	Sleeping (10 min) -> Wakeup	Time after log in	Total VMs on
Kali VM	26.8		4.9	7.5	34
Backtrack 5 R3	40.5	55.4	7.4	27.8	34
Fedora	92.6	143.5	13.9	155.3	34
Windows 7	58.2	63.8	3.8	4.3	34
Day 4					
ISLE Specs in Seconds					
	Start	Reboot	Sleeping (10 min) -> Wakeup	Time after log in	Total VMs on
Kali VM	60	31.1	3.7	8.7	48
Backtrack 5 R3	50	65.6	3.5	17.3	48
Fedora	92.6	107.6	18.3	195.2	48
Windows 7	60.7	62.5	7.3	5.8	48

Table 2. *Personal VM Performance 4-Day Comparison Average of Multiple Students (Seconds)*

Day 1					
Personal VM Specs in Seconds					
	Start	Reboot	Sleeping (10 min) -> Wakeup	Time to Login	Time of Day
Kali VM	44.2	46.2	1.9	10.6	11:00PM
Backtrack	26.5	31.7	2.5	15.9	10:00PM
Fedora	0	0	0	0	9:20PM
Windows	81.5	57.5	5.6	9.8	9:15PM
Day 2					
Personal VM Specs in Seconds					
	Start	Reboot	Sleeping (10 min) -> Wakeup	Time to Login	Time of Day
Kali VM	45.4	44.3	3.9	10.8	10:30PM
Backtrack	25.9	34.8	1.9	14.8	9:00PM
Fedora	0	0	0	0	10:08PM
Windows	79.9	62.4	3.5	10.6	7:00PM
Day 3					
Personal VM Specs in Seconds					
	Start	Reboot	Sleeping (10 min) -> Wakeup	Time to Login	Time of Day
Kali VM	47.5	48.9	4.3	11.8	9:10PM
Backtrack	31.7	24	3.6	12.3	10:15PM
Fedora	0	0	0	0	
Windows	82.7	51.6	4.8	13.5	10:40PM
Day 4					
Personal VM Specs in Seconds					
	Start	Reboot	Sleeping (10 min) -> Wakeup	Time to Login	Time of Day
Kali VM	47.2	50.2	3.5	13.3	5:30PM
Backtrack	29.4	24	2.3	15.1	6:00PM
Fedora	0	0	0	0	
Windows	95.7	72	2.9	11.5	9:00PM

While the individual results varied by student, samples of expected behaviors are shown in Figures 2 and 3.

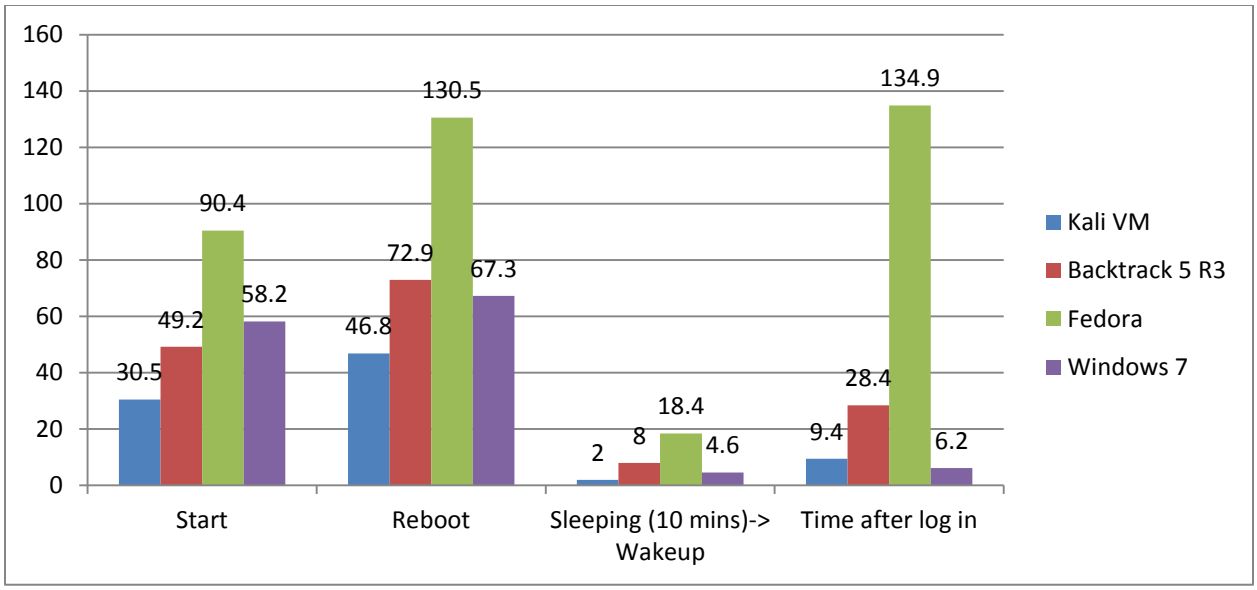

Figure 2. ISLE VM performance day 1 average of multiple students (seconds).

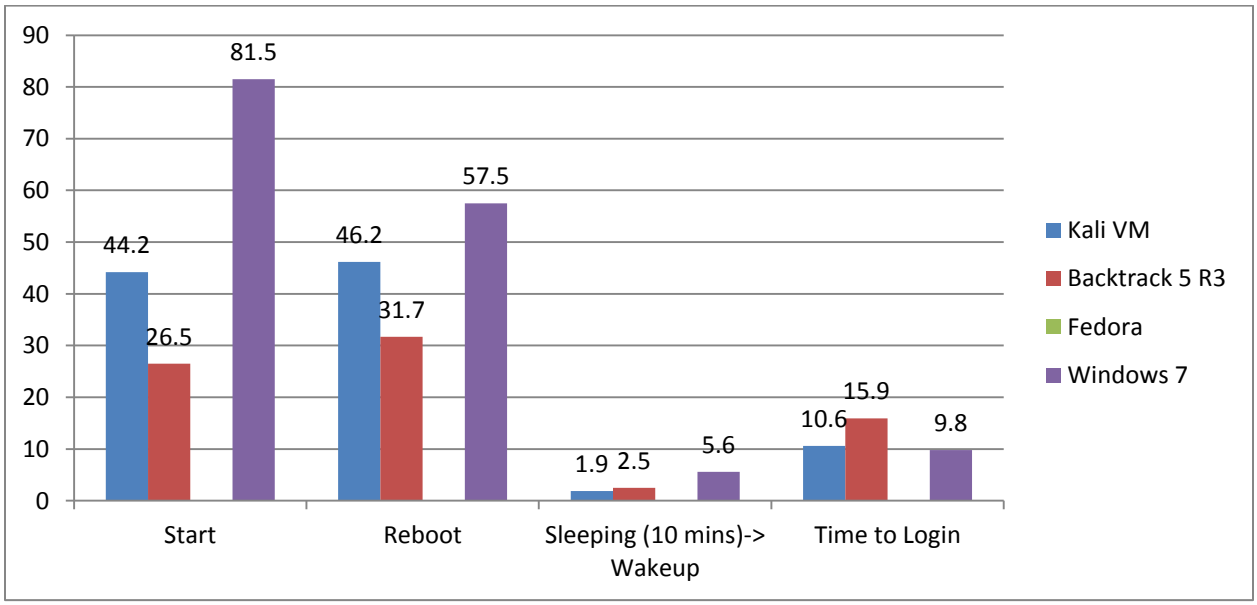

Figure 3. Personal VM performance day 1 average of multiple students (seconds).

Data Analysis

As shown in Tables 1 and 2, and Figures 2, 3, 4, 5 and 6, as well as in the comparison of the 19 student surveys, the ISLE Fedora box was by far the slowest, least reliable, and most subjectively

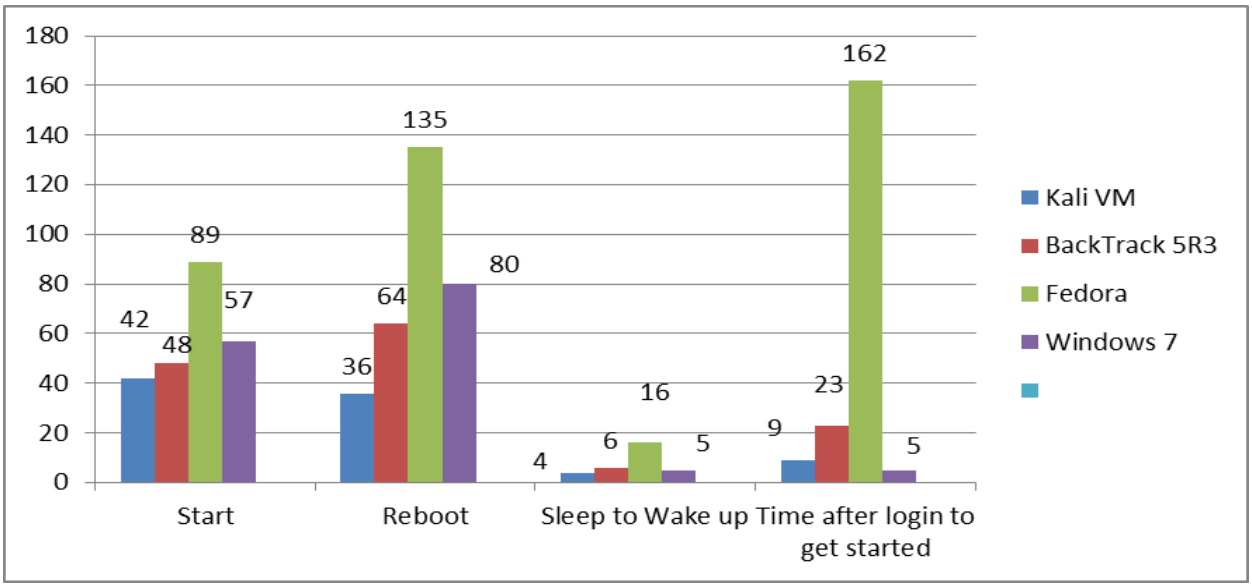

Figure 4. ISLE VM performance 4-day average (seconds).

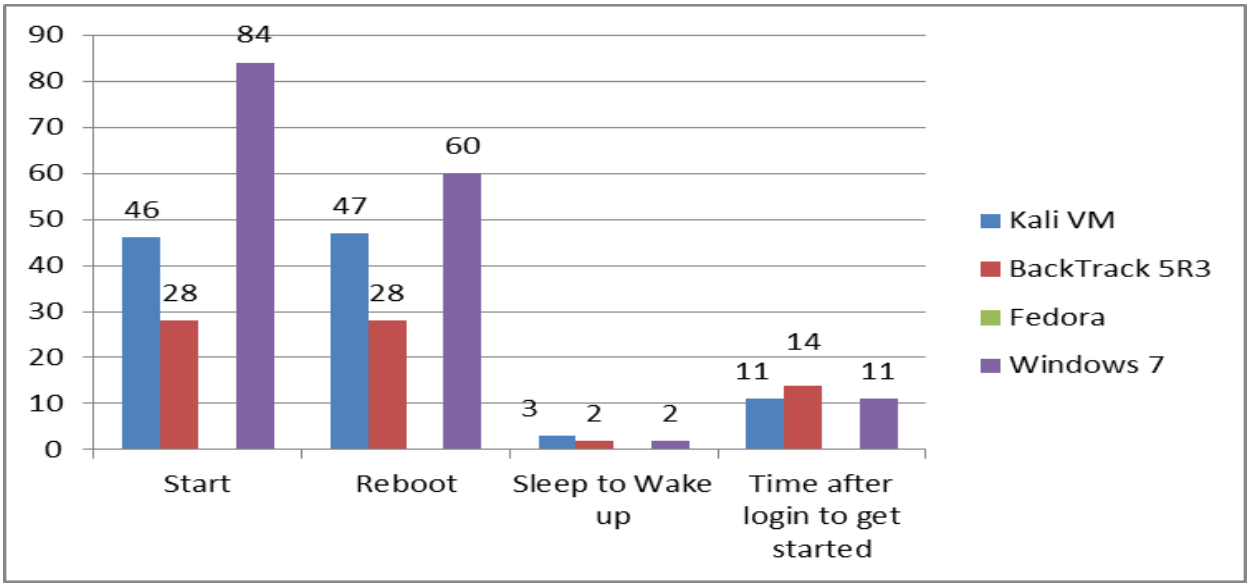

Figure 5. Personal VM performance 4-day average (seconds).

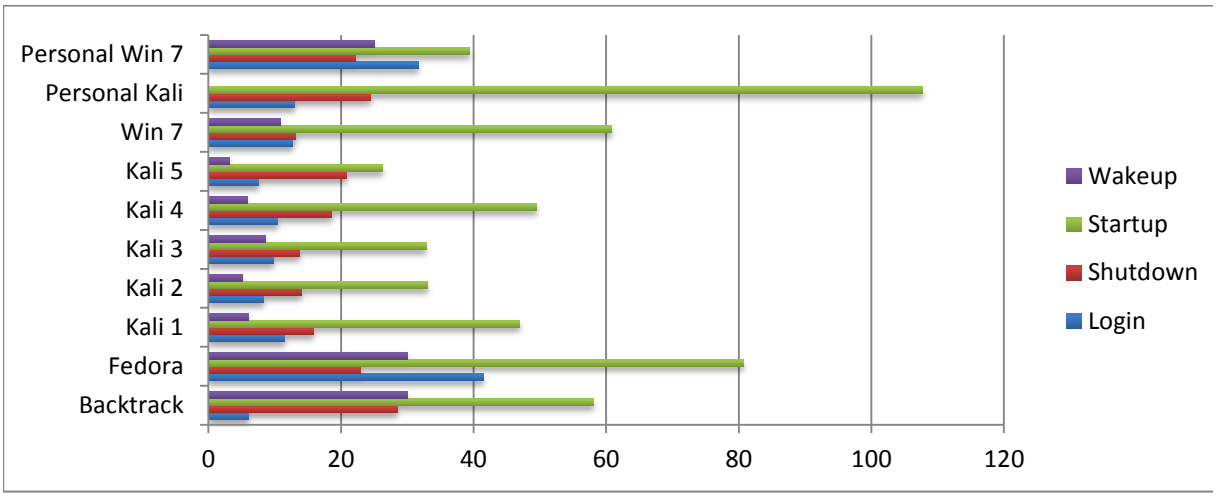

Figure 6. Launching and shutting down VMs (seconds).

frustrating VM to use. The variety of Kali machines shown in Figure 6 represented different configurations of the virtual machine in terms of memory and 32/64 bit architecture. One of the specific outcomes sought in this analysis was to determine the wisdom in migrating to the latest Backtrack version that is Kali. Kali Linux based on Debian was released in March 2013 and is to replace Backtrack 5. The finding for Kali on ISLE by the students, as shown in Figure 6, is that Kali performed consistently, irrespective of the configuration, resources, or hosting. In all instances when it came to application response time, the personal VMs were more responsive in the opening and closing of applications. Consequently, in spite of loading and bandwidth issues, ISLE performed remarkably well. Students also found Kali Linux to be more responsive than BackTrack 5. Another observation was that Linux boxes performed faster than Windows boxes, regardless of platform.

Student Recommendations

Based upon the empirical data collected in CYB 602, the following suggestions for the ISLE were made by the students in the program:

1. Give students “root” level permissions on the assigned Linux machines.
2. Allow students to create snapshots of the VMs, aiding with student testing.
3. Ensure student password functionality prior to class.
4. Fix Fedora machine latency issues.
5. Increase bandwidth.
6. Add load balancers to architecture.
7. Add Kali Linux to the stable of virtual machines used in CYB courses.

Use Cases

During the 3-month period surveyed, the following courses were taught:

1. CYB600 – Cyber Security Technology
2. CYB601 – Cyber Security Toolkit Utilization
3. CYB602 – Threat Mitigation Policy and Audit

These were all taught in the one-course-per-month format unique to NU (NationalUniversity.com, n.d.). In these courses, students learned how to achieve the following objectives: analyze techniques for mitigating malicious software attacks, write reports on the testing of virtual machines in a lab environment, inspect the operation of certificate authorities and issue digital signatures, test cyber tool kit components, compare and contrast the benefits of Intrusion Detection and Prevention systems, compare and contrast trusted computing and multilevel security models, analyze enterprise physical and logical security policies and best practices, recommend security policies, implement multifactor authentication via virtualization, recommend improvements to global Internet practices, and diagnose distributed denial-of-service attacks. All students surveyed indicated they could not have learned several key concepts without the use of a virtual environment, especially in an online course-delivery format.

More specifically, several students indicated the value gained by being able to test the Kali Linux and BackTrack 5 penetration tool set in a secure, sandbox environment. These are cutting-edge penetration testing tools (BackTrackLinux.org, n.d.), and knowledge of them is required for any Cyber Security professional wanting to work in the field. BackTrack 5 is the original "Swiss army knife," whereas Kali Linux is the newer, updated version (Kali.org, n.d.). Students stated that the virtual environment allowed them the confidence to experiment without having to worry about causing any collateral damage.

Nmap and Wireshark, two powerful de facto network mapping tools, were also used in the virtual environment. These tools help students understand how packet captures work and allow subsequent packet analysis (Nmap.org, n.d.; Wireshark.org, n.d.). These two tools could be very dangerous to run outside of a controlled environment, as they sniff network traffic. If accidental traffic were to be sniffed, from a student's Internet Service Provider (ISP) or neighbor, for example, it could result in legal actions' being taken against said student. This problem is completely alleviated by running the software applications in the university's ISLE.

Conclusion

Scientific research conducted via survey data and analysis confirms the benefits of using virtualization for teaching Cyber Security concepts. Both students and professors in the CYB program acknowledged the value gained by facilitating hands-on learning in both online and onsite education programs. The benefits of teaching agility in software development were previously described (Romney, 2009), and now it is time to explore the benefits of agile teaching through virtualization.

Cyber Security is a hands-on field. To be successful, one needs experience with the tools in the field. This needs to occur not only in a conceptual manner but in a physical manner as well. Virtualization aids in student experiential learning by providing (a) a safe environment for testing applications that might not otherwise be available, (b) efficient set-up, (c) cost-effective

solutions for both the school and students, and (d) the ability, in near real-time, to configure a scenario custom designed for learning.

Agile pedagogical techniques were used in the execution of CYB 602. The instructor, Romney, in consultation with NU/IT, (a) developed the metric for capturing ISLE versus local machine performance data on a select set of virtual machine configurations and (b) introduced Kali Linux into the curriculum just days before the course began. It was critical for the CYB program to have tested the viability of Kali Linux prior to replacing Backtrack 5 in the entire CYB curriculum.

Baseline benchmark numbers for the specific loading encountered in a "low usage" month were obtained for several subjective parameters that users frequently use to judge the performance of any IaaS or CLasS service, specifically for a virtual machine, times in seconds to (a) Startup, (b) Reboot, (c) Wakeup, (d) Total time after login to get started, (e) Application Startup, and (f) Shutdown. The month was "low usage" because the statistics-gathering class, CYB 602, was the largest, and the other students using ISLE totaled 14 students using a variety of virtual machines. Ideally, it would be good to have had only CYB 602 using ISLE during the sampling period. Nevertheless, the statistics gathered do provide a baseline for comparison purposes to judge ISLE performance in the future. The results definitely suggest that if Fedora is to be used in any of the exercises, a more stable and efficient build needs to be found. One of the major objectives of the research, however, was to evaluate the quality of the new Kali Linux distribution, as it is targeted to be used in at least six future CYB courses to replace the use of Backtrack 5. Tests by all students were conclusive in proving that Kali is the definite choice for migration.

The authors recommend that the university continue to leverage its unique virtual infrastructure to advance student learning in not only the CSIA program but in other programs as well. This idea has been proven successful to allow enhanced student learning at reduced university cost and overhead. In the end, the value added to the degree will pay for any infrastructure modifications that might arise. After all, it is technology like this that has helped the university gain such notable recognition in providing academic excellence (NUCSIA, n.d.). Personally, for Anderson, as an active student, virtualized instruction was a large part of the decision to attend National University and this specific program. Anderson knew the importance of getting hands-on exposure to the tools in the field, and the NU CSIA program afforded that option.

Future Research

The authors recommend, minimally, that each CYB 602 class perform the same tests as shared in this paper in order to determine the current "state of health" of ISLE and use the findings to help NU/IT tune ISLE to be functioning to its optimum capacity. The gathering of the data fits in with the course learning outcomes, so the task is not a distraction. Obviously, much of the data collected in this study is highly subjective, and the authors suggest developing an expanded set of criteria and process to more systematically and scientifically capture timing data.

References

Anderson, R., and Romney, G. (2013). Comparison of two virtual education labs: Closing the gap between online and brick-and-mortar schools. *ITHET 2013 Conference*, Antalya, Turkey, Oct. 12–13, 2013, In print.

BackTrackLinux.org. (n.d.). *BackTrack.* Retrieved August 2, 2013, from www.backtrack-linux.org
Committee on National Security Systems (n.d.). *National Centers of Academic Excellence in IA Education (CAE/IAE) criteria for measurement.* Retrieved August 22, 2013, from http://www.nsa.gov/ia/academic_outreach/nat_cae/cae_iae_program_criteria.shtml
Digi.com. (n.d.). *Anywhere USB overview.* Retrieved August 14, 2013, from http://www.digi.com/pdf/prd_usb_anywhereusb.pdf
dlc.sun.com. (n.d.). *Oracle VM VirtualBox user manual.* Retrieved August 2, 2013, from http://dlc.sun.com.edgesuite.net/virtualbox/4.2.16/UserManual.pdf
iNetwork, (2013). CLasS is a trademark of iNetwork, Inc., San Diego, CA 92119.
Kali.org. (n.d.). *Kali Linux.* Retrieved August 2, 2013, from www.kali.org
NationalUniversity.edu. (n.d.). About National University. Retrieved August 8, 2013, from http://www.nu.edu/OurUniversity/TheUniversity.html
NIST.gov. (January, 2011). *Special Publication 800-125: Guide to security for full virtualization technologies.* Retrieved August 2, from http://csrc.nist.gov/publications/nistpubs/800-125/SP800-125-final.pdf
Nmap.org. (n.d.). *Nmap.* Retrieved August 8, 2013, from www.nmap.org
NUCSIA.nu.edu. (n.d.). *Cyber security and information assurance.* Retrieved August 23, 2013, from http://community.nu.edu/csia
PaloAltoNetworks.com. (n.d.). *PA-2000 series.* Retrieved August 14, 2013, from https://www.paloaltonetworks.com/products/platforms/firewalls/pa-2000/overview.html
Romney, G. (2004). A teaching prototype for educating IT security engineers in emerging environments. *ITHET 2004 Conference*, Istanbul, Turkey, June 1–3, 2004, IEEE Catalog Number: 04EX898C; ISBN 0-7803-8597-7.
Romney, G. (2009). The integration of Ruby on Rails as an agile teaching tool in IT curricula. *ASEE/PSW-2009 Conference*, San Diego, CA, March 19–20, 2009, p. 481.
VMware.com. (n.d.). *Physical topology of vSphere Datacenter.* Retrieved August 14, 2013, from http://pubs.vmware.com/vsphere-51/index.jsp?topic=%2Fcom.vmware.vsphere.vcenterhost.doc%2FGUID-8BE2902F-AF5D-4493-95E3-B93A8A862192.html
VMware.com. (n.d.). *VMware high availability.* Retrieved August 14, 2013, from www.vmware.com/pdf/ha_datasheet.pdf
VMware.org. (n.d.). *Desktop education solutions.* Retrieved August 2, 2013, from http://www.vmware.com/solutions/education/desktop/case-studies.html
Wireshark.org. (n.d.). *Wireshark.* Retrieved August 2, 2013 from www.wireshark.org

About the Authors

Roberta C. Anderson
MS CSIA Student
Department of Computer Science, Information and Media Systems, School of Engineering, Technology and Media
National University
San Diego, CA
Jrjanderson11@hotmail.com
Research interests: information assurance, cyber security, online education, cybercrime and the human psyche, hacking technology, youth security education, awareness, training

Gordon W. Romney
PhD, Professor
Department of Computer Science, Information and Media Systems, School of Engineering, Technology and Media
National University
San Diego, CA
gromney@nu.edu
Research interests: information privacy, authentication, identity management, biometrics, securing wireless body area networks, 3-D graphics, virtual instruction cloud, hacking technology, virtualization, trusted computing

Heuristically Oriented Systems of Problems in Teaching Mathematics

Olena Scafa

Abstract
The commonly accepted interpretation of a system of problems in mathematical education is a selection and sequence of problems that help to develop all components of the students' mathematical background: (a) actual knowledge and skills required by the program, (b) mental operations and mental activity techniques, (c) the mathematical style of thinking, and (d) rational and productive ways of learning and cognition. The author introduces special heuristically oriented systems of problems that serve as an efficient tool of "light-hand" guiding the process of learning mathematics. The goal is to develop students' mathematical culture and build up their heuristic skills.

Key Words
Systems of problems in teaching of mathematics, heuristically-oriented problems, heuristic skills.

Introduction

One important task of a mathematics teacher is to teach students to think creatively, engage in critical thinking, discover new regular patterns, and cultivate an interest in research. These qualities can be developed, for the most part, in the process of solving problems.

Over the past three decades, different investigations dedicated to the theory of problem solving have been completed in educational psychology in general and in didactics and methodology of teaching mathematics in particular. A significant contribution to this theory was made by many researchers, such as G. Ball, K. Besher, M. Burda, L. Friedman, M. Ganchev, L. Gurova, L. Hollinves, Yu. Kolyagin, V. Krupich, L. Larson, A. Matjushkin, N. Marshall, S. Papet, G. Polya, E. Raybis, W. Reitman, G. Sarantsev, A. Stolyar, R. Streng, L. Terman, T. Uiston, P. Uitti, and others. Fundamental investigations on construction of problems, their structure, and typology were performed. Methods of teaching problem solving, including teaching mathematics through solving a specially constructed and organized set of problems, have been formulated and developed. The concept of "problem" has been expanded in the context of intellectual and creative activities. The term "a heuristic problem," which is synonymous to the terms "a creative problem" (G. O. Ball, O. F. Esaulov, L. M. Fridman, Y. M. Kolyagin, Yu. M. Kulyutkin, L. N. Landa, I. Ya. Lerner, A. M. Matyushkin, P. I. Pidkasisty, Ya. O. Ponomarev, & V. G. Rozumovsky), "a challenging problem" (I. Ya. Lerner, M .I. Mahmutov, A. M. Matjushkin, and others) and "a non-standard problem" (D. O. Aleksandrov, L. M. Fridman, E. M. Turetsky), has been introduced.

This author thinks that the concept of "creative problem" is wider, while the concept of "challenging problem" is narrower. In this author's understanding, the terms "heuristic problem" and "non-standard problem" are close. This conclusion was based on that fact that a non-standard problem usually allows some independent formulation of its solutions based on the analysis of existing knowledge and experience.

Under different conditions of human intellectual activity, the dynamic correlation of heuristic approach (a search leading to the discovery of new ways of solving problems) and non-heuristic approach (solving problems performed by certain regulations and algorithms) depends on the mental activity of the person (Krupich, 1995). In the psychology of thinking, there are two fundamentally distinct ways of problem solving: algorithmic and heuristic. The first procedure is based on a certain established algorithm, while the second discovers new ways of solving

problems (Polya, 1965). Teaching mathematics should involve both algorithmic and heuristic approaches.

Theoretical Aspect of the Notion of a Heuristic Problem

In the process of interaction with a heuristic problem, students generate so-called rules (methods) of preferred search for its solution. These rules help students attain a subconscious level allowing self-regulation of their activities. In the theory of heuristic teaching mathematics, such techniques are referred to as heuristic methods of general and special types. Both types are the means of a "light-hand" guidance process of problem solving (Skafa, 2009).

Heuristic problems form the basis for introducing the students to a situation where their positions appear subjectively heuristic. A problem becomes heuristic depending on how students perceive it: They may take it either as personally meaningful and valuable or as insignificant and valueless.

In the first scenario, students consider problem solving as a way to learn a method to reach further goals, while in the second case the solution itself is the goal. In the second case, the cognitional process is over as soon as the problem is solved. On the contrary, in the first case the process is developing continuously, leading students to the situational stimulation of heuristic activity that, in turn, allows them to extend the knowledge beyond the standard boundaries.

That is why such researchers as Hoon, Singh, Han, and Kee (2013), Koichu (2003), Larson (1983), Lee and Reigeluth (2003, 2009) and others support the heuristic approach.

Thus, by a *heuristic problem* we mean a problem allowing independent formulation of the solution method. In the process of such solution, the students get in a situation in which they reveal their heuristic positions. In other words, it is a problem aimed at finding an individual method of solution by applying heuristic skills.

For instance, for students who have already learned an algorithm for solving quadratic equations, a problem of solving such equation is algorithmic.

However, when it is given to students who only know the factorization method, and can solve equations of the form $(x - a)(x - b) = 0$, they can apply some heuristic methods, namely, analysis, scaled arithmetic, transition to a similar problem, and so on. In this case, the initial problem is a heuristic one.

The students' heuristic activity appears in the process of solving such problem.

It is known, however, that an efficient way of teaching mathematics cannot be based on offering separate problems, including heuristic ones. The problems should be organized in a system having strong connections with the theoretical material, because it can be understood and acquired efficiently only in the process of solving problems.

The Methodological Requirements to the Systems of Heuristic Problems

The components of the system are heuristic problems. Each problem has a certain function in the system. The problems are connected with each other. We call these connections *relations*. The system itself is built by means of the relations between the problems.

One relation can include several problems. Relations that are typical for systems of heuristic problems may include the following: relation of the general idea, relation of specialization,

relation of generalization, relation of analogy, relation of concretization, relation of modeling, relation of the extreme case, and so on.

It should be noted that systems of heuristic problems have a high level of structural organization. They are effective means of a goal-oriented mathematical development of students, formation of their cognitive independence, activity, interests, attitudes, and other personal qualities.

Based on the requirements to systems of problems, as proposed by Zilberberg (1995), Kolyagin, Khar'kovskaya, and Gyl'chevskaya (1979), Krupich (1995), and others, *the methodological requirements to the system of heuristic problems* have been formulated as follows:

1. The problem selection must match the mathematics course content and completeness of the presentation of heuristics.
2. The problems in the system must correspond to their roles in the process of teaching mathematics and provide for a reasonable balance between the heuristic and logical components at each stage of teaching.
3. Each problem must have strategic complexity (a logical sequence of steps leading to the problem solution), as well as technical complexity. Therefore, it is important to alternate the ideological and technical complexity as the priorities in the system of problems.
4. Solving one or two problems as examples should be the basis for comparing and discussing different ways and methods of solution. They may be viewed in various aspects: standard or original approach, the amount of calculations, the practical value, and everything else that may turn out useful for solving other problems of the system.
5. Selection of the problems in the system should be performed differently for different typological groups of students.
6. The problems in the system should facilitate inter-subject generalization of the knowledge and skills. They must focus the student on "discovery."
7. The system should include problems of different kinds of structure and content, aimed at understanding the main mathematical ideas by raising intuitive reasoning to the level of conscious logical process according to the scheme: *pre-understanding–formalization–perception* and providing for the motivation of this transition.
8. Some of the problems in the system must be offered in the form of hypotheses. The system must provide for their further development.
9. The system of problems should help students to master heuristic skills and encourage their open-mindedness.

A problem system may include several subsystems, for which it plays the role of a supersystem. Solving problems within a specific subsystem is aimed at achieving a certain didactic goal. That is why a subsystem cannot always be removed in an arbitrary way, although, generally speaking, it is possible. The system must be flexible, because its structure changes with its purpose.

Such systems of heuristic problems have been presented in the monograph by Skafa and Milushev (2009).

A Heuristically Oriented System of Problems

In the present research, systems of heuristic problems have been developed with the purpose of guiding students' heuristic activity as they learn mathematics. Such problem systems are referred to as heuristically oriented.

Solving such problems helps in building up the students' heuristic skills.

In other words, a *heuristically-oriented problem system* is a system of heuristic problems, designed to guide students' heuristic activity. Such system is based on a set of general and special heuristics.

The student activity in the process of solving a system of heuristically oriented problems is organized in a four-stage process.

Stage 1

At the first stage, the heuristic problems are used, depending on the situation, in order to achieve a specific didactic goal of the lesson (application of knowledge, incentives to better understanding of new information, differentiation of new knowledge acquisition process, or control), as well as to stimulate the students' cognitive interest and boost their heuristic activity.

For example, Students are offered the following assignments in order to help them "discover" the fact that all axioms and theorems of plane geometry are also valid in stereometry:

1. *Which of the following figures are not plane: an interval, a circle, a prism, a cylinder, a right angle, a right triangle, a rectangular prism, or a plane?*
2. *Take six matches and make four equilateral triangles so that each side of each triangle is one whole match long.*
3. *Are the following objects geometric figures: a point, a line, a plane, a space, an aerobatic maneuver performed by a pilot, or chess pieces?*
4. *Cut the cylinder into 8 pieces with three planes.*
5. *Make the shape shown in Figure 1 from a rectangular sheet of paper.*

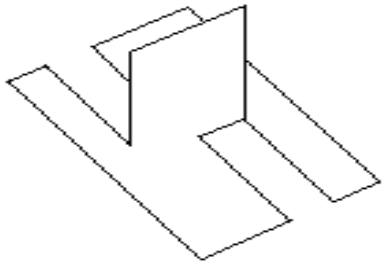

Figure 1.

In the process of solving problems, students look for analogy with plane geometry and use such heuristic tools as "think about the model," "experiment," "act by analogy," and so on. To successfully form the students' heuristic skills, the teacher must make sure that the formal shell of a concept or fact does not overshadow its sense and practical meaning in the students' eyes. Therefore, the problems for initial solving should be selected in such a way that the student can see the practical application of abstract mathematical concepts.

Stage Two

At the second stage, the problem-solving process is organized in typical forms in order to stimulate heuristic activity:

1. Oral activity—for heuristic problems of definite content
2. Cooperation in dialogs—for semi-definite problems
3. Teamwork—for indefinite heuristic problems

For example, the teacher offers a problem similar to Assignment 6 to the students for oral discussion.

6. *The net of a cube is shown in Figure 2. Which of the cubes from (b) through (f) match this net?*

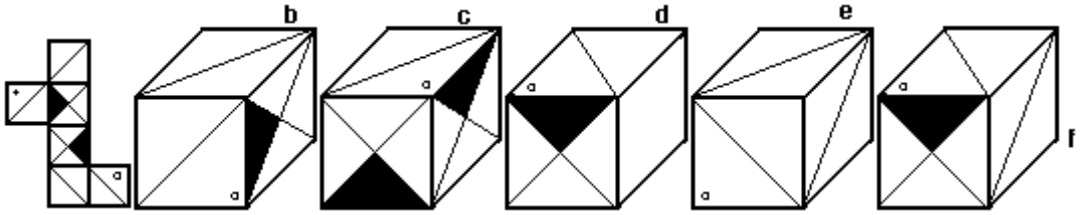

Figure 2.

Students explore and determine the quantitative characteristics of the object, its forms and proportions, and formulate questions and problems related to more interesting facts, for example: How does the exterior of the cube depend on its net and the figures on its faces?

Stage Three

At the third stage, the principle of the problem "development" is actively used, which helps to display heuristic activity of students. Students perform various graphic experiments, which facilitates the process of finding an unknown product of activity and forms the skills needed for constructing new problems. The problem "development" can be defined as independent achievement of results, such as formulating and solving problems new for the student, as well as new theorems, formulas, hypotheses, and methods (Ol'binskiy, 1998).

For example, the teacher offers the problem: *In a regular triangular pyramid, the lateral edge length is l. A lateral face is inclined to the plane of the base at the angle ß. Find the volume of the pyramid.*

While analyzing the problem, the student notices that the process of solving would have been much easier if the side of the triangle in the base *a* or the height of the pyramid *H* were known. By "developing" the problem in this direction, students come up with a new problem:
In a regular triangular pyramid, lateral edge is l, and lateral face inclined to the basal plane at the angle ß, the height is h. Find the volume of the pyramid.

We have found a number of "problem development" methods in practice: transformation of a problem, formulation of a similar but more complicated problem, generalization of a problem, specifying a problem, and formulating an inverse problem.

Here the most interesting thing for us is not the way the students solved the problem but the tasks they were setting for themselves.

Stage Four

The fourth stage allows creative application of heuristic problems of the system. At this stage, students feel a necessity of independent search for new "discoveries." Students determine their readiness for this stage, which is the stage of search, formulating and solving heuristic problems of various types.

For example, the following problems are offered to the students as an object of investigation.

1. *Prove the analogy of Pythagorean Theorem for a rectangular tetrahedron.*
2. *Are there four mutually perpendicular skew lines in space?*

The results of solving such problems can be introduced at student research conferences, in elective classes, or in mathematics student clubs. The project-based learning can be used in this situation.

Based on the preceding, we can formulate the didactic goals of teaching mathematics by means of heuristic-oriented problem systems:

1. *Inspiration for studying mathematics*—the textbooks and exercise books may benefit from augmenting them with systems of heuristic-oriented problems, boosting interest for practical and theoretical issues of mathematics.
2. *Carrying out propaedeutic functions*—problems of the system play a certain generalizing role and contain useful information of practical importance to be used in the future.
3. *Preparation for studying theoretical issues of the course*—problems of the system help to focus students' attention on ideas, concepts, and methods of the mathematics course that are going to be studied; they facilitate motivation for studying new concepts and create a problem situation with the goal of acquiring new knowledge.
4. *Helping to acquire theoretical material*—the problems of the system require the use of heuristic techniques to consolidate the acquired theoretical knowledge. They are important for learning mathematical concepts and theorems of the mathematics course and give students an opportunity to learn ways to apply the acquired theoretical knowledge for practical purposes.
5. *Building up research skills as a structural component of heuristic activity*—systems of heuristically oriented problems with research features (for example, problems involving parameters) build up research skills through knowledge and skills acquired by multiple repetition of the operations, activities, methods, and algorithms that are the subject of study.
6. *Review*—application of the previously gained knowledge and skills is possible due to the strong interrelation of the course units. Besides, reviewing the previously covered material may be a special goal of heuristic problems offered by the teacher.
7. *Assessment of acquired mathematical knowledge*—systems of heuristically oriented problems offer an opportunity to assess the presence and depth of the knowledge acquired by students in certain parts of a mathematics course.

Conclusion

Systems of heuristic-oriented problems are offered by the present author for all basic topics of the school mathematics program. They can be used for classwork, teamwork, and individual student work. The system has the following structure:

1. *Application of knowledge* by testing the students' fundamental skills in the basic topics of the mathematics course. This is performed by assigning a system of tests and reviewing each of them afterwards.
2. *System of heuristic problems* with "heuristic hints," putting students on the right track in search for a problem solution. Such hints contribute to a meaningful approach to the problem-solving process. This develops students' ability to use various heuristic tools in the process of searching for the solutions of various mathematical assignments.
3. *Assignments for assessment of the acquired skills*, both educational and heuristic. Such assignments are presented in the form of "problem-sophisms," "problem-methods" (for example, finding mistakes in a reasoning or finding solution methods for the given problem), and problems on recognition of heuristic types. (Skafa & Prach, 2013)

Teaching mathematics with the help of heuristic-oriented systems of problems allows students to acquire the heuristic abilities to:

1. Analyze a given situation with the purpose of finding specific characteristics.
2. Correlate the known elements of the problem with the unknown ones (that is, given elements with elements to be found).
3. Identify known/given elements in various situations.
4. Compare the given problem with problems already known.
5. Create new combinations of the given concepts and facts relating to the elements of the given problem and compare them to the statement of the problem and its goal.
6. Develop simple mathematical models of the given situation.
7. Identify elements of the problem with elements of the model.
8. Perform an imaginary experiment and predict its intermediate and final results.
9. Form hypotheses using inductive methods and make conjectures.
10. Divide the given problem into subproblems, identifying partial problems whose solutions help to find elements necessary for solving the primary problem.
11. Confine inductive search to reasoning by intuition, logic, and common sense.
12. Verify the suggested hypotheses by deduction or disprove them by a counterexamples.
13. Interpret the results of the work on the model of the situation defined by a problem, encode the language of the situation in terms of the model, and decode the results expressed in the language of the model.

The aforementioned structure forms an efficient approach that helps to extend students' creativity, engages them in critical thinking, and cultivates in them an interest in research. These qualities can be developed in the process of solving problems. It is crucial that the accurate

organized and selected set of such problems be developed, taking into account that fact that a non-standard problem usually allows some independent formulation of its solutions based on the analysis of existing knowledge and experience.

References

Hoon, T. S., Singh, P., Han, C. T., & Kee, K. L. (2013). Heuristic approach experience in solving mathematical problems. *Educational Research, 4*(8), 607–611.

Koichu, B. (2003). Junior high school students' heuristic behaviors in mathematical problem solving. Unpublished doctoral thesis, Technion, Haifa.

Kolyagin, Y., Khar'kovskaya, V., & Gyl'chevskaya, V. (1979). *A system of learning problems as a tool for developing mathematical thinking of high school students.* Moscow: Prosveschenie.

Krupich, V. (1995). *Theoretical basis of teaching of solution of school mathematics problems.* Moscow: Prometey.

Larson, L. (1983). *Problem-solving through problems*. New York, Berlin, Heidelberg, Tokyo: Springer-Verlag.

Lee, J.-Y., & Reigeluth, C. M. (2003). Formative research on the heuristic task analysis process. *Educational Technology Research and Development, 51*(4), 5–24.

Lee, J.-Y., & Reigeluth, C. (2009). Heuristic task analysis on e-learning course development: A formative research study. *Asia Pacific Education Review, 10*(2), 169–181.

Ol'binskiy, I. (1998). Problem development. *Mathematics in School*. №2, 24–30.

Polya, G. (1965). *Mathematical discovery. On understanding, learning and teaching problem solving.* New York, London: John Wiley & Sons.

Skafa, O. (2009, March). A heuristic component in the secondary school teaching methods. *Journal of Research in Innovative Teaching, 2*(1), 136–143.

Skafa, O., & Milushev, V. (2009). *Construction of educational knowledge heuristic work on solving mathematics problems.* Plovdiv: РUI ПУИ «Paisiy Hilendarskiy».

Skafa, O., & Prach, V. (2013). Management of heuristics activities of students in mathematics classrooms. *Mathematics in modern school*. №5.

Zilberberg, N. (1995). *A mathematics lesson: Preparedness and conducting.* Moscow: Prosveschenie.

About the Author

Olena Skafa
Doctor of Pedagogic Sciences, PhD, Professor,
Department of Mathematics
Donetsk National University
Donetsk, Ukraine
e.skafa@ukr.net

Research interests: heuristic teaching of mathematics, online learning, teacher preparation, innovative approaches in teaching, educational tech

Merging the Tower and the Cloud through Virtual Instruction: The New Academy of Distance Education

Gordon W. Romney and Baird W. Brueseke

Abstract
Education is being reshaped by recent advances in technology including mobile devices, the ability of MOOCs to reach thousands of distance learners, and the widespread use of social media. Universities must confront challenging questions on how to maintain course completion revenue. In order to remain competitive, institutions of higher education need new tools and agile staff that can attract and retain students with innovative, online teaching. The reported Virtual Instruction Cloud research delivers new virtualization technology, CLaaS, that provides both Connectivist and Constructivist theoretical support, and provenance and IP protection of content; preserves accreditation standards, and protects academic revenue streams.

Key Words
Agile, CLaaS, cloud computing, experiential virtual lab, MOOCs, online, provenance, vetting

Introduction

Virtual instruction is a trending form of pedagogy that is rekindling curiosity and a desire to learn in the world's population. Universal social media adoption, combined with the technological capabilities of Web 2.0, foretell the exciting capabilities that future Web 3.0 mash-ups will bring to online education. The Virtual Instruction Cloud (VIC) described in this paper is the product of several years of research and is a proposed online educational model that institutions of higher learning might use to maintain accreditation and degree standards, assure properly vetted course material, protect curriculum intellectual property, and receive payment-toward-degree for completed, accredited courses. The VIC is a research initiative that parallels the development of Massively Open Online Courses (MOOC) and Connectivist learning theories and models (Siemens, 2012). VIC offers students trial courses as part of the curiosity-driven learning process and flexible course content in a distance-learning environment, while assuring that academic institutions receive recognition for accredited degrees and a sustainable revenue stream.

The use of virtualization technology is particularly useful in the teaching of computer science and information technology curricula. A Glossary of Information Technology Terminology used in this paper is provided at the end of the manuscript. Ever since the advent of computer technology education in the 1960s, academic institutions have invested large sums of capital to equip their programs with the computing equipment necessary to support the learning outcomes defined in computer-related curricula. Increasingly, virtualization provides a greatly enhanced service capability at a significantly reduced cost per student. The School of Engineering, Technology and Media (SETM) of National University (NU) has distinguished itself by providing a Virtual Education Lab (VEL) to support experiential cyber security laboratory exercises that use virtualization (Romney & Juneau, 2009; Romney & Juneau, 2010). The advent of Cloud computing, which leverages virtualization, brings with it the possibility of even greater efficiencies (Romney, Gatton, Cruz, & Kennedy, 2008; Gonzales, Romney, Bane, & Juneau, 2013; Gonzales, Romney, Dey, Amin, & Sinha, 2012). The VEL (SETM) and its successor, the ISLE (NU), are private clouds and are described in another publication (Anderson & Romney, *in press*).

The Computer Lab as a Service (CLaaS) (CLaaS, 2012) concept implemented in the Virtual Instruction Cloud is a collaborative product of academic (National University) and industry (iNetwork) research conducted during the agile development of a Master of Science in Cyber Security and Information Assurance (MS-CSIA) program created and deployed by the authors and others at National University. The instructional design (Lunt, Ekstrom, & Romney, 2006) evolved over a 10-year period in classes taught by one of the authors in two different universities (Romney, Higby, Stevenson, & Blackham, 2004; Stevenson & Romney, 2004; Romney & Stevenson, 2004). Research and student feedback encouraged the use of agile teaching methods (Romney, 2009; Dey et al., 2009; Dey et al., 2012) to include virtualization as a vital teaching tool (Sahli & Romney, 2010); Romney et al., *in press*). The curriculum development and instructional design of the MS-CSIA program was based on VEL/ISLE usage. The program design met both Western Association of Schools and Colleges (WASC) Accreditation standards and the Committee on National Security Systems (CNSS) 4011 and 4012 certification requirements (NSA.gov, n.d.). In June 2013, after 4 years of planning and implementation and 2 years of operation and graduation of three cohorts of students, National University, jointly with the MS-CSIA program, was designated a Center of Academic Excellence (CAE) by the National Security Agency (NSA) and the Department of Homeland Security (DHS) (NSA.gov, n.d.; NUCSIA.nu.edu, n.d.) This achievement is a clear demonstration of the value that agile pedagogy and experiential learning through virtualization bring to the curriculum development and instructional design process.

The authors' experience during the development of NU's MS-CSIA curriculum inspired the creation of a new distance-learning model for teaching and learning in the 21st century. The Virtual Instruction Cloud (Romney & Brueseke, 2012) is a patented design for a creative system that will unify the Tower and the Cloud in a powerful new tool that will empower institutions of higher education to confront and dominate the educational challenges that loom large in the immediate future.

Distance Education and Online Education

The distance-education modality was coined by Dr. Otto Peters in Germany in 1982 (Anderson, 2013). Anderson, of Athabasca University (AU) in Canada, was involved with the International Council for Correspondence Education when its name was changed to International Council for Distance Education in 1982. Subsequently, with the availability of the Internet, the evolution of new social trends, and economic constraints, online education has flourished. AU is an online university focused on the future of learning. George Siemens, a colleague of Anderson, is a researcher at the Technology Enhanced Knowledge Research Institute at AU, and has focused on the influence of technology and media on education. Siemens pioneered open Connectivist courses for over 15,000 students and educators in thirty countries. Connectivism is a learning theory for the digital age. In 2008, colleagues of Siemens, Dave Cormier and Bryan Alexander, inspired by his open courses, coined the term Massively Open Online Courses (MOOC) that many consider a new educative practice (gsiemens, 2012).

Digital Age Pedagogical Theories (MOOCs)

Siemens, Groom and Couros base their online teaching on a pedagogical participatory model that

differs from the elite and well-funded university model (Coursera/edX) that was initiated in 2012–13 and is more publicized (Stacey, 2013). Siemens distinguishes between the two as being Connectivist versus Constructivist (gsiemens, 2012). Important differences exist in the underlying views of knowledge and learning that constitute the structure used by the different MOOC models, as explained by Siemens (gsiemens, 2012). Perhaps the most significant difference is that the participatory model is based on Connectivist theory "… that knowledge is distributed and learning is the process of navigating, growing, and pruning connections" (gsiemens, 2012). In contrast, the Constructivists adopt a traditional view of knowledge and learning. Instead of distributed knowledge networks, their MOOCs are based on a hub-and-spoke model: the faculty and knowledge are at the center, and the learners are replicators (spokes) of knowledge (Egan, 2004).

Technology allows "… institutions to blur, if not erase, institutional boundaries once clear and distinct" (Katz, 2011). In addition to the Connectivist version of MOOCs, both commercial nonprofit (Mitx, edX) and for-profit (Coursera, Udacity) entities (MOOC, *Wikipedia*, n.d.; Kolowich, 2013) have developed. The Constructivist MOOCs partner with multiple educational institutions for contributed courseware and focus on distributing select free courseware to online students. Early MOOC models emphasized open access, open licensing of content, and open structure and learning goals, while newer MOOCs use closed licenses for course materials but free access for students (MOOC Celebpedia, 2013; Sloan Consortium, 2013).

The Influence of Mobile Cloud Computing on Education

Students and faculty increasingly interact with databases and Big Data (Big Data, n.d.; "Special Report," 2010; IBM, n.d.) through mobile computing, cloud computing, wireless networks, and distributed information repositories. Frequently this is referred to as Mobile Cloud Computing, as shown in Figure 1, and it influences the very framework of education, at all levels, at an accelerating pace.

The rate of information usage on the Internet increases almost more rapidly than manufacturers can produce mass storage. Seagate Technologies, a disk storage manufacturer, sold a record high 0.33 zettabytes (Zettabytes, n.d.) of storage in 2011 (Cisco, 2011). International Data Corporation forecast 2012 total global data at 2.7 zettabytes, an increase, in one year, of 48% over the 2011 level (IDC, 2011). Cisco (2011) estimated total monthly Internet traffic in 2011 to be 20 petabytes. Routinely, the U.S. Library of Congress (LofC) archives, monthly, 0.5 petabytes of digital information. The authors estimate the total printed and digital content of the LofC, as of October 2013, to be 20 petabytes, not including four times this amount in multiple archived copies (Johnston, 2012). Hence, the global Internet currently processes, monthly, more than the equivalent information content of the LofC. One zettabyte is one million petabytes, or the equivalent of the contents of 50,000 Libraries of Congress.

Mobile computing devices have become the preferred delivery instruments for digital content. Increasingly, video delivery of information is the preferred method, and it is forecast that by 2015 it would require 5 years to watch the amount of video that crosses global networks every second (Cisco, 2013). Student learning by means of the cloud has become a collaborative, or social process, and students do not see social interaction as "jumping on the Internet" but, rather, as a lifestyle.

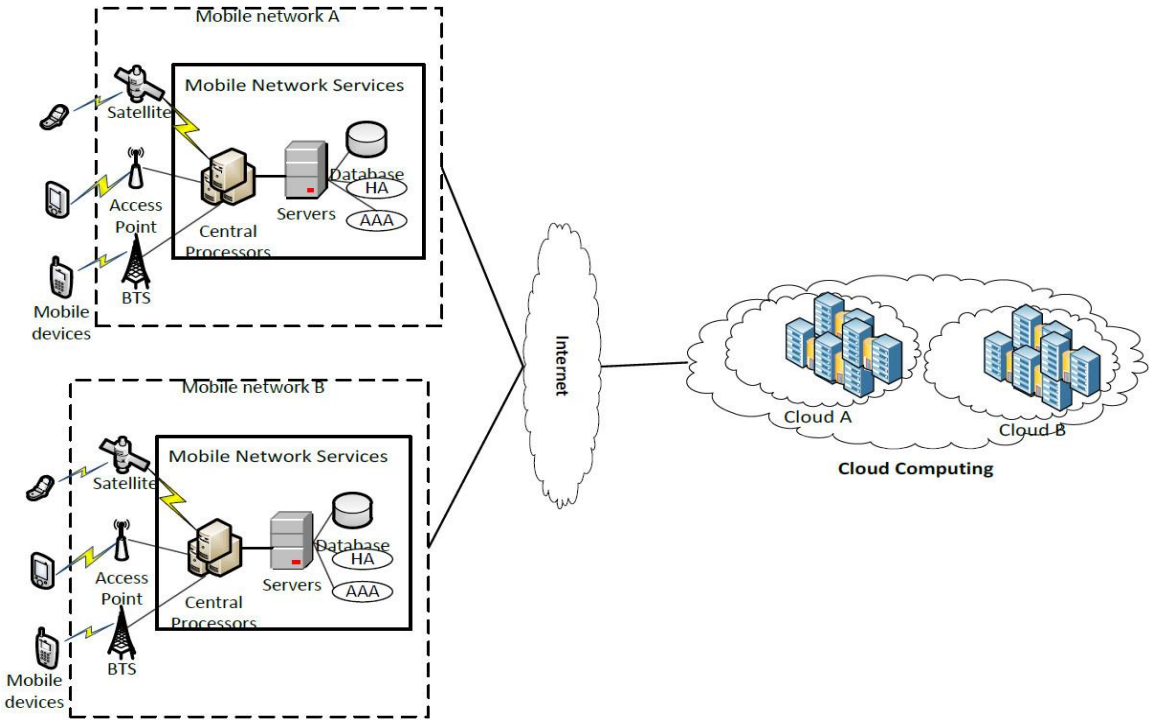

Figure 1. Mobile cloud computing.

Cloud computing, increasingly, has become the technology of preference used to distribute masses of data to users-on-the-go of mobile technology smartphones, pads, and computers. Most Internet users with initiative, a common wireless device, and access to a search engine can join the learning fun. Educause cautions that the rate of change is accelerating and the change is taking the form of a traditional cloud in nature and even assumes its "cloudiness." There is concern that this denotes confusion and lack of clarity and the fact that clouds do not get clearer as you approach them.

The Educause publication, *The Tower and the Cloud* (Katz, 2011), emphasized that the emergence of "cloud" technology has significant implications on us, individually and collectively, for higher education as we know it. It posits that it is "likely that IT will cut its own channels, leading to the creation of institutions that differ from those of today" (Katz, 2011). The Virtual Instruction Cloud (VIC) is one embodiment of pedagogy, processes, information, and technology that raises higher education to the next quantum level of framework success. VIC was inspired by, and is based on, a decade of distance-enabled learning research and experience in cyber security education that requires experientially interactive laboratory exercises. The VIC concepts, however, address even the broader, challenging concepts of Massive Open Online Course (MOOC, n.d.) education as it evolves daily before our eyes.

Confrontational and Challenging Higher Educational Questions

This leads to confrontational and challenging questions to higher education, namely:

1. How does teaching begin to handle and make available to users escalating volumes of information overload?

2. How does the educational process protect the quality and attribution of contributed intellectual property?
3. How does the "openness" of the Internet and available information, and the MOOC trend, fit into the traditional accreditation and certification norms of higher education?

Unaddressed are other questions that are not dealt with in this paper, such as the ability of online education to meet the needs of the student. The Sloan online education report (Sloan Consortium, 2012) highlights the opinion of 89% responding education administrators that online students need more discipline in order to succeed, an increase over the 2011 survey. This caution, however, influenced VIC design, its processes, iterative learning capacity, and pedagogy; and, therefore, VIC includes processes to support and assist students less receptive to online delivery.

Research in Online Usage Patterns

The VEL is basically an IaaS (Infrastructure as a Service) cloud service that evolved from a research project directed by one of the authors, Romney, during 2008–2013 and involved deployment of four different versions, each building on the features, hardware, and software of the previous version. As a proof-in-concept research initiative, system administration was provided by faculty and students. The initial network was deployed in class and gradually evolved to include remote access for onsite students. With the decision to create the VEL in support of the MS-CSIA program, an industry collaborator, iNetwork, Inc., provided design and system administrative services to create the SETM Cloud Infrastructure that included the VEL and course support.

The SETM faculty and iNetwork learned together how best to deploy virtual machines in course instruction. iNetwork supervised a student "security officer in training" who served, also, as one of the system administrators. Student assignments and surveys became the vehicle by which VEL Quality of Service data were collected and analyzed. Basic information, such as the frequency of access (Figure 2), duration of usage (Figure 3), and usage time of day (Figure 4) provided by students helped in the design adjustments made to the VEL in each new version.

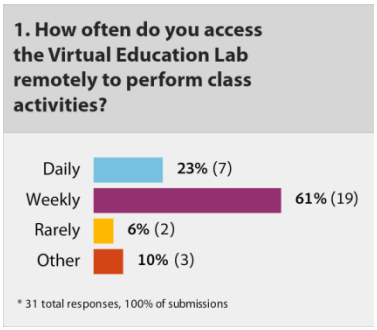

Figure 2.
Frequency of access.

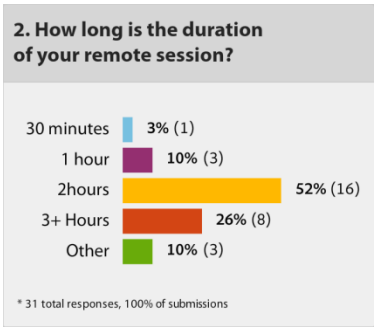

Figure 3.
Duration of usage.

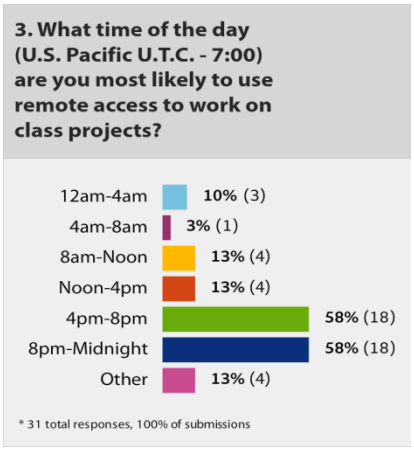

Figure 4.
Usage by time of day.

Figures 2 through 4 represent the responses of 31 students, and these data helped determine the justification for increasing bandwidth expenditures to provide a jump to 50 Mbps from the initial 15 Mbps, and how best to manage system loading challenges.

Additionally, the usage data provided incentive to experiment with different VMware software, so a change of virtual desktop manager from vCenter to View was implemented that provided increased student satisfaction with the IaaS cloud service and virtual lab experience. The goal of each improvement was to minimize latency and delay for entered commands in order to improve Quality of Service.

Useful Tools for Teaching Online Computer Curricula

Virtualization

In order to more effectively manage laboratory time, operating system virtualization (Virtualization) of a computer laboratory exercise was introduced in 2003 by one of the authors, Romney, in cyber security instruction in a semester-based university (Romney et al., 2004). The National Institute of Standards and Technology (NIST) defined virtualization as the simulation of software and/or hardware solutions (NIST.gov, 2011). Microsoft's Virtual PC served as the hypervisor, and Windows XP virtual machines were deployed to students.

The ability to provide students with a stable, hardware-independent, virtual machine configuration that ran on a Windows computer on the first day of lab regained 2 weeks of lost time traditionally spent on coordinating all students with different laptops and hardware drivers to simply begin the assignment.

Virtualization became even more important 4 years later at NU with its one-course-per-month modality (Romney, 2009). For an onsite course, each of the nine class periods was all the more critical, and hands-on assignments were made even more dependent on the use of virtualization. Virtualization facilitated introducing new concepts. Using agile development techniques, a sophisticated course project of a parser written in a popular web computer language, Ruby on Rails, was delivered in a month. Virtualization also facilitated student publishing in the one-course-per-month modality for graduate students Sahli (Sahli & Romney, 2010) and Anderson (2013). Virtualization is part of the fundamental technology that has made cloud infrastructures possible and facilitated the rapid adoption of cloud concepts.

Cloud Infrastructure

Student enrichment is enhanced by agile use of technology (Dey et al., 2009; Katz, 2011; Romney, 2009; Sahli & Romney, 2010). Virtualization and deployment of cloud infrastructures go hand in hand with the use of agile pedagogy. The creation of a Virtual Education Lab (VEL) evolved from the onsite classroom exercises and became a private cloud infrastructure of firewalls, routers, and servers. It was designed and implemented to allow students to access virtual machines in a VMware ESXi based virtual computer environment located in the NU SETM. Secure access was provided from a classroom or remotely through a virtual private network (VPN).

The VEL made it possible to provide online instruction of hands-on computer exercises and a new program, Master of Science of Cyber Security and Information Assurance (MS-CSIA) was designed, accredited by the Western Association of Schools and Colleges (WASC), and placed into operation. The MS-CSIA program, based on VEL usage, offers 15 courses in an MS degree

in CSIA and is one of the few graduate programs nationwide that provide hands-on, experiential security exercises through virtualization.

Useful Tools Led to Successful Outcomes

Over 120 students have graduated and another 100 are enrolled in both onsite and online cohorts. In June 2013, the MS-CSIA program was designated a National Security Agency (NSA) and Department of Homeland Security (DHS) Center of Academic Excellence (CAE) in Information Assurance Education (NUCSIA.nu.edu., n.d.). The VEL, administered by SETM, evolved through four phases of upgrading with 200 virtual machines and reached a need for its next improvement to higher capacity. In the summer of 2013, the Information Security Laboratory Environment (ISLE), operated by NU Information Technology staff, began operation with over 770 virtual machines (Anderson & Romney, *in press*; Romney, Dey, Amin, & Sinha, *in press*).

Online Curriculum Development and Instructional Design

WASC Accreditation and CNSS Certification

Under WASC accreditation, each program has approximately 10 Program Learning Outcomes, and each course in the program has 10 Course Learning Outcomes. For a 12-course program, which is the norm, this means a total of approximately 120 Learning Outcomes. The MS-CSIA program additionally must meet the requirements specified by the Committee on National Security Standards (CNSS) of the U.S. Government in two areas (4011 and 4012 are possible selections) in order to be CNSS certified and qualify as an NSA/DHS CAE. The CNSS Learning Objectives are much more granular and specify another 600 Learning Objectives for CNSS 4011 and 4012 that must be mapped to each of the 12 or more courses in the program. Only with the implementation of virtualization in the lab exercises can a CSIA initiative, such as taught by NU with a course-per-month approach, begin to meet both regional accreditation and CNSS certification standards.

VIC distinguishes between the WASC Institutional, Program, and Course Learning Outcomes (ILO, PLO, CLO) and the much more granular CNSS Learning Objectives. Each Learning Objective is mapped to a Course Learning Outcome (CLO) for all courses in MS-CSIA.

Development of the MS-CSIA Curriculum

The VIC pedagogical model is the product of agility in action, developed as academy, WASC, NU, SETM, MS-CSIA, CNSS, CAE/IAE, VEL, ISLE, and distance learning all converged in the development and implementation of the MS-CSIA curriculum. Assumptions and design principles for MS-CSIA were the following:

1. The curriculum was designed to be used first in online and second in onsite instruction.
2. A CSIA Advisory Council of industry and academic partners was created in order to incorporate needed skills required to meet the Cyber Warrior demand.
3. The VEL was created and implemented to provide virtual machines (VMs) for Cyber Security laboratory exercises.
4. Course usage of VMs, previous templates, laboratory exercises, and the virtual and cloud infrastructure would be designed and specified by SETM faculty and staff, and an industry

partner, iNetwork Inc. (iNetwork-west.com, 2013).
5. The courses were designed in order to meet the specific security certification requirements of the CNSS standards, 4011 and 4012.
6. Both online and onsite instruction and assessment were designed to meet WASC accreditation requirements.
7. MS-CSIA, on a trial basis, would incorporate shared courseware developed and owned by NIATEC (a CAE for the past thirteen years) of Idaho State University and Dr. Corey Schou (NIATEC, 2013).
8. The objective was to have NU qualify for and be designated an NSA/DHS CAE.

A 21st Century Approach to Teaching and Education: VIC Pedagogical Theory

In 2011, during the initial six months of delivery of the MS-CSIA courses and as preparation for the CAE application, it became evident that processes, as implemented at NU/SETM or any other university that the authors could identify, were not in place to efficiently deliver both course material and VEL laboratory exercises. Consequently, the authors collaboratively began to create the VIC with processes that would be scalable in order to better achieve educating the shortfall of 60,000 Cyber Warriors identified by U.S. federal government agencies. Furthermore, VIC would address the "Confrontational and Challenging Questions" previously listed in this paper that apply to not only Cyber Security education but higher education as now challenged by the MOOC initiative that has come into prominence in the last 2 years.

VIC Features

The Virtual Instruction Cloud provides distance learning at Internet speed (e.g. the NU standard of one course per month). VIC employs mobile cloud computing, virtualization for courseware and hands-on laboratory exercises, secure authentication of users and protected course content, and the other capabilities shown in Figure 5. Referencing select VIC Features from Figure 5, associated Instruction Issues that relate to distance learning implementation are summarized in Table 1. The numbers in parentheses within the table refer to a specific VIC feature shown in Figure 5.

VIC Terminology and Environment

Instruction Issue, Item 1: Course/Lab Content Design (204). The predecessor to online education, Computer Based Training was first introduced to the mainstream business community in the late 1980s as desktop PCs became a cost-effective part of the normal business office. Since then, the advances in technology driven by Moore's law, combined with the explosive adoption of the Internet as a medium for knowledge acquisition, have spawned many new teaching methods, including the wide body of software applications that can be grouped together under the moniker of "online education." One aspect of learning that has not yet been satisfied by the current online education applications is "hands on" training. The "hands on" experience is particularly important in the field of computer science; even more so for students seeking to learn the special skills required to become experts in Cyber Security.

Figure 5. VIC infrastructure features.

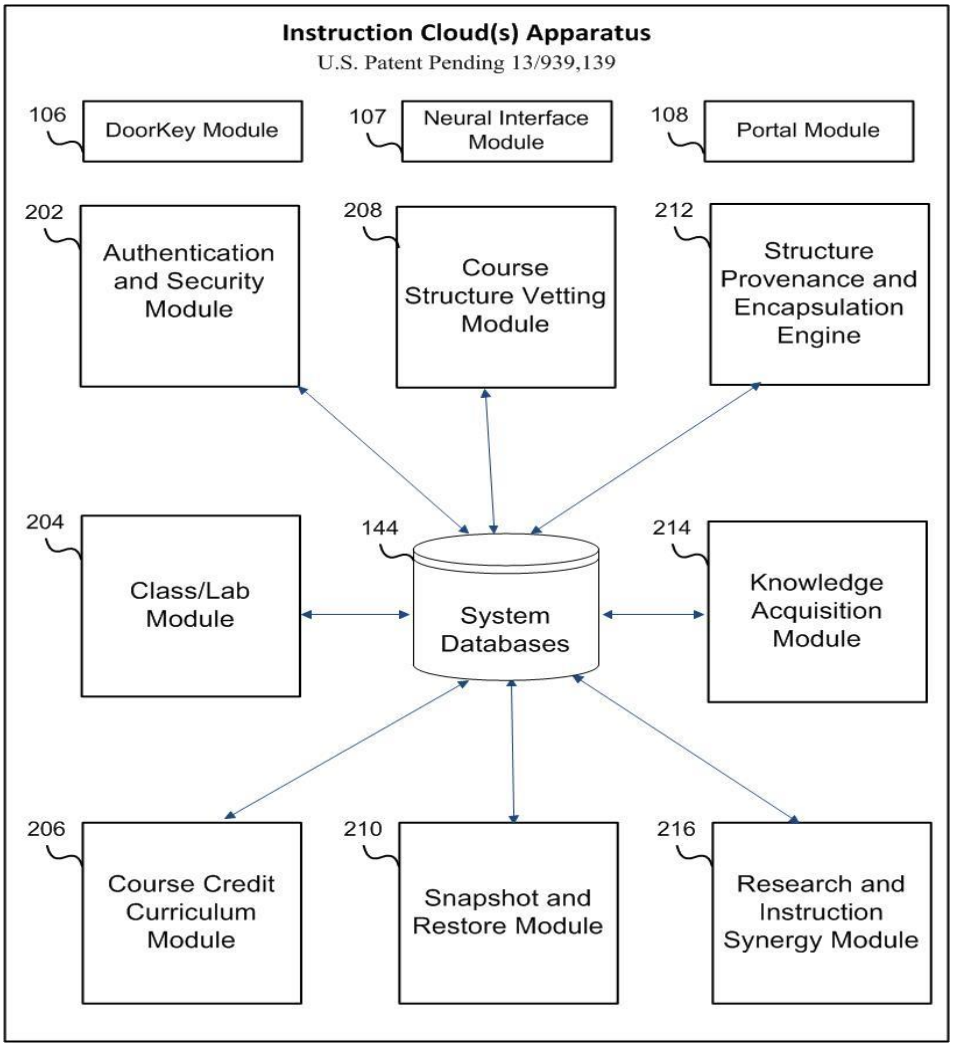

Table 1. *Instruction Issue and VIC Solution*

Item	Instruction Issue	VIC Feature (Figure 5 pointer)
1	Course/lab content design	CLaaS/Lab – CLaaS (204)
2	Obtain credit for completed course	Course Credit Curriculum (206)
3	Content validation and vetting	Course Structure Vetting (208)
4	Virtual machine configuration	Snapshot and Restore (210)
5	Content origin and ownership	Structure Provenance and Encapsulation (212)
6	Integrate research and instruction	Research and Instruction Synergy (216)

Insufficient use of "hands-on training" in the study of computer science is a problem that the VIC resolves. Specifically, the Computer Laboratory as a Service (CLaaS) module (204) shown in Figure 5 provides academic institutions with the ability to provide distance learners with a

remote computer science laboratory experience. CLaaS provides a course-specific, portal-based computer science lab environment for a fee approximately equivalent to the cost of an expensive textbook. This secure environment includes features such as template libraries of predefined laboratory exercises and multiple network configuration variants, which provide the instructor with flexible tools easily modified to meet specific learning objectives.

Instruction Issue, Item 2: Obtain Credit for Completed Course (206). As described earlier in this paper, the nascent MOOC community has brought both excitement and concern to the stolid halls of brick-and-mortar educational institutions. On one hand, the opportunity to simultaneously educate thousands of students is an educator's dream. On the other hand, the potential loss of traditional revenue streams, as well as with the difficulties associated with certification and accreditation, combine to make widespread growth of MOOCs a true nightmare for the individuals tasked with the administration of educational institutions.

The MOOC accreditation problem is solved by the operational function and structure that VIC facilitates in the online modality. The Course Credit Curriculum module (206) shown in Figure 5 provides students with the ability to document the learning activities. This includes everything from watching a YouTube video to completing an online certificate program. It all gets tracked. Another feature of the Course Credit Curriculum module is that it maintains a library of course catalogs and the associated graduation requirements from multiple institutions. Using this module, students are able to create an academic plan and, when they are ready, provide traditional institutions with evidence of their learning activities and the associated provenance supporting their request for equivalent transfer credits.

Instruction Issue, Item 3: Content Validation and Vetting (208). Accreditation of undergraduate course content is an imperative requirement for universities and colleges. The ability to audit classroom assignments against course learning outcomes and trace their pedagogy back up the chain of program objects all the way to the institutional learning outcomes established for the academic organization is an ongoing process that separates the good schools from those that fail to measure up to the high standards set by their peers.

Professors and department chairs tasked with the arduous process of validating and vetting course content and structure find their assignment simplified via the VIC Course Structure Vetting module (208) shown in Figure 5. The Course Structure Vetting module is an automated tool which, when used in conjunction with the VIC Structure Provenance and Encapsulation module, empowers the academic institution with the capability to unequivocally demonstrate individual course compliance with both program and institutional accreditation requirements. One additional feature of the Course Structure Vetting module is the built-in vetting function. The built-in vetting module provides an authoritatively positive identification of the individual evaluating the course content. The vetting function goes further, in that it also encapsulates the provenance of all the content objects used as part of the instruction set(s) that comprise the course curriculum presented to the student. In this way, the Course Structure Vetting module protects the intellectual property rights of the subject matter developer, while ensuring the academic institution is meeting its fiduciary responsibilities to present students with course content that conforms to the requirements of the accreditation organization.

Instruction Issue, Item 4: Virtual Machine Configuration (210). Traditional computer science laboratory configurations include computers linked together in networks that emulate real-world

environments so that students can practice the technical methods presented in the classroom. Recent advances in computer technology have resulted in a number of schools' upgrading their computer labs through the implementation of virtualization using a variety of hypervisor platforms. This trend has produced cost efficiencies and also reduced the amount of system-administration labor necessary to prepare the laboratory for a specific class. However, the ad-hoc adoption of virtualization has not yet addressed the need to save course-specific laboratory configurations consisting of multiple virtual machines combined in complex network configurations. The use of "golden images" specifically tailored for individual course content is the most efficient method of class/lab configuration. This ability to re-deploy "golden images" of predefined labs each time a new instance of a class occurs is an unmet need for many computer science departments.

The need to standardize virtual machine configurations is met by the VIC Snapshot and Restore module (210) shown in Figure 5. The Snapshot and Restore module provides instructors, students, researchers, and system administrators with the ability to configure complex virtual environments and then "save" the configuration for future use. The module's Restore function provides the user with the ability to restart the configuration from a previous checkpoint. The Restore function also has the ability to redeploy the configuration in a new environment. This ability to redeploy in a new environment facilitates the development of libraries containing predefined virtual machine templates for multiple operating systems, predefined network configurations designed to emulate various real-world business environments, and topical and course-specific collections of virtual environments. This need for the rich collection of tools embodied by the VIC Snapshot and Restore module was specifically identified during the research described in preceding sections of this paper.

Instruction Issue, Item 5: Content Origin and Ownership (212). Universities and colleges have produced many innovations and technological advancements that have both enhanced the world we live in and enriched the lives of the content creators and intellectual property owners. The drive to learn, investigate, research, design, create, develop, and produce is a natural result of student curiosity and intellectual ambition. The academic world has many stories of jealousy and intrigue involving developmental timelines and accusations of stolen and misappropriated ideas and techniques. The U.S. patent application process is a tedious, multi-year process that often does not provide sufficient protection for the ideas generated in the rapidly paced and continuously evolving world of academic research. The issues of authorship and usage rights often inhibit idea sharing, and the resulting professional territorialism is a significant limiting factor is the dispersal of new material, theories, and concepts.

The issue of intellectual property origin and ownership is addressed by the VIC Structure Provenance and Encapsulation module (212) shown in Figure 5. This module ensures the integrity of all content objects in the Virtual Instruction Cloud. The module encapsulates all content objects with a digital algorithm that ensures 100% content integrity and attribution. In addition, this module records the author and the date/time stamp of encapsulation. One unique aspect of the date/time stamp metadata is the use of time server appliances to synchronize the encapsulation algorithms results with the atomic clocks maintained by the National Institute of Standards and Technology. This method ensures the auditability and traceability of all content objects maintained in the VIC. Encapsulation addresses the issue of content origin and structural integrity. The provenance feature of this module addresses the issue of ownership. The VIC has many features which facilitate the multiple steps required to fully vet specific content objects.

The provenance function of this module records the complete history of this vetting process and provides the traceability necessary for attestation of intellectual property ownership. The combined functions of Structure Provenance and Encapsulation embodied by this module provide a rigorous method which for the first time will allow academic institutions to rely on accredited, open-source learning materials sourced from the World Wide Web.

Instruction Issue, Item 6: Integrate Research and Instruction (216). The advancement of knowledge has always required the investment of time and effort to discover and understand previously unknown principles of physical objects and intellectual constructs. The vernacular term for this effort is *research*. Not every institution of higher learning sponsors active research programs. However, all universities and colleges do have to deal with the issue of how and when to incorporate new research into mainstream instruction.

The integration of research and instruction is handled by the VIC Research and Instruction Synergy module (216) shown in Figure 5. This module incorporates research as part of the regular class/lab functionality. In addition to the traditional instructor/student roles, all classroom and laboratory functions support the additional role of research. Researchers can post participatory opportunities for students to explore. In addition, researchers can respond to knowledge requests placed by students in the Knowledge Acquisition module (214 in Figure 5). The unique combination of instruction and research is a fundamental feature of the VIC, which ensures real-time synergy between instruction and research, reducing the time lag commonly associated with the introduction of new discoveries. The Research and Instruction Synergy module works in conjunction with the Course Structure Vetting module to ensure that students are not provided with instructional content that does not meet academic accreditation standards.

VIC Model Theory Support in Comparison to Digital Age MOOC Models

The digital age pedagogical MOOC models previously discussed focused on the differences between Connectivist and Constructivist models. Siemens (Gsiemens, 2012) compared the two MOOCS using eight different attributes that the authors have renamed Knowledge Sharing, Student Knowledge Assimilation, Domain of Knowledge, Technology, Synchronization, Resonance, Innovation, and Autonomous Learning (Siemens, 2012). Table 2 shows the comparison of these attributes for three implementations: Athabasca University (Connectivist), Coursera/edX (Constructivist) and VIC.

Table 2. *Pedagogical Theory Comparisons*

Concept	Connectivist	Constructivist	VIC
Implementation	Athabasca University	Coursera/edX	Theoretical
Knowledge sharing	Distributed	Centralized hub	Hybrid
Student knowledge assimilation	Generative	Declarative	Hybrid
Domain of knowledge	Open	Instructor bounded	Hybrid
Technology	Distributed tools	Centralized tools	Hybrid
Synchronization	Open	More rigidly controlled	Hybrid

Resonance	Synergistic	Synergistic	Synergistic
Innovation	Integrative	More structured	Hybrid
Autonomous learning	Unbounded	Unbounded	Unbounded

Only limited features of VIC are operational, whereas both of the other comparisons are operational and undergoing dynamic improvements. Design-wise, however, this research and the developed patent for VIC incorporate all of the features listed in Table 2. VIC is designed to accommodate the teaching preferences of the instructor or institution and will support Connectivist, Constructivist or a hybrid of both models.

VIC Model Operational Feature Support in Comparison to Digital Age MOOC Models

VIC was designed to be flexible in its pedagogical theory emphasis (Connectivism, Constructivism or hybrid), scalable in its ability to support thousands of students, distributable in its network connectivity (Connectivism), and capable of maintaining whatever accreditation standard an institution desires. The features listed in Table 3, Operational Feature Comparison, address many identified challenges that have surfaced in the current digital age and appear to be threatening the foundation of traditional higher education. VIC offers a solution for all denoted features, issues, and challenges and anticipates many that have not been previously addressed.

Table 3. *Operational Feature Comparison*

Feature	Connectivist	Constructivist	VIC
Implementation	Athabasca University	Coursera/edX	Theoretical
Cloud technology	Possible	Yes	Yes
Virtual laboratory	Possible	Possible	Integrated
Accredited courses	Yes; single universities	Yes; multiple universities	Yes; multiple universities
Non-accredited courseware	Possible	Possible	Yes
Non-accredited courses leading to credit	No	No	Yes
Non-vetted courseware	No	No	Yes
IP provenance	No	No	Yes
Vetting of non-accredited material	No	No	Yes
Certification courses	No	No	Yes
Sequence recovery	No	No	Yes
Research integration	No	No	Yes

"Possible" indicates that the feature could be implemented if institutional policy supports such a change. "No" indicates that a major policy or process change would be required to implement the feature. "Yes" indicates that the model was designed to integrate the feature from

the first stages of implementation.

Future Research and Development

The full Implementation of VIC is a priority next step in the research and development life cycle. The modules of Figure 5 are clearly identified and now need to be prioritized, fully designed, programmed, and tested. A number of potential candidates for deployment in academia have been identified and discussions are underway. The continual assessment of MOOC evolution must be watched and analyzed in order to update VIC features to ensure its successful full implementation.

Conclusion

The use of virtual instruction in both traditional and distance learning is a trending form of pedagogy. The academic profession is faced with many confrontational and challenging questions as it attempts to assimilate evolving uses of social media such as mobile computing and MOOCs into mainstream practice. The use of Cloud Infrastructure has already begun and will continue to have a growing impact on curriculum development and instructional design.

Three confrontational and challenging questions to higher education were previously raised by the authors, and VIC was designed to meet the challenges. First, "How does teaching begin to handle and make available to users escalating volumes of information overload?" A cloud infrastructure with distributed secure repositories of data is the only viable solution. Mobile devices in the hands of distributed users make usage scalable. Securing the data while at rest in cloud nodes and in transit to the mobile device remains a significant challenge to both service providers and users, but solutions are imminent in the opinion of the authors. The volumes of data are of such a magnitude that it makes no sense to aggregate a large subset in a single operations center.

Second, "How does the educational process protect the quality and attribution of contributed intellectual property?" VIC security in the form of encapsulating all courseware objects using military grade cryptography, vetting all courseware by accredited institution faculty members, and proving provenance of all courseware will ensure preservation of all intellectual property and provide usage licenses to rightful owners or licensees.

Third, "How does the 'openness' of the Internet and available information, and the MOOC trend, fit into the traditional accreditation and certification norms of higher education?" VIC allows accredited and certified institutions to maintain their existing degree-granting and certifying function and to be compensated when a candidate desires to qualify for a degree granted by the institution. At the same time, the openness of the Internet, coupled with the freedom granted to students to go anywhere that free learning is available, provides a level of unstructured learning. What may start as an act of curiosity in exploring a new topic may motivate the student to focus on a specific discipline; and, upon proving mastery of learning outcomes and following a structured degree path and paying tuition, an accredited degree may be obtained.

The 21st century requires the development of new teaching and learning methods to maintain pace with Internet speed and new social norms. The Virtual Instruction Cloud developed by the authors expands upon digital age Connectivist and Constructivist pedagogical theories and

facilitates both or a hybrid mix of the two. VIC combines the use of innovative tools (virtualization, Cloud Infrastructure) with new teaching methods (mobile computing, MOOCs) in a learning platform that provides solutions for a significant number of instructional and revenue issues facing institutions of higher learning and their professional staff of administrators, professors, instructors, and researchers. The Virtual Instruction Cloud empowers teachers with agile tools that can be used to develop and deliver vetted curriculum, while preserving academic intellectual property rights, in innovative ways to both traditional students and distance learners using teaching methods developed by new and exciting educational research.

Acknowledgements

The authors are grateful to the National University administration, staff, and faculty for providing support for virtual laboratories and a willingness to allow the degree of academic freedom that has facilitated the creation of new tools for distance learning. Our colleagues and their enthusiastic support for the experimentation and research in order to develop these tools are most appreciated. The NU/SETM faculty appreciate the vision and significant contribution of iNetwork, Inc., as an industry partner to the MS-CSIA program. One of the authors, Romney, appreciates the many hours contributed, pro-bono, by staff of iNetwork in order to assist in the creation of the VIC product. In NSF terms this has been the ideal collaboratory for distance-learning pedagogy. The authors are most grateful to a remote MS-CSIA student, Roberta Anderson, who relishes research and writing, has assisted in the production of this manuscript, and has learned to use agile principles in both teaching and project management.

Glossary of Information Technology Terminology

Agile. Ability to move quickly as applied to pedagogy, delivery, development and management.
Authentication. Validating identity of a person or object.
CLaaS. Computer Lab as a Service or Class as a Service. Specific computer services delivered via cloud resources.
Cloud. The Internet or network of computing resources. May be either public or private.
Cloud computing. The delivery of computing resources or services over the Internet.
Collaboratory. Coined by the National Science Foundation to identify a laboratory consisting of collaborating colleagues.
Cyber security. The discipline of securing computer resources and information.
Encapsulation. Wrapping an object in a secure container using cryptography. A digitally signed file is one example.
Firewall. A hardware or software system designed to prevent unauthorized access to an infrastructure.
Golden image. A deployed ISO mage of a virtual machine ready for use and lab exercise.
Hypervisor. Computer software or hardware that manages and executes virtual machines.
Infrastructure. Physical computing hardware and resources that are part of a network, a cloud, or the Internet.
ISLE. Information Security Lab Environment at National University that uses VMware hypervisor virtualization technology as a private cloud.
Mobile cloud computing. Comprises three heterogeneous domains of mobile computing, cloud computing, and wireless networks.
Mobile Device. A portable computing device that is most often hand held, such as an iPad, notebook, or smartphone that uses a wireless network.

Module. A procedure or process.
Neural. Processes inspired by human brain and nervous system functions.
Petabyte. One thousand terabytes, or 10 to the 15th power bytes of data.
Private cloud. A cloud that is private to an enterprise and may be physically local to the user.
Provenance. Historical trail of possession or change since origin of a data structure.
Public cloud. A cloud available to the public at large and normally physically remote from the user.
Restore. Reestablish a previous functional state of computer usage.
Snapshot. Capture all relevant data of current session computer processes for user(s) that will facilitate a restore to current state(s).
Structure. An electronic file used for data, learning, course, instruction sets, cloud configuration, VM configuration, encapsulation, vetting, or provenance functions.
Terabyte. One thousand gigabytes, or 10 to the 12th power bytes of data.
VEL. Virtual Education Lab that uses VMware hypervisor virtualization technology and was the first private cloud implementation at National University.
Vetting. A careful and thorough examination by an accredited reviewer or instructor of course material.
Virtual laboratory. Facilitates the use of virtualization in laboratory exercises.
Virtual machine. An instance or emulation of a real, physical computer with its own segmented, private, unshared operating system and memory space.
Virtual private network (VPN). A method for providing secure, encrypted communication for a remote computing device over the Internet.
Virtualization. The act of using a hypervisor and virtual machines to provide a virtual, non-physical computing resource environment.
VM. A virtual machine.
Web 2.0. The second stage of implementation of the World Wide Web or Internet, characterized by social networking and general collaboration.
Web 3.0. The next, future, and anticipated evolution of the World Wide Web that has been under definition for at least 5 years.
Wi-Fi. Wireless technology that uses high-frequency radio waves to send and receive data and normally connects with the Internet.
Wireless network. A computing infrastructure that supports cable-less connectivity of computing and mobile devices frequently through Wi-Fi technology.
Zettabyte. One million petabytes, or 10 to the 21st power bytes of data.

References

Anderson, R. C., & Romney, G. W. (in press). Comparison of two virtual education labs: Closing the gap between online and brick-and-mortar schools. *IEEE ITHET 2013 Conference*, Antalya, Turkey.

Anderson, T. (2013, November 25). The man who invented distance education [Web log post]. Retrieved from http://terrya.edublogs.org/2013/11/25/the-man-who-invented-distance-education/

Big Data (n.d.). In *Wikipedia.* Retrieved from http://en.wikipedia.org/wiki/Big_data

Cisco (2011). *Cisco Global Cloud Index: Forecast and methodology, 2011–2016* [White paper]. Retrieved from http://www.cisco.com/en/US/solutions/collateral/ns341/ns525/ns537/ns705/ns1175/Cloud_Index_White_Paper.html

Cisco (2013). Dawn of the zettabyte era [Web log post]. Retrieved from http://blogs.cisco.com/news/the-dawn-of-the-zettabyte-era-infographic/

CLaaS (2012). Computer Lab as a Service, U.S. Trademark of iNetwork-West, Inc. San Diego, CA: iNetwork-West, Inc.

Dey, P. P., Gatton, T., Amin, M., Wyne, M., Romney, G., Farahani, A., & Cruz, A., (2009, March). *Agile problem driven teaching in engineering, science and technology.* Paper presented at the *ASEE/PSW–2009 Conference*, San Diego, CA.

Dey, P. P., Romney, G., Amin, M., Sinha, B., Gonzales, R., Farahani, A., & Subramanya, S. R. (2012). a structural analysis of agile problem driven teaching. *Journal of Research in Innovative Teaching*, 5, 89–105.

Egan, K. (2004). *Getting it wrong from the beginning: Our progressivist inheritance from Herbert Spencer, John Dewey, and Jean Piaget*. New Haven, CT: Yale University Press.

Gonzales, R. F., Romney, G. W., Bane, C., & Juneau, P. (2013). Virtual education laboratory test bed experimentation. *Journal of Applied Learning Technologies, 3*(1), 6–11.

Gonzales, R. F., Romney, G. W., Dey, P. P., Amin, M., & Sinha, B. R. (2012, July 26). Cyber warriors for cyber security and information assurance. *World Academy of Science, Engineering and Technology, 67,* 286–289.

Gsiemens (2012, June 3). What is the theory that underpins *our* moocs? [Web log post]. *ELEARNSPACE.* Retrieved from http://www.elearnspace.org/blog/2012/06/03/what-is-the-theory-that-underpins-our-moocs/

Stacey, P. (2013, May 11). The Pedagogy of MOOCs [Web log post]. *EDTECH FRONTIER*. Retrieved from: http://edtechfrontier.com/2013/05/11/the-pedagogy-of-moocs/

IBM (n.d.). IBM *What is big data? Bringing big data to the enterprise.* Retrieved from http://www.ibm.com

IDC (2011, December 1). IDC predicts 2012 will be the year of mobile and cloud platform wars as IT vendors vie for leadership while the industry redefines itself [Press release]. Retrieved from http://www.businesswire .com/news/home/20111201005201/en/IDC-Predicts-2012-Year-Mobile-Cloud-Platform#.UuMnFsrTmJA iNetwork-west.com (n.d.). San Diego, CA: iNetwork Inc.

Johnston, L. (2012, April 25). A 'Library of Congress' worth of data: It's all in how you define it [Web log post]. Retrieved from http://blogs.loc.gov/digitalpreservation/2012/04/a-library-of-congress-worth-of-data-its-all-in-how-you-define-it/

Katz, R. N. (Ed.). (2011). *The tower and the cloud: Higher education in the age of cloud computing.* Washington, DC: Educause. Retrieved from http://net.educause.edu/ir/library/pdf/pub7202.pdf

Kolowich, S. (2013, September 10). Google and edX create a MOOC site for the rest of us [Web log post]. *The Chronicle of Higher Education.* Retrieved from http://chronicle.com/blogs/wiredcampus/google-and-edx-create-a-mooc-site-for-the-rest-of-us/46413?cid=wc&utm_source=wc&utm_medium=en

Lunt, B., Ekstrom, J. J., & Romney, G. W. (2006, June). Computing curricula: The history and current status of four year computing programs, *ASEE 2006 Conference*, Chicago, IL.

MOOC. (n.d.). Retrieved from http://mooccampus.org/?gclid=CJ_Q14bO-bkCFcxAMgodJH4A0g

MOOC. (n.d.). In *Wikipedia.* Retrieved from http://en.wikipedia.org/wiki/Massive_open_online_course

MOOC Celebpedia (n.d.). Retrieved from http://www.wiedzadlaciebie.elk.pl/page-MOOC

NIATEC (2013). Retrieved from http://sands.niatec.iri.isu.edu/flash/#slide=1

NIST.gov. (2011). *Special Publication 800-125: Guide to security for full virtualization technologies.* Retrieved from http://csrc.nist.gov/publications/nistpubs/800-125/SP800-125-final.pdf

NSA.gov. (n.d.). National Centers of Academic Excellence in IA Education (CAE/IAE) Criteria for Measurement. Retrieved from http://www.nsa.gov/ia/academic_outreach/nat_cae/cae_iae_program_criteria.shtml

NUCSIA.nu.edu. (n.d.). *Cyber security and information assurance.* Retrieved from http://community.nu.edu/csia

Romney, G. W. (2009, March). The integration of Ruby on Rails as an agile teaching tool in IT curricula. Paper presented at *ASEE/PSW-2009 Conference*, San Diego, CA.

Romney, G. W., & Brueseke, B. W. (2012). U.S. Patent Pending No. 13/939,139. Washington, DC: U.S. Patent and Trademark Office.

Romney, G. W., Dey, P. P., Amin, M., & Sinha, B. R. (in press). The flexibility, agility and efficiency of hypervisors in cyber security education, *IEEE ITHET 2013 Conference*, Antalya, Turkey.

Romney, G. W., Gatton, T. M., Cruz, A. P, & Kennedy, P. A. (2008, July). Integration of services computing curricula in information technology, *IEEE International Conference on Services Computing*, Honolulu, Hawaii. DOI: 10.1109/SERVICES-1.2008.99

Romney, G. W., Higby, C., Stevenson, B. R., & Blackham, N. (2004, May–June). A teaching prototype for educating IT security engineers in emerging environments. *IEEE ITHET 2004 Conference*, Istanbul, Turkey. IEEE Catalog Number: 04EX898C; DOI: 10.1109/ITHET.2004.1358254

Romney, G. W., & Juneau, P. D. (2009, March). Implementation of efficient two-factor authentication for university computer systems. *ASEE-PSW 2009 Conference*, San Diego, CA.

Romney, G. W., & Juneau, P. D. (2010 April–May). Service-oriented architecture and scalable two-factor authentication for academic and medium-sized enterprises. *IEEE ITHET 2010*, Cappadocia, Turkey.

Romney, G. W., & Stevenson, B. R. (2004, October). An isolated, multi-platform sandbox for teaching IT security engineers. *SIGITE 2004 Conference Proceedings*. ACM Press. DOI: 10.1145/1029533.1029535

Sahli, M. A., & Romney, G. W. (2010). Agile teaching: A case study of using Ruby to teach programming language concepts. *Journal of Research in Innovative Teaching, 3*(1), 63.

The Sloan Consortium (2012). *Changing course: Ten years of tracking online education in the United States.* Retrieved from http://sloanconsortium.org/publications/survey/changing_course_2012

Special report: Data, data everywhere. (2010, February 25). *The Economist*. Retrieved from http://www.economist .com/node/15557443

Stevenson, B. R., & Romney, G. W. (2004). Teaching security best practices by architecting and administering a security lab, *SIGITE 2004 Conference Proceedings.* ACM Press. DOI: 10.1145/1029533.1029578

Zettabytes. (n.d.). In *Wikipedia*. Retrieved from http://en.wikipedia.org/wiki/Zettabyte

About the Authors

Gordon W. Romney
PhD, Professor
Department of Computer Science, Information and Media Systems
School of Engineering, Technology and Media
National University
San Diego, CA
gromney@nu.edu
Research interests: authentication, data privacy and confidentiality, distance learning, securing big data, securing wireless body networks, virtual instruction, 3D graphics

Baird W. Brueseke
Vice President of Engineering
iNetwork, Inc.
San Diego, CA
Association for Information and Image Management (AIIM)
Company of Fellows No. 185
bbrueseke@inetwork-west.com
Research interests: use of virtual environments in distance learning, evolving requirements for cyber security skills and certifications, advancements in digital storage technology

Web-Based Learning

Embedding Social Media Tools in Online Learning Courses

Steven Brownson

Abstract
The diverse learning styles of 21st century online students require a deeper social connection with interactivity, increased levels of student satisfaction online, and higher student retention rates. Embedding social media into distance-learning classes can increase the level of interaction in an online course by three methods: student/student, student/instructor, and student/content. Social learning and collaboration supports higher retention rates and greater levels of interaction.

Key Words
Social media, interactivity, student satisfaction, academic discourse, retention rates, dialogues

Introduction

Online learning in the 21st century has reached a crossroads in the level of credibility and student satisfaction, where critical thinking skills and the ability to move through multiple online learning mediums represent a vital career skill (Pattison, 2012). While many changes in programming and content have occurred over the last decade, the rate of student retention for many online programs requires a new approach that embeds oral language and the multiple intelligences (Brualdi 1996). Robinson (2005) believed that onsite courses are more for the prior Industrial Age. Bernard, Borokhovski, Tamim, and Bethel (2009) examined the level of interactivity in a meta-analysis on three levels (student/student, student/teacher, and student/content) wherein all three levels were critical for collaboration and mastering the content online. Based on the research and on the necessity to improve the online learning experience, there is a need for reform and changes in the design and delivery of distance learning programs that incorporate social learning. This type of learning is needed where students can form academic discourses in both written and oral forms interactively.

To achieve higher levels of interactivity and student satisfaction, several changes must be implemented, such as incorporating a new social media paradigm for online course design and delivery. Liu, Kalk, Kinney, and Orr (2009) noted that the common social media for online classes includes blogs, podcasting, social networking, and virtual environments. Social networking sites incorporate social traits, technology, and high-level social networks that engage learners with interactivity and facilitate higher levels of knowledge transfers within the courses (Boyd & Ellison, 2007). Callaghan and Bower (2012) developed the idea of engaging students in the online classroom through the inclusion of targeted social media tools, and they tested it with a comparison of courses that did not contain social media. Through the process of supporting cognitive development on all level and peer interactions, the depth of deeper learning and the development of higher cognitive skills occur, especially with 21st century learners as espoused by Lynch, Debuse, Lawley, and Roy (2009). In the conclusion regarding the study, students who were in the higher level social media course showed stronger abilities to complete the assignments intrinsically and "85% of students overall remained on task during each lesson" (Callaghan & Bower, 2012, p. 15).

Several factors are essential to embed social media in the online classroom. First of all, the level of interaction must move from mainly discussion threads and journals to interactive social

conversations and dialogues using Twitter, Facebook, and other social networking tools. Another key element utilizes Tumblr and other blogging sites to bring out the students' voices and include their thoughts and expertise on the content. Through blogging, online journals, and social conversation, the impact can lead to creating an academic discourse. The third factor of forming oral language focuses on building a vibrant classroom community using social media such as GoToMeeting, Adobe Connect, and Class Live Pro to resemble face-to-face sessions and to increase interactivity in the online environment. Finally, another important variable is the participation and presence of the instructor who facilitated the usage and interactions with the social media tools. Acting on these ideas about extending social learning (Grusec, 1992) with oral and written language can lead to higher levels of student satisfaction, greater interaction, and higher retention rates in the online course.

Social Media

Learners in the 21st century have formed a strong level of interactivity through social networking in which they must use multiple learning platforms, as well as build their problem-solving and critical thinking skills. In their research, Friedman & Friedman (2013) noted that 30% of college students took some form of online learning courses in 2010, based on a Sloan Consortium Study. Thus, colleges seek to maximize the course offerings in a cost-effective manner with distance learning courses using a standardized format of instructional and learning environments. Social media, according Friedman and Friedman (2013) can be uni-, bi-, or multi-directional; collaborative; networked; or viral linked to communication within the online learning environment. Pattison (2012) believed that in the online environment, social learning media contain text, videos, audio, photo, and a combination of media. The idea of interactions evolved from cell phones and texting to web-based programs such as Twitter and Facebook, which promoted sharing photos, messages, and events that shaped one's life. Suddenly, hundreds of millions of young people were hooked on the levels of interactivity person-to-person and person-to-content, where they formed their vibrant social communities. The effect has been a totally wired generation who use the Internet and their smart phones in place of direct conversations as a natural form of communicating and discourse.

One of the essential ingredients for online social media exchanges involves Facebook, where members interact on a real-time basis. Through postings and announcements, Facebook Friends find out about the events that shaped the lives of their circle of friends. Within the system of Facebook, friends can also chat in real time, leading to the immediate feedback for their social networks. Another related site, Edmodo, provides for social interaction within the academic environment. The impact has been to form deeper levels of connections in a personalized manner that creates the warmth of a feeling of community.

Another important social media tool relates to Twitter, where members communicate their ideas and comments in 140 characters or less per message. Socialization becomes precise and time-sensitive as members communicate their stories in short, abbreviated messages. The implication of Twitter involves sending a constant level of interaction that motivates other linked members to respond in a dialogue for their conversation or give important information about events.

On a professional level, LinkedIn offers a dynamic networking tool for careers and social interactions with other professionals in your field. In your social network, you can upload your résumé and other professional information to improve your professional standing with other

members of your social group online. Through the exchange of job tips as well as collaboration, professionals gain referrals, gain insight on changes in their field, and form social networks for job sharing. The impact has been to raise avenues for professionalism through social networking, whereby new members build dynamic connections that lead to greater satisfaction with the networks and outlets for interactivity.

Several professional-level meeting tools, such as Gotomeeting, Adobe Connect, and Class Live Pro, enable users in professional and academic settings to connect in an onsite-like environment where they can see each other and communicate orally. The effect leads to social media impacts where they form professional connections with others using academic discourses in the online classroom. As participants view each other and listen to views, the level of interactivity, student/student, student/instructor, and student/content rises in small-group learning environments. Thus, embedding learning in a dynamic and engaging environment leads to a deeper knowledge base and greater student satisfaction that parallels the live classroom environment.

Linkage of Social Media to Increased Levels of Interactivity

After reviewing the multiple social media applications, the Callaghan Study (Callaghan & Bower, 2012) showed that the impact of social media in online courses motivated students to participate actively in the online classroom. One key idea from the Callaghan Study related to the inclusion of social media that inspired interactivity leading to deeper levels of student satisfaction. In social media chats, the overall conversation formed a strong rapport, student/student, student/instructor, and student/content, leading to higher levels of academic discourse in the classroom. At the same time, the Callaghan Study results indicated how the students could effortlessly connect the course content with social media tools. In the learning environment, the inclusion of social media allowed for the integration of tools such as wikis and blogs for building collaborative efforts and for using real-world thinking (Pattison, 2012). To be effective, there was also a high level of instruction interaction (teacher/student) that formed a strong sense of online presence to guide students through the learning process.

Palfrey (2013) used the idea of "Connected Learning" to indicate how the communities, content, interactions, and technology improves the learning process. During the learning process, social media can be embedded to connect students' interactions with each other about the concepts and skills being studied. Face-to-face time in social media such as Facebook or Class Live Pro can work to flip the classroom where higher levels of online content are discussed in the connected environment. In conjunction research from the Callaghan Study, the three levels of learning interactions provide a way to build strong interactivity online, leading to higher levels of content mastery with both oral language and written responses with the incorporation of social media.

Social Media also promoted an emotional outlet for learning, as examined by Greenhow (2011) within research regarding the impacts of social networking websites such as Facebook and MySpace. One theme focused on incorporating social networking sites as building direct and indirect support for learning, as well as stimulating social and civic implications through the use of online social interactions. Students can use these web technologies 24/7 with the inclusion of constructivist-based strategies, in order to form online learning situations that promote increased levels of human interactivity and content mastery. Also, social networking sites have been the dominant aspect of social interactions for younger people outside the classroom (Rideout, Foehr,

& Roberts, 2010). Online classrooms that use the standard online environment can face the potential of losing the students' attention, whereas learning for many millennial learners involves a constant flow of social networks and interactions. The result of the professional and private interactions enables online students to interact and to visualize the learning process. Within the idea of social media is a "cognitive surplus" (Greenhow, 2011) with higher levels of knowledge developing from these learning experiences. Furthermore, the learning environment promotes a strong connection to transitioning to college, with higher levels of different perspectives and creativity that can be mapped by social networking graphing software (Greenhow, 2009).

Embedding Social Media in Online Learning

Linking social media to the online learning environment requires only a few adaptations to the design and delivery of online courses. In the 21st century, professors are not stand-alone instructors but providers of knowledge who must engage online learners with the tools to learn and to acquire knowledge (Friedman & Friedman, 2013). The use of links within the course or added to the announcements can easily move students to the social media websites. Through the ease of navigation, online students can access different aspects of social media by simply selecting a predefined hyperlink. Furthermore, blogs could replace some discussion threads, while the use of a Class Live Pro classroom could replace discussions or potentially be added as synchronous-based discussions for grading. Through social media, a constructivist approach links learning with extensive collaboration, as examined by Tay and Allen (2011). The key is to ascertain how the social learning can be embedded in the classroom to enhance collaboration and content mastery. Facebook access can be enabled as a student café or for creation of a community of learners. Finally, Twitter augments the online learning experience as a tool for announcements, articles, and other resources, such as multimedia, where students can receive the information on a real-time basis. Instructors consistently apply a targeted approach where online learners can improve their interactivity and also increase their satisfaction with social media's being embedded as a natural part of the course.

One idea that promotes the use of social media in the classroom involves using Facebook as a discussion tool by either incorporating the social media into extensions and reinforcements of discussions or having it replace standard discussion prompts. The online community created within a course moves forward in Facebook with visuals, conversations, and student/instructor postings in a natural environment similar to their personal social networking, as shown in a study by Shaltry, Henriksen , Wu, and Dickson (2013), with higher collaboration among groups of teacher education students. Since students might feel higher degrees of comfort in the Facebook environment compared to learning platforms, the levels of interactivity (student/student, student/instructor, and student/content) can be enhanced in a way that forms a nurturing environment. Shaltry et al. (2013) noted that over 50% of adults in the U.S., in a 2010 Pew Survey used social networking, while 92% utilized Facebook. The chat feature in Facebook permits students and instructors to have conversations about the concepts or to ask questions on the assignments or even to clarify key points from the weekly assignments. One of the most critical aspects of Facebook emerges with the community of learners (Friedman & Friedman, 2013) that extends throughout the online classroom, leading to satisfaction about the quality of the experiences.

Adding Twitter enables instructors to suggest articles, exchange brief comments, and make important announcements. Twitter represents a useful real-time source of information for students for identifying resources or forming targeted comments. The idea is that entering email or the online classroom takes multiple steps, whereas Twitter can be a constant source of information on the content. In addition, instructors can post links to multimedia where students can watch videos, Prezi presentations, animation, and other tools that form a level of dual encoding (Fu, W., & Anderson, J. R. (2008) leading to a deeper mastery of the content into the long-term memory. As students have questions or comments, instructors can also send article links or devise short comments on critical ideas about the online concepts studied.

Professional collaboration through GoToMeeting and other professional social networks for communication leads to the incorporation of oral language and face-to-face interactivity. Findings from e research of Wei, Chen, and Kinshuk (2012) show the need to create intimacy and interpersonal relationships in an asynchronous course that mimics face-to-face learning. Think of online collaboration as being useful for online lectures, where the instructor can add visuals and information that establishes interactivity through whole and small-group activities. Thus, the levels of interactivity lead to a deeper sense of meaning using written and oral language in a supplemental format to add academic dialogue on the content. Other outlets can be for office hours and team-based work, where learners can embed social learning (Grusec, 1992) into the ordinary reading and response with the standard online classroom.

Using LinkedIn extends the social conversation by facilitating online students' to connecting with professionals in their field of study. The idea is to add mentors as well as real-life experiences for the online students, who can then form a stronger connection to their field of study. When the online learners integrate the social networking of LinkedIn with professional profiles, they are also developing their brand or persona regarding their images in their potential career. Online learners can join professional discussion groups where they can obtain information about the concepts and newest research in their field.

Best Practices with Social Media Online

The review of the best practices for embedding social media online revealed the emergence of several important best practices within the literature review, for improving retention rates, raising the level of interactivity, and increasing student satisfaction about the quality of distance learning courses. One important factor relates to targeting the social media tool for learning modalities of the students and online course activities. Another best practice includes the active participation of the instructor for both modeling the social media and interacting with students using social media to enhance the level of student/student, student/instructor, and student/content interactivity. Subsequently, a beta test of the social media is recommended in order to provide students with precise usage instructions and successful embedding of social media as a natural component of the course.

Other best practices for embedding social media online focus on building knowledge by integrating the different components of social media, such as using Twitter for announcements, Facebook for online chats and community building, Tumblr for reflecting and extending content with blogs, and online communities such as GoToMeeting for oral language with social learning (Grusec, 1992). The ultimate benefit for incorporating social media into the online classroom relates to the formation of dynamic and communication-based learning environments, increasing

the level of student/student, student/instructor, and student/content activity, and ultimately providing satisfying online learning experiences leading to higher levels of student retention online through social presence (Wei et al., 2012). In their review of social media, Wei et al. (2012) noticed that social presence improves the psychology of interactions in learning and represents a strong predictor of mastering the learning outcomes within an online course.

Conclusion

Embedding social media in the online classroom increases interactivity, extends collaboration, and forms increased levels of student satisfaction in the online classroom. An essential element of increased student/student, student/instructor, and student/content interactivity (Bernard, Borokhovski, Tamim, & Bethel, 2009) emerges with the incorporation of such social media as Class Live Pro and Facebook as tools for social learning. Linked to the interactivity is the ability to form constructivist environments where students extend their schema of learning using social media for a deeper social presence and higher levels of content mastery. The overall goal, then, of increasing student satisfaction with the online environment emerges with the melding of the traditional distance-learning classroom with targeted applications of social media, creating a dynamic and engaging learning environment with higher learning retention rates and student satisfaction.

References

Bernard, A., Borokhovski, W., Tamim, S., & Bethel, E. C. (2009). A meta-analysis of three types of interaction treatments in distance education, *Review of Educational Research 79*(3), 1243–1289.

Boyd, D. M., & Ellison, N. B. (2007). Social network sites: Definition, history, and scholarship. *Journal of Computer-Mediated Communication, 13*, 210–230.

Brualdi, A. C., & ERIC Clearinghouse on Assessment and Evaluation, W. C. (1996). *Multiple Intelligences: Gardner's Theory. ERIC Digest*.

Callaghan, N. & Bower, M. (2012). Learning through social networking sites: The critical role of the teacher. *Educational Media International*, *49*(1), 1–17. doi:10.1080/09523987.2012.662621

Friedman, L. W., & Friedman, H. H. (2013, January). Using social media technologies to enhance online learning. *Journal of Educators Online*, *10*(1). ERIC No. EJ1004891

Fu, W., & Anderson, J. R. (2008). Dual learning processes in interactive skill acquisition. *Journal Of Experimental Psychology: Applied*, *14*(2), 179-191. doi:10.1037/1076-898X.14.2.179

Grusec, J. (1992). Social learning theory and developmental psychology: The legacies of Robert Sears and Albert Bandura. *Developmental Psychology*, *28*(5), 776-786. doi:10.1037/0012-1649.28.5.776

Greenhow, C. (2011). Online social networks and learning. *On the Horizon, 19*(1), 4–12.

Lynch, K., Debuse, J., Lawley, M., & Roy, S. (2009, July 6–9). An early investigation into factors in student's choice of technology for e-learning. Proceedings of the 32nd HERDSA Annual Conference, Darwin.

Palfrey, J. (2013). Connected learning now. *Independent School*, *72*(4), 30.

Pattison, D. (2012). Participating in the online social culture. *Knowledge Quest*, *41*(1), 70–72.

Rideout, V. J., Foehr, U. G., & Roberts, D. F. (2010, January 20). *Generation M2: media in the lives of 8- to18-year-olds.* Report No. 8010. Meno Park, CA: Kaiser Family Foundation.

Shaltry, C., Henriksen, D., Wu, M. L., & Dickson, W. P. (2013). Situated learning with online portfolios, classroom websites and Facebook. *Techtrends: Linking Research & Practice to Improve Learning*, *57*(3), 20–25. doi:10.1007/s11528-013-0658-9.

Tay, E., & Allen, M. (2011). Designing social media into university learning: technology of collaboration or collaboration for technology. *Educational Media International*, *48*(3), 151–163. doi:10.1080/09523987.2011.607319

Wei, C., Chen, N., & Kinshuk. (2012). A model for social presence in online classrooms. *Educational Technology Research & Development*, *60*(3), 529–545. doi:10.1007/s11423-012-9234-9

About the Author

Steven M. Brownson
PhD, Professor
College of Liberal Arts
Ashford University
Clinton, IA
Sbrownson@ashford.edu
Research interests: student interactivity, retention rates, multimedia, social media

Is Flipped Learning Appropriate?

Thomas J. Francl

Abstract
This study examines new pedagogy available and more appropriate for student learning in our current world of technology. It contrasts today's typical course setting with a "flipped learning" approach. Traditionally, a lecture accompanied by clarifying questions and answers is reinforced with homework assignments. We question if this pedagogy is still appropriate in today's environment of high-speed Internet, iPhones, and movie-capable tablets. We can compete for students' attention with taped lectures accessed by students on any device, at any time, and anywhere. Class time can be utilized to discuss the material in much greater detail.

Key Words
Flipped learning, flipped classroom, Internet videos, student attention, workload shift, MOOC

Introduction

"Teaching is causing one to know something and to guide the study of" (Merriam-Webster, n.d.). In our modern world, teaching has evolved into a one-way conversation, due primarily to class sizes, time limitations, and economics. Research on the great teachers shows that Socrates, one of the earliest and greatest teachers, taught Plato, who, in turn, taught Aristotle (Socrates, n.d.). Class size in 400 BC was probably limited to one or two students, and Socrates accepted no fee for teaching. Now, 2,400 years later, with 30 to 130 students in a class, teachers attempt to discuss how a not-for-profit organization should market itself, or they are tasked with training future teachers in how to teach probability and statistics—all in less than 40 hours of class time!

The challenge before us is to abandon one-way teaching practices and evolve into "facilitators of learning." Flipping our classrooms upside down can do just that. Two introductory MBA classes at National University were flipped this year under the guidance of this paper's author, with great success. Students reported acceptance of the new format and instructors experienced greater student satisfaction and assessment with the flipped pedagogy. This paper details the literature discussing flipped learning, the pedagogy for the flipped classes, the MBA course experiment, pedagogy challenges, and conclusions.

What Is Flipped Learning?

The Flipped Learning Network™, (FLN Summary) relates class lectures, and direct instruction is delivered outside of the classroom using video or other modes of delivery. Consequently, class time is then available for students to engage in peer collaboration, deeper discussion of the topic at hand, and personalized instructor guidance. It is a shift from a teacher-centered classroom to a student-centered learning environment. In other words, instructors are no longer "teachers" in the modern sense, as that implies a one-way communication from their mouths to the student's ears. Instructors need to become "facilitators of learning," which reinforces the goal of student learning.

Barber, Donnelly, and Rizvi (2013) note that MIT, Stanford and other universities now offer free or low cost video learning over the Internet, commonly referred to as a Massive Open Online Course, or MOOC. Some of those courses even grant college credits for successful completion and payment of a fee. When students have a question about a particular topic, they

must normally post it onto a class blog and wait for a fellow student to respond. There is often little teacher interaction. These solutions are not flipped learning and fall short of what can be possible. However, Stanford's Beckett (2012) states that its faculty is experimenting with a "flipped classroom."

Flipped learning places more of the burden upon the student to take the lead in the learning process. Students are able to view course content at anytime, anywhere, and on any device. The content is delivered outside of the classroom. Instead of doing homework exercises on their own time, students are viewing fresh material. The homework is instead moved into the classroom and completed by students individually or in work groups monitored by the instructor. One might conclude that instructors get a free ride because they no longer need to deliver lectures. On the contrary, their work becomes more challenging as it results in more one-on-one time with students and requires preparation of in-class activities, with deeper questioning of the subject matter.

Students engaged in a flipped learning environment also have a tendency to conduct more Internet searches for related material. Some of those inquiries seek out different explanations of the material or expanded discussions of interesting subject matter. In order to improve student learning, students need to be engaged to much a greater degree. To get their attention, technology that they take for granted must be utilized.

While most of the flipped learning literature is based upon K–12 experiences, large universities are paying attention. Johnson, Johnson, and Smith (1991) report on several studies indicating that lectures are a relatively ineffective way of promoting learning. Rich (2013) found that both Stanford University and MIT offer enrollment in online classes free unless the students want college credit. MIT (Massachusetts Institute of Technology, n.d.) offers 2,150 free online courses that are recordings of actual classes, some over 10 years old. For example, a student in Turkey could take an online course in Linear Programming in his native tongue.

Kenrick (2013) reported that Stanford medical school is experimenting with flipped learning, as is Vanderbilt University (Brame, n.d.). At the Stanford medical school, 70% of formal instruction takes place online (Mintz, 2013). Brame (n.d.) states, "In terms of Bloom's revised taxonomy (2001), this means that students are doing the lower levels of cognitive work (gaining knowledge and comprehension) outside of class, and focusing on the higher forms of cognitive work (application, analysis, synthesis, and/or evaluation) in class where they have the support of their peers and instructor."

Pennsylvania community colleges in Lehigh Valley are implementing flipped classes. Teachers using the flipped classes including Farhat in accounting and Bradley in psychology, who stated, "Students are doing much better than students in a traditional classroom environment" (Satullo, 2013). Lafayette College's Childs stated, "Technology deepens student engagement and makes instructors more accessible" (Satullo, 2013).

Based upon the success rate of a pioneered flipped course at San Jose State University, the program was being expanded to other campuses. The electrical engineering course witnessed an increase in the pass rate from 59% to 91%. According to Lt. Gov. Newsom, "This is a different pedagogy in terms of educational experience. It is extraordinarily exciting" (Kucher, n.d.)

Warter and Dong (2012) concluded, "Assessment findings demonstrated that less lecturing can actually lead to more effective learning, with the integration of various active learning components streamlined with class curriculum. The educational value of flipping the classroom sometimes is to allow the students to apply what they are learning, to engage them in the learning process, and to energize the classroom."

Sams and Bergmann (2013) stated, "Lecturing forgoes one-on-one time with students and doesn't necessarily engage students in higher-order thinking but they go on to say that courses that are more inquiry-based that don't have a great deal of factual content to learn aren't really suited for flipping." Sams and Bergmann began the Flipped Learning Network™ back in 2007 (FLN Summary).

"Not all content is suited to the approach and not all students are suited to the type of learning. Neither are all teachers comfortable or savvy with new technology," stated Evans (2012). Evans related a story about Stannard, principal teaching fellow at Warwick University, who created videos to help explain technical issues for his class, finding that when the videos went public, enrollment in the class doubled.

In a study by the Classroom Window™ (2012), based upon 500 primarily secondary school teachers, 88% reported improved job satisfaction and 46% stated that their job satisfaction improved significantly. That same survey indicated that 67% of their students had improved scores on standardized tests, and 80% of the students had improved attitudes.

Ebbeler (2013) found success in a revised flipped approach: "The same content, more difficult exams, and new instructional methods led to improved learning. More anecdotally, the students were able to discuss the complexities of Roman history in a way I have never seen among non-majors. They were clearly thinking hard and engaged in the course content."

Rivero (2013) itemized reasons why flipped classrooms are here to stay:

1. All set up: Students get most of their information before class.
2. No more yawns: "Boring lecture" times are reduced to nearly nothing.
3. At your own pace: No spacing out. Lectures watched at home can be paused and replayed as soon as a student becomes lost. Usually, it is an unfamiliar term that derails the learner and a good dictionary or help from a parent can clear things up.
4. Authentic learning: Class time becomes more meaningful; teachers can really get into higher-level questions and activities instead of droning on about the basics.
5. Active learning: More experiments, more time to explore the content, and more interaction time with other students surrounding the subject matter furthers deeper learning.
6. Practice makes perfect: With a solid background from at-home lectures, students can practice skills in class with expert guidance from teachers and peers.
7. Transformative: This is not just integrating new technologies; it is shifting a paradigm to take advantage of them.

Instructor Network

"The mission of the Flipped Learning Network™ is to provide educators with the knowledge, skills, and resources to successfully implement flipped learning" (FLN Summary, n.d.). The objectives of the network include providing professional learning opportunities and acting as the clearinghouse for distributing successful practices for educators. The network's online community includes more than 14,000 members, including this author.

Pedagogy for the Flipped Classroom

Sequencing Activities

Traditionally, teachers have conducted classes in the following sequence of events:

1. Topic presentation via PowerPoint presentations, videos, and other visual and verbal means
2. Questions and answers during or after the lecture
3. Student practice exercises, otherwise known as "homework"
4. After homework submittal, explanation of the correct answers
5. Conducting of a brief quiz or other graded exercise to test retention

Generally, the only way to encourage students to stay focused is to reward them with participation grade points. With additional preparation, the sequence of these events can be shuffled, resulting in improved student involvement and learning:

1. Topic presentation viewed by the student outside of the classroom
2. Practice exercises and critical thinking projects in the classroom
3. Formal discussion and review in the classroom
4. Brief self-quiz to check understanding and retention

This sequence puts more of the burden of learning on the student, which is precisely what needs to be accomplished. The instructor's workload is changed from a "slide reader or explainer" to a "responsive knowledge provider."

Here is a more detailed list of what needs to take place:

1. Automate the topic presentations (lectures), enabling self-pacing
2. Acquire supplemental material from the textbook publisher or other sources
3. Facilitate student viewing on any device, anywhere, and at any time
4. Require students to view this lecture material outside of the classroom
5. Provide a short, graded quiz to be taken online for students to test themselves
6. Enable students to retake that quiz, thus using it as a learning experience
7. Have students complete the "homework" in the classroom, either individually or in groups
8. Conduct an in-class open forum for discussion about the topic; present further explanation of complex topics as necessary
9. Test retention and understanding with formal exams

By flipping the focus of the learning environment from "teacher centered" to "learner centered," an environment that engages students and enhances learning is created and transforms the classroom atmosphere. Moving from a lecture-based class to a flipped class requires a new set of skills. In order to do it well, one needs to shift the way the class is designed and the way teaching strategies are implemented.

MBA Course Experiment

I converted to flipped learning for two introductory MBA courses at National University. The PowerPoint lectures were completely redesigned to include a professionally dictated voice-over and then converted to a WMV video. That video has been uploaded to the course eCollege website and to a private YouTube area. Students are able to access these lectures anytime, anywhere, and on any device.

After viewing the lecture, students then complete a short quiz to evaluate their comprehension. These short quizzes provide additional learning opportunities as the students are allowed to retake the quiz to achieve a higher score. If the student does not achieve a perfect score, the student can review the lecture again, search out answers in the text or on the Internet, and contact the instructor if necessary.

The flipped online chat sessions and on-site classroom sessions were not designed to include lectures, but repeating portions of the videos has been sometimes helpful when explaining a topic. Experience indicates that 25% of the students finish viewing all of the lectures in the first week of the two-week class and achieve a perfect score on each quiz. Only 25% of the students attended the chat sessions, and another 25% got their questions answered via email or class blog.

A regular final exam is administered under controlled conditions. This course design offers many of the advantages of MOOC courses, but with the added benefit of a live instructor to help when needed.

Program foundation courses. The National University MBA program includes two, 2-week courses as the first offering of the course sequence: ACC 501, Accounting Fundamentals, and FIN 501, Introduction to Finance. These courses are offered sequentially and are staffed with the same instructor. No graduate-level credit is granted for the courses. Students receive a Satisfactory or Unsatisfactory grade.

Demand for course offerings. Because of the popularity of the MBA program, this sequence is offered every other month in both an online and on-site environment. Due to the online enrollment demand and class size standards, there are normally two online sections in addition to on-site classes offered at the National Spectrum campus, military bases, and regional centers. In September 2012, five on-site classes were offered, a full 38% of all accounting courses offered that month.

Initial solution pursued. With decades of information technology experience, my initial solution to meet this demand while reducing the challenges associated with staffing, was to automate the process. I proceeded to redesign each PowerPoint lecture to include voice-overs and automation. I even experimented with computerized avatars and voices. My goal was to offer no more than one online class per month, with an unlimited enrollment and a single instructor. Students would view the lectures on their own time, take a quiz associated with that lecture, and complete limited homework assignments. Attendance at semi-weekly chat sessions was optional and recommended if they sought clarification on a topic. The final exam was scheduled on the last day of class, and all grading was objective. The experiment had a low risk associated with it because it was a pass/fail course, and student achievement continued to be measured.

The initial class ran with 25 students in January 2013. It completed successfully, but I felt the result could be improved. While I felt that the course had a much better format than the teacher-

less MOOC offerings from Stanford and MIT, it needed more content and rigor. The course needed more student-teacher interaction.

Reality sets in. As the course design evolved, I realized that my initial automated solution bore a strong similarity to the one promulgated by the Flipped Learning Network™. Its pedagogy was much more advanced and easily adapted. Further, the economics of a single, online class could not be justified, due to student-tuition-reimbursement guidelines and the need to maintain a workable student-teacher ratio.

The good news from the January class was the extremely positive student response. Student participation in the chat sessions indicated a higher level of critical thinking, and discussions among the students evolved into significant detail. Because that January class was split due to high enrollment, one student ended up on the other instructor's roster for the second 2-week course and begged the advisor to transfer him back into my class. A student comment that was made in a subsequent class taught by another instructor read, "I know several students did not like the module system, but I personally *loved* it, it allowed me to truly go at my own pace."

The flipped solution. The MBA foundation courses continue to be offered with the same frequency as before. The course design now includes professionally recorded voice-overs for the 12 PowerPoint lectures. Each lecture has been converted to a Windows video using the standard functionality of Microsoft software. The videos were uploaded to YouTube, and direct hyperlinks are included in the course outlines. Each lecture is accompanied by a brief, multiple-choice quiz that the students can retake if they do not obtain a perfect score. This design meets the anywhere, anytime, any device goal.

"Homework" was redesigned to include a total of eight exercises, a short research paper, and several discussion blogs on eCollege. The exercises are designed to be completed in group environment in class. The discussion questions are designed for sequential student contributions.

An orientation paper has been written for the instructor that includes suggestions on running the class. For instructors new to these flipped classes, I meet with them to explain the class structure.

On-going enhancements. As the Course Lead for these two foundation courses, I have taken it upon myself to obtain instructor feedback and suggestions for improvement.

Evaluation of the flipped approach. There are no objective measures in place to determine if the design of these two courses has been a success. All classes in the School of Business, in addition to other schools, utilize a "Student Course Assessment Form" to obtain feedback in three areas: student self-assessment of learning, assessment of teaching, and assessment of course content. I have found this assessment process unreliable due to very low student completion (less than 50% and frequently less than 25%) and mechanical failure of the recording equipment. While proponents of a new pedagogy should rely on an objective assessment of student learning, such an assessment has not been possible for these courses.

An end-of-course student questionnaire is also being designed to supplement the standard student-assessment process. This questionnaire can be used to evaluate the effect of flipping the next course, providing a before-and-after comparison.

Technology

Even though National University students are older than the typical college student, they are quite adept with electronic devices. It seems that everyone has a smart phone, be it an iPhone, an Android, a BlackBerry, or a Windows Phone. They also own a tablet, a laptop, or a desktop computer. These devices have more features than most know how to use, including calendars, calculators, word processors, media players, digital cameras, video recorders, WiFi, and Internet browsers, in addition to their function as a plain telephone. It is actually amusing to witness everyone in the classroom pull out their phones when we take a dinner break.

The bottom line is that our students have no problem accessing digital lectures, class assignments, digital textbooks, and online exams.

Post Graduate Activities

A basic college degree in today's world does not carry the same status that it did 50 years ago. To distinguish oneself from the crowd, students are pursuing Master's degrees and specialized certificates. In the public accounting industry, students are required to possess an extra year of education and successfully complete rigorous exams to achieve a Certified Public Accounting license. Even accountants wishing to join private industry need to achieve a Certified Management Accounting status to add to their qualifications. Other industries have similar post-graduate education and/or certificate requirements.

The escalation of these requirements places a much greater burden upon instructors and the amount of learning that really takes place. The learning outcomes promised by our programs must serve students well beyond the classroom.

Challenges

Instructor Adjustment

Teaching the teacher is the biggest challenge faced when implementing flipped learning. What makes this task even more of a challenge is that there are no formal standards to follow. Individual instructors need to access successful stories and apply the appropriate tools and techniques to their own classrooms. Is that a time-consuming process? Does that require thinking creatively, outside the box? Will the students be better off? Yes, yes, and yes.

Student Adjustment

Unless students are properly prepared for a flipped classroom, they can become disoriented and unprepared for class discussions. While students have more control over when and where the course material is viewed, they also need to assume more responsibility for their own learning. They might be accustomed to coming to class without having even reviewed the material, relying on the instructor to lead them through it. They must now take on that task themselves. They may be accustomed to spending an hour or two on homework over the weekend, but that task is replaced by the automated lectures and online quizzes that greatly increase the amount of time spent outside the classroom.

Administration Approval

Given the newness of the flipped learning concept, university administrators cannot be expected to grant carte blanche to implement these techniques. However, they should be open to experimentation because of the promise of increased student learning and adoption of the flipped learning approach by competing institutions. Course Learning Outcomes do not change, but learning assessments will need to be refined. The goals of each of program are not compromised but enhanced.

One area of particular concern to university administration is the actual length of each class session. On-site sessions at National University operate between 5:30 and 10:00 p.m., two nights per week. The dedication of 3.75 hours of instruction is easier to budget when delivering formal class lectures but more difficult to manage when the class is engaged in group learning and in-depth discussions about the material. More student learning is taking place prior to the class session, so flipped courses may need to be designated as "hybrids," reducing the amount of on-site time.

Learning Materials

Course designers will be particularly challenged by the flipped learning concepts. The amount of preparation that needs to be accomplished prior to the first class offering is substantially greater than what is required today in a regular lecture-based course. The goal of the design should be to provide a formal structure for the class that would include multimedia, class exercises, exams, etc. Because of the increased design workload, a substantial increase in the stipend needs to be adopted.

Each instructor, especially an adjunct, can continue to exert academic freedom as desired but cannot be burdened with designing and implementing a flipped course from the ground up.

Printed textbooks are no longer sufficient. In fact, they should be replaced by digital versions wherever possible. Using digital textbooks on an iPad, Kindle, or laptop enables the student to follow embedded hyperlinks for additional reference material and to insert personalized notations for sharing or future usage. In addition, the cost of digital textbooks is much lower. Rental versions that time-out after a few months cannot be recommended for courses in the student's major.

Prerecorded videos are becoming available from textbook publishers and make it easier to view the course material. However, these videos adhere to the accompanying textbook material, which may need to be supplemented.

Custom PowerPoint presentations can be created by the course designer, based upon either the publisher-supplied material or the designer's own creativity. Each slide needs to be accompanied by textual explanation, which can be converted into a voice-over. At National University, consultants at Spectrum Pacific Learning can help facilitate this process.

Classroom Assignments

Traditionally, homework assignments were chosen to reinforce the subject matter while the student was outside of the classroom. Depending upon the task at hand, these assignments might entail repetition, application of mathematical or statistical formulas, or critical thinking. Accommodation for in-class work groups should be provided for. In an on-site class, separating the students into working groups is easily accomplished by moving desks and chairs. In an online class, separate discussion rooms can be utilized.

Conclusion

While the design of a flipped course appears to lessen the instructor's workload because of the elimination of lectures, in fact it does not. The instructor's engagement with the students is a change from lecture to discussion about the material. Bringing up topical discussions is very helpful. It is also helpful to create additional classroom exercises for small groups of students. Depending upon the students in the class, reviewing the automated lecture may also be appropriate.

Students might complain about their increased workload, but once they become accustomed to their increased control of their own schedule, they find the flipped environment more conducive to learning.

The flip is more than just a fad. It is reinvigorating learning (and teaching) experience in thousands of classrooms. A network of educators from around the country are having success with this concept (FLN site, 2013). Kucher (2013) reported that San Jose State University has pioneered flipped learning and is currently expanding the number of courses included. Their flipped courses are being adopted by other California State Universities.

References

Barber, M., Donnelly, K., & Rizvi, S. (2013, March 11). An avalanche is coming: Higher education and the revolution ahead. *IPPR - Institute for Public Policy Research*. Retrieved July 15, 2013, from http://www.ippr.org/publication/55/10432/an-avalanche-is-coming-higher-education-and-the-revolution-ahead

Beckett, J. (2012, March 6). Stanford offers more free online classes for the world. Standard report. *Stanford News.* Retrieved from http://news.stanford.edu/news/2012/march/online-courses-mitchell-030612.html

Brame, C. J. (n.d.). Flipping the classroom. *Vanderbilt University Center for Teaching.* Retrieved July 15, 2013, from http://cft.vanderbilt.edu/teaching-guides/teaching-activities/flipping-the-classroom/

Classroom Window and Flipped Learning Network. (2012). *Flipped Classrooms: Improved test scores and teacher satisfaction*. Retrieved from Classroom Window website: http:// classroomwindow.com/

Ebbeler, J. (2013, July 22). "Introduction to Ancient Rome," the flipped version. Commentary. *The Chronicle of Higher Education.* Retrieved August 4, 2013, from http://chronicle.com /article/Introduction-to-Ancient/140475/?cid=cr&utm_source=cr&utm_medium=en

Evans, D. (2012, March 23). Lessons turned upside down. *TESconnect.* Retrieved July 15, 2013, from http://www.tes.co.uk/article.aspx?storycode=6196199

Flipped Learning Network site. (n.d.). Retrieved from http://www.flippedlearning.org/Page/1

Flipped Learning Network summary of research, reports, and studies. (n.d.). Retrieved from http://www.flippedlearning.org/domain/41

Johnson, D. W., Johnson, R. T., & Smith, K. A. (1991). *Cooperative learning: Increasing college faculty instructional productivity*. Washington, DC: School of Education and Human Development, George Washington University.

Kenrick, C. (2013, May 10). Flipping the university classroom. *Palo Alto Weekly.* Palo Alto Online. Retrieved July 15, 2013, from http://www.paloaltoonline.com/weekly/story.php?story_id=18872

Kucher, K. (2013, April 10). CSU to offer more "flipped" classes. UTSanDiego. Retrieved July 15, 2013, from http://www.utsandiego.com/news/2013/apr/10/edX-san-jose-partnership-online-education/

Merriam-Webster. (n.d.). *Merriam-Webster Dictionary and Thesaurus*. Retrieved July 15, 2013, from http://www.merriam-webster.com/dictionary/teach

Mintz, S. (2013, July 22). The future is now: 15 innovations to watch for. Commentary. *The Chronicle of Higher Education.* Retrieved August 4, 2013, from http://chronicle.com/article/The-Future-Is-Now-15/140479/?cid= cr&utm_source=cr&utm_medium=en

Massachusetts Institute of Technology. (n.d.). *MIT Open Courseware.* Retrieved from http://ocw.mit.edu/

Rich, G. (2013, May 10). Massive open online courses on rise, but impact still small in U.S. *Investor's Business Daily.* Retrieved July 15, 2013, from http://news.investors.com/technology/051013-655667-moocs-on-rise-but-

few-grant-college-credits.htm
Rivero, V. (2013, January 1). Tools for learning: Flipping out—a new model to reach all students all ways. *Internet@Schools Magazine.* Retrieved July 16, 2013, from http://www.internetatschools.com/Articles/ Editorial/ Features/TOOLS-FOR-LEARNING-Flipping-Out--A-New-Model-to-Reach-All-Students-All-Ways-86947.aspx
Sams, A., & Bergmann, J. (2013, March). Flip your students' learning. *Educational Leadership, 70*(6): Technology-Rich Learning pp. 16–20. Published by ASCD. Retrieved July 16, 2013, from http://www.ascd.org/publications/educational-leadership/mar13/vol70/num06/Flip-Your-Students%27-Learning.aspx
Satullo, S. (2013, April 14). Lehigh Valley colleges are flipping classrooms. *Lehighvalleylive.com.* Retrieved July 16, 2013, from http://www.lehighvalleylive.com/breaking-news/index .ssf/2013/04/lehigh_valley_colleges _flippin.html
Socrates. (n.d.). *Wikipedia, the free encyclopedia*. Retrieved July 15, 2013, from http://en.wikipedia.org/wiki/Socrates
Warter-Perez, N., and Dong, J. (2012, April). Flipping the classroom: How to embed inquiry and design projects into a digital engineering lecture. *Proceedings of the 2012 ASEE PSW Section Conference, California State Polytechnic University, San Luis Obispo.*

About the Author

Thomas J. Francl
MBA, Associate Faculty
Department of Accounting and Finance, School of Business and Management
National University
San Diego, CA
TFrancl@NU.edu
Research interests: student learning, student careers, instructor assessments

Assessment and Evaluation

Formative and Summative Assessment in Online Education

Dilani M. Perera-Diltz
Jeffry L. Moe

Abstract
Assessment is an integral part of both traditional and online education, especially when determining student learning outcomes. In the online learning environment, both formative and summative assessment practices require an understanding of the features and tools inherent to the electronic medium. Creating assessments for online education, either formative or summative, also requires application of constructivist learning principles to our collective understanding of the educational process and related goals. In this paper, we offer an overview of formative and summative assessment approaches suited to the online education environment.

Key Words
Formative assessment, summative assessment, online education

Formative and Summative Assessment in Online Education

Assessment is an integral part of education. Education is traditionally involved the action of learning by those defined as students and the imparting of knowledge by those defined as teachers. Currently, this construction of knowledge could involve three types of models of education: (a) the traditional banking model (Freire, 1970/2000) or teacher-led learning, (b) cognitive apprenticeship framework (Collins, Brown, & Newman, 1989) or collaborative construction of knowledge between students and teacher, and/or (c) legitimate peripheral participation in a situated learning framework (Lave & Wenger, 1991) or learning between or among students. The latter two types of education models are supported by knowledge that student learning improves through social interaction and collaboration (Lave & Wenger, 1991; Knowles, Holton, & Swanson, 1998). Within each of these three education frameworks, assessment is viewed as an essential component for learning (Hanson & Mohn, 2011) in terms of identifying and documenting increased knowledge, awareness, or skills.

An expansion from this original purpose of assessment has occurred recently with the rise of the accountability paradigm, including heightened scrutiny onto all aspects of the educational process by various internal (e.g., budget needs) and/or external (e.g., accreditation boards, national organizations) entities (Hanson & Mohn, 2011). Stakeholders expect the assessment of learning outcomes to occur more frequently and more rigorously, and to simultaneously be more transparent and accessible to non-expert reviewers and consumers (Hanson & Mohn, 2011). In this new era of heightened expectations for accountability, education professions also face the challenge of adapting to the online learning environment. Learners prefer both the flexibility and convenience of online education (Hewson, 2012), while also indicating expectations for personal achievement comparable to face-to-face learning environments (Stewart, Waight, Norwood, & Ezell, 2004). Despite the flexibility afforded by the online environment to students, instructors are expected to be more available, to provide more and quicker feedback, and to be otherwise proficient at establishing the basis for rapport with all students. With societal expectations for education and learning in all modalities increasing, it is important for educators to revisit basic concepts of assessment in order to both deepen and broaden their skills and thereby facilitate learner achievement. Reconceptualization of two important assessment themes, namely formative and summative assessment, in light of the capabilities and limitations of learning in online education, is discussed in this paper.

Formative and Summative Assessment

Assessment may occur in two forms (i.e., formative and summative) in the learning environment. Formative assessment provides on-going evaluation (Perera-Diltz, 2009) of a student's learning. This type of assessment requires evaluation of student learning outcomes several times during a semester and facilitates the evaluation of different content areas, skills, and the progress of learning within specific knowledge domains. Formative assessment could occur with repeated use of the same assessment form (e.g., a quiz four times in a semester) or with the use of multiple assessment forms (e.g., a quiz, an essay, and an experiential activity). Summative assessment is a measure of an end product (Perera-Diltz, 2009), and at best represents a holistic and qualitative appraisal of whether specified learning outcomes were achieved. Measures such as a capstone final project or a comprehensive final exam are examples of common summative assessment tools. However, there are times that formative assessment could serve summative purposes (Gikandi, Morrow, & Davis, 2011) when it informs stakeholders regarding a student's progress (Smith, 2007). Similarly, summative assessment can serve in a formative role when results are used for learning in subsequent units (Gikandi et al., 2011).

There are benefits and limitations to both types of assessment, which are sometimes based on such factors beyond the actual assessment as a sense of virtual community created (Glassmeyer, Dibbs, & Jensen, 2011) by the assessment task. Formative assessment has been articulated as the preferred assessment mode in online education, but full implementation of formative assessments requires careful design, monitoring, and the communication of feedback to learners in a clear and meaningful timeframe (Rovai, Ponton, Derrick, & Davis, 2006) to augment their overall education experience (Glassmeyer et al., 2011). Formative assessment provides the advantage of students' being able to demonstrate knowledge gained in small sections, which may be easier to master and express. Formative assessment also allows students to fail an assignment (e.g., 1 of 5 quiz scores), learn from mistakes, and subsequently not suffer penalty in the form of a poor final grade (Oosterhof, Conrad, & Ely, 2008; Vonderwell, Liang, & Alderman, 2007). Formative assessment, however, does require students to continuously demonstrate learning and engagement with the ongoing process of evaluation. The assessment of continuous improvement can be stressful for students and instructors alike. On the contrary, summative assessment has the benefit of being a potentially one-time, holistic, and integrated evaluation. If a student is unable to perform at his or her peak on the chosen summative assessment format (e.g., final projector test), then student learning is not accurately assessed and students' feelings of engagement and empowerment with the learning process may be diminished.

The New Era of Learning: Online/Blended Learning

The practice of teaching in higher education's including counselor education, with the ascendency of the Internet in the early 1990s, is increasingly facilitated either in whole or in part with communications technology (Naughton, Smeed, & Roder, 2011). Along with the rise in the use of technology to improve or provide educational experiences, movements in the theoretical and philosophical foundations of teaching and learning coincide with public expectations for increased access, flexibility, and participation in the co-construction of learning, including evaluation methods and protocols (Leppisaari, Vainio, Herrington, & Im, 2011). Proponents of constructivist education echo advocates for online learning (Williams, 2006) calling for instruction that is dynamic, authentic, and practical, and that engages the skills and lived

experiences of an empowered and technologically capable learner community (Herrington & Standen, 2000).

While online and blended education presupposes reliable access to appropriate communications technologies, a condition that makes this practice more adaptable to Western(-ized) or developed societies, the potential to reach an ever more globalized and diverse population of students is another motivating factor in the widespread adoption of online learning as a standard offering for higher and continuing education providers in the United States and around the globe (Leppisaari et al., 2011). For the purposes of this paper, fully web-based and blended learning will be referred to as online education that involves education facilitated either in whole or in part by a web-based learning management system (e.g., Blackboard) via access through both desktop and laptop computers, smart phones, e-tablets, or other Internet-capable devices (Perera-Diltz & Moe, 2012).

Eagerness to utilize a potentially dynamic new way of teaching and learning, coupled with valid concerns over quality assurance and fairness in access to technology, have remained central to professional dialogue on best practices in online education since its emergence as a widespread phenomenon in the mid to late 1990s (Bonk & Cummings, 1998). At best, online learning becomes a space where the principles of constructivist, learner-centered, authenticity-based, and adult education can be synthesized by instructors to produce meaningful and valid educational experiences (Lesnick, Cesaitis, Jagtiani, & Miller, 2004) similar to the cognitive apprentice model (Collins et al., 1989). A key principle of the constructivist learning framework is that human beings learn best in collaboration and interaction with others (Herrington & Standen, 2000) or through what is sometimes referred to as legitimate peripheral participation (Lave & Wenger, 1991). In comparison, behaviorist or instructivist education is based on rote memorization and on-demand, individual articulation of expert-imparted knowledge content (Herrington & Standen, 2000). Such teacher-led instruction, also referred to as the banking model (Freire, 1979/2000), is unsuitable in the online medium, as the learner becomes uninvolved in and disengaged from learning. Conversely, constructivist education that is learner-centered relies on the auto-didactic capacity inherent in all people and seeks to engage individuals in the active co-construction of their own learning experience (Eyal, 2012). In this way, knowledge becomes emergent as individual learners interact and synthesize previous learning with both novel experiences and ways of knowing cherished by local communities of learning and practice (Lepisaari et al., 2011). Hence, online education involves more than placement of all of or some of the material from a traditional face-to-face course onto the web.

Assessment of student learning in online education, similarly, cannot be merely transferred from a traditional face-to-face classroom, but must be re-conceptualized to account for the benefits and drawbacks of the given communication medium (Perera-Diltz & Moe, 2012), especially given the asynchronous nature of interactivity among the participants (Vonderwell et al., 2007). The issues of validity, reliability, and dishonesty related to assessment (Hargreaves, 2007) needs to be carefully considered in the design (Oosterhof et al., 2008) and management phases of online education (Gikandi et al., 2011). Online communication technology allows a number of assessment tools, such as discussion boards, model answers, electronic feedback systems, reflections, and online small group discussions (Escudier, Newton, Cox, Reynolds, & Odell, 2011; Thelwall, 2000), which can all be modified into formative or summative assessments to document student learning based on the purpose and needs of a course. The creation of meaningful and effective assessment, both formative and summative, is achievable through deep familiarity with and use of online education tools. The following is a closer look at

the available literature on the validity of formative and summative assessments in online education. We also provide an overview of common assessment tools for online learning, including adapted tools such as examinations, as well as such tools unique to online education as discussion boards or wikis. A chart that demonstrates the type of assessment involved with the various assessment tools is provided in Table 1.

Table 1. *Categories of Formative Assessments Available*

Assessment	Type	Peer Assessment	Co-Assessment (Instructor-Student)	Self-Assessment	Instructor Assessment
Rubrics	F or S	Yes	Yes	Yes	Yes
Netfolio	F or S	Yes	–	Yes	Yes
Student generated MCQ and concept maps	F or S	Yes	–	–	Yes
Reflection Journals and Papers	F or S	–	Yes	Yes	Yes
Comprehensive final exams	S	–	–	–	Yes
Assessment	Type	Peer Assessment	Co-Assessment (Instructor-Student)	Self- Assessment	Instructor Assessment
Comprehensive final exams	S	–	–	–	Yes
Research Projects and Reports	F or S	_	–	–	Yes
Case Study Analysis and Report	F or S	Yes	–	Yes	Yes
Wikis or blogs	F or S	Yes	Yes	Yes	Yes

Note: F = Formative; S = Summative

Formative Assessment Tools

The intent of formative assessment is to promote student development *during* a learning process through active engagement of the student with various assessment means. Feedback from formative assessment, when appropriately utilized in the online environment, has been found to promote learning (Pachler, Daly, Mor, & Mellar, 2010; Wang, Wang, & Huang, 2008) not only through monitoring progress toward learning outcomes but also by crystalizing learning strategies in students (Gikandi et al., 2011). As mentioned elsewhere, issues of validity, reliability, and dishonesty need to be addressed (Gikandi et al., 2011; Hargreaves, 2007) in

formative assessment, and this entails a prior consideration of both processes and products of learning (Vonderwell et al., 2007). According to Gikandi et al. (2011), characteristics of validity in formative assessment include (a) authenticity of assessment activity (i.e, engage student in decision making and problem solving relevant to real world situations), (b) effective formative feedback (i.e., useful, timely, ongoing, and easy to understand feedback to student), (c) multidimensional perspectives (i.e., diverse opportunities for the student), and (d) student support (i.e., mentoring role of the teacher). Reliability characteristics of formative assessment (Gikandi et al., 2011) include: (a) opportunities for documenting and monitoring evidence of learning by teacher and student, (b) multiple evidences of learning while guiding students to manage tasks without being frustrated (Smith, 2007), and (c) explicit clarity of learning goals and shared meaning of rubrics (Gikandi et al., 2011). Finally, dishonesty relates to the ability to verify ownership of work to a specific student (Gikandi et al., 2011) which Oosterhof et al. (2008) observed may not become an issue in formative assessment if students are provided with scoring rubrics and model products with assessments. Formative assessments are multifaceted and could be in the form of peer assessment, co-assessment, self-assessment, and/or feedback from the instructor. Such formative assessment is said to achieve autonomous and independent learning (Nicol, 2007).

Rubrics: Discussion Boards

Rubrics can be utilized to evaluate any assignment by the instructor, peers, or the combination of the two. Brookes and Lin (2010) discussed a formative assessment rubric created for an online course to guide student learning and provide formative evaluation on learning of concepts and feedback on how to improve. The rubric was created with four broad concept points horizontally, which are then broken down to as many sub-abilities as needed to assess. In their rubric, Brookes and Lin used "ability to evaluate models, equations, solutions, and claims" (p. 6) as their broader concepts. On the vertical scale, Brookes and Lin used columns labeled "missing, inadequate, needs improvement, and adequate" (p. 6).

This rubric concept can be applied to the evaluation of discussion board posts. Usually, an online asynchronous discussion board has discussion questions posted by the instructor. Consideration of and reflection upon these questions facilitates engagement with a larger concept or concepts, which in turn represent important learning outcomes. For instance, the broader concepts for school counseling services delivery are advisement, guidance curriculum, responsive services, and support systems (ASCA, 2005). Under these four broader concepts, sub-abilities that can be evaluated are "student is able identify individual advisement needs" or "student is able to identify appropriate topics for guidance." Instructors can adapt the four grading scales suggested by Brookes and Lin (2010) to their own assignment rubrics. Indicating in the form of formative assessment rubrics if the student met or did not meet the concepts and sub-abilities as the learning occurs, provides the opportunity for the student to understand any knowledge gaps related to a specific content area. Such evaluation using a rubric can be conducted by instructor alone or by instructor and/or peers. Awareness gained from such continuous feedback can lead to further learning of those areas and possible future competency in those areas. Without such formative evaluation, students would move forward until a summative assessment is conducted. It may be too late at that point to gain missing knowledge and provide proof of such knowledge to an instructor for grading purposes.

Journals

Reflective journaling, where learners articulate knowledge from their reading, collaboration in discussion, and personal experiences, is one method of formative assessment (Naughton et al., 2011). The content of this reflection can be requested to include not only text but exploring of websites and blogging the information with peers, inclusion of interactive video and other media sources. Concerns for learner privacy are naturally heightened when communicating online, and the scope and depth of journal entries should be carefully demarcated by instructors in order to facilitate learner disclosure and ensure that the online classroom is a supportive environment. Electronic journal entries shared directly and only with instructors may be more unbounded, and principles of etiquette should be explained, regardless, in syllabi and other locations, to promote collegiality whenever peer review and collaboration are linked to the assessment of reflective journals.

Netfolio

The use of an e-portfolio, which aims for metacognition, authentic tasks, contextual feedback, and student responsibility (Black & Williams, 1998), aims to depict student abilities developed during a learning process and is a summative assessment. Netfolio is derived from this e-portfolio concept, in that it is a "set of e-portfolios produced by different students" (Barbera, 2009, p. 344) that offer students the opportunity to better understand learning objectives as well as to revise self-portfolios through participation of assessment of and feedback to other students' portfolios (Barbera, 2009). At set intervals, peers provide new content and different perspectives through online communication. The netfolio is evaluated in a manner similar to the e-portfolio, with attention given to the presentation of ideas, competency evidenced in communications, and learner's ability to engage in self- and other-reflection. The advantages in using a netfolio assessment are: (a) It promotes collaboration between instructor and learner as well as among leaners (Barbera, 2009); (b) it provides quick and explicit feedback (Barbera, 2009); (c) it mitigates feelings of isolation through creating a sense of a virtual community (Glassmeyer et al., 2011); and (d) it allows learners to view exemplary work samples of other students (Barbera, 2009), improving one's own work through self-reflection (Wang, 2010). Therefore, netfolio provides a student opportunity for continuous improvement through reflection on others' work and feedback on one's own work (Barbera, 2009).

Multiple-Choice Examinations: Student-Generated Questions and Concept Maps

Multiple-choice quizzes (MCQs) are a more traditional form of assessments that has been criticized for not facilitating active learning due to its lack of justification of the answer (Arthur, 2006). Despite these concerns, the primary advantages of online MCQs include time efficiency, fairness, and quality assurance. Online MCQs provide reduced marking time, elimination of the need to verify personal error, rapid analysis of data and item analysis, verification of reliability, validity across years, elimination of teacher bias, and portability (Escudier et al., 2011). Some learning management systems permit the design of MCQs so that feedback is provided to the student while in the process of completing the quiz, while others may provide options for branching and extended multiple-choice questions (Escudier et al., 2011). Pittenger and Lounsbery (2011) recommended student-generated MCQs as an effective form of assessment, mitigating the lack of engaged learning, as it fosters student engagement with course content, metacognitive skills, and ownership of learning experience. Berry and Chew (2008) reported

"improved exam performance and presumably learning" (p. 310) when students generated their questions with a positive correlation with the number of questions generated by a student. Concept maps (Berry & Chew, 2008) were another method recommended that improved student performance on MCQs. Another option is to provide long- and short-answer quizzes or exams. However, this eliminates some of the aforementioned advantages. Finally, the equivalency of online- versus paper-based MCQs may be another consideration with online tests and examinations. Researchers Escudier et al. (2011) and Hewson (2012) found that student performance in online versus traditional forms of MCQ format was similar.

Wikis

An assessment tool unique to the online environment is the wiki. It is a space in which a group of students can be assigned to create a case study, a treatment plan, or a lesson plan. Each student can be directed to utilize a different font color with their name within parenthesis for easy identification of contribution by peers and instructor. This assessment can be designed to be graded by a combination of peers and/or instructor, and it can be repeated over the course of a semester or quarter, allowing a student to improve performance through participation, peer feedback, and self-reflection. Grading of this assignment can be designed as one time at the end of the term, as more of a summative assessment, or else as a fraction (e.g., 3 of 5 times).

Summative Assessment Tools

Summative evaluation in education is simultaneously more familiar to those involved in the instructional process (e.g., students, teachers, administrators) and a potentially under-theorized practice in regards to online learning. Readers may be familiar with the use of so-called high-stakes testing, where a summative evaluation is used as the primary or sole indicator to determine if learners have achieved educational objectives (Escudier et al., 2011). This use of summative evaluation, in the form of a mid-term and final exam only, though common in higher education, is discouraged when planning and implementing assessment of a learner's experience and achievement in online educational environments (Stewart et al., 2004). Just as formative assessment provides in-process benchmarking of learner achievement, summative assessment at best seeks to comprehensively document and richly depict the emergent process of learning that occurred over a given time-bounded learning experience, e.g., over a semester or a quarter (Naughton et al., 2011).

Upon first consideration, the principles of constructivist, learner-centered, and authentic education may seem difficult to thread into the design of meaningful summative assessments. Recalling that the principles of authentic education include a focus on problem-solving, learner-decision making, and applicability to situations outside of the educational context, it becomes reasonable to ask whether instructors can engage students in sufficient time and at a valid level of participation to co-create summative evaluation protocols in an online education environment. Lesnick et al. (2004) suggested that re-appropriation of the goals of assignments in online education should serve as the foundation for design, instruction, and assessment. Proponents of online education (Eyal, 2012; Lesnick et al., 2004; Russell, Elton, Swinglehurst, & Greenhalgh, 2006) asserted that, due to the interactive, instant archiving of text and communication availabilities in standard learning management systems, the separation between activities designed to promote learning and the assessment of said activities is diffused. A commitment to the goals of constructivist and authentic education, coupled with deep familiarity with the tools available in learning management systems, supports re-conceptualization of how summative

assessments are created, what they are designed to assess, and why a given set of assessment practices is valid in terms of supporting over-arching learning themes or objectives.

Summative assessment in online education needs to be based on facilitating and documenting the learner's abilities to synthesize his or her own perspective and personal experiences with novel texts, media content, and other knowledge artifacts. The depiction of achievement, rather than the appraisal of learners' capacity for rote memorization and recitation, involves optimizing the use of assessment tools that focus on problem-solving, critical analysis of media sources, and articulation of the learner's voice as an engaged co-creator of the educational experience. A basic design for summative assessment in online education would represent the instructor's ability to competently use learning management systems to approximate face-to-face assessment strategies, such as a comprehensive exam or final paper. An advanced design for summative assessment would maximize the potential for learning management systems to engage learners and facilitate the co-design of capstone projects and assignments based on learners' input (Levia & Quiring, 2008). As collaboration is commonly identified as an ideal to incorporate throughout the online learning process (Eyal, 2012; Lesnick et al., 2004; Swan, Shen, & Hiltz, 2006), embedding an interactive, peer-based feedback and revision process is considered to be a best practice in the design and implementation of either formative or summative assessments.

Rubrics: Case Studies

The use of case studies to assess and depict actual learning encapsulates the principles of authentic, learner-centered education by focusing on problem-solving and decision-making skills, the textual construction of the learner's perspective and engagement with course material, and the chance to blend the lived experiences of learners with concepts cherished by professional/academic communities (Williams, 2006). Instructors are encouraged to incorporate the advantages and potential power of the online medium when using case study analysis as a comprehensive or summative assessment tool (Bonk & Cummings, 1998), including the expectation that learners are able to review a wider breadth of resources and media to inform their ability to critically analyze case material. Case material can be presented by the instructor with web-links to scholarship, press releases, and other news sources; video documentation of case-related events; and either fictional or non-fictional media (e.g., books, interviews, films). Learners in turn can be encouraged to provide a similar array of texts and media to support their analysis, including learner-generated videos and images.

In the spirit of subverting the use of summative assessment as a high-stakes evaluation tool (Stewart et al., 2004), rubrics for evaluating learner-generated content should be based equally on valuing the learner's perspective and voice (Lesnick et al., 2004), rather than solely upon appraising learner performance (Williams, 2006). This encourages instructors to devise evaluation protocols with attention to learners' process of learning, including collaborating with others and the adoption of authoritative positions within a given learning discourse (Lesnick et al., 2004). Eyal (2012) recommends that summative assessments be broken down into smaller, constituent elements that either can be used as formative assessments or can be presented to learners for their consideration and comment. The deconstruction of a larger capstone project, such as a case study analysis, can lead to the identification of related learning components and form the basis of evaluation rubrics.

A grading or evaluation rubric incorporates two key dimensions, one being identification of discrete learning components or themes related to overall learning objectives, and the other being a point-system hierarchy to represent degree of learner achievement (Swan et al., 2006).

Elements in an authentic evaluation rubric for case study analysis could include (a) the richness (in both breadth and depth) of resources upon which analysis is based; (b) the ability to identify salient and divergent perspectives in best practices relative to presented case material; (c) articulation of a clear process of analysis that appears to incorporate consideration of alternative perspectives; and (d) authoritative and or innovative synthesis of all elements of the learning process into a coherent viewpoint. Case study reports can be designed as interactive and collaborative assessments, with time periods for peer and instructor commentary (and subsequent revision of submitted work) incorporated into the design and implementation of this form of assignment. Degree and quality of collaboration and the ability to integrate critical feedback then can become another component in the evaluation rubric.

Tests and Examinations

Tests or exams are commonly used to measure academic achievement (Eyal, 2012), and issues of fairness, validity, authentic depiction of learning, and optimal use of resources are important for both face-to-face and online education (Williams, 2006). The literature base in general supports the use of exams to document learner performance in online environments (Hewson, 2012). In a comparative study, Escudier et al. (2011) found that dental school students performed equally well on face-to-face or web-based versions of an important high-stakes test. The authors concluded that using web-based assessment does not disadvantage learners, though it should be noted this study focused on the outcomes of learning and not on depicting learners' experience of the educational process. On the topic of student expectations, Stewart et al. (2004) found that positive expectations for learning were high in a participant sample of students in online classes during a college semester. Students identified positive expectations for meeting educational goals, having a meaningful experience, and being supported by instructors and staff throughout the course (Stewart et al., 2004). Students rated the actual experience of learning less favorably, though a majority of participants still rated the overall experience as positive (Stewart et al., 2004).

Williams (2006) suggested that an open-book, open-media format for administering exams in online education is preferred to the more common closed-book, proctored exam typical of education that is facilitated in primarily face-to-face education. If security of exam procedures is the chief concern, software such as a lock-down web-browser or a text comparison tool (that permits evaluation of submitted material for plagiarism) can be deployed. Williams and Wong (2009) identified that a sample of students, when comparing online versus face-to-face exams, viewed both formats as equally conducive (or restrictive, depending) to academic dishonesty or cheating. Students in the same study significantly preferred online, open-resource, and asynchronous examinations, as opposed to time-bound, face-to-face, and closed-resource (i.e., book) examinations, mostly due to the convenience of the former (Williams & Wong, 2009). Most learning management systems allow the use of time-limited, synchronous, and single-attempt submissions of exams, though this format may reduce the potential of exams as authentic summative assessment tools (Eyal, 2012; Levia & Quiring, 2008; Williams, 2006).

Journals, Blogs, and WIKIS

Applying the principles of authentic and constructivist education to online education encourages instructors to place the voice and experiences of the learners at the center of the assessment and evaluation process (Herrington & Standen, 2000; Russell et al., 2006). Reflective journals, where learners are prompted to articulate their own perspective relative to key educational themes, are

one way to enrich the assessment process in both a formative and summative sense (Naughton et al., 2011). Adapting the concept of the reflective journal to the online, collaborative learning environment, students can be asked to create web links in text to pertinent resources, images, streaming videos, or other media that help to underscore and contextualize learners' awareness and reflection upon their own learning process. Another adaptation would be to frame the journal, which implies either student-to-instructor or student-to-self-only communication, as a web-log (i.e., blog) designed for commentary and review by other students (Eyal, 2012). A rubric for evaluating the blog could be shared with all students, in order for student peer evaluations then to be incorporated in the overall/summative assessment of student and class-wide learning. If learners expected to augment their skills at scholarly and critical writing, instructors can assign students to create collaborative web-pages or wikis (Eyal, 2012). Wikis, as web-based knowledge resources, typically require detailed referencing and a comprehensive overview of covered topics. Many elements used to evaluate final term papers can be adapted to evaluate wikis, with the addition of assessing elements such as other web-based multimedia, timeliness of revisions, and the professionalism of collaborators and peer reviewers.

Conclusion

In this article, we have provided an overview of formative and summative tools available in the literature and some of our own ideas that can be adapted for the online education environment, along with the philosophical foundation for design and evaluation of the now-ubiquitous practice of online learning. However, due to the speed at which technology advances, it is necessary to be deliberate in learning about newly available tools. In the digital world, one is limited only by how far the imagination can stretch. Digital literacy is a key skill for instructors committed to learner success in online education (Bonk & Cummings, 1998; Eyal, 2012; Herrington & Standen, 2000), and professional educators in the 21st century need to augment and attend to their own digital literacy, both individually and by expecting educational institutions to provide opportunities to develop and maintain this crucial skill set. Along with cultivating digital literacy, educators need to re-conceptualize commonplace or mundane features of such online communication as email, in light of these features' potential to enrich the learning process beyond what can be expected of even traditional, face-to-face instruction (Lesnick et al., 2004). Constructivist education practices, such as encouraging collaborative learning and feedback (Russell et al., 2006), basing assessment on the progressive problem-solving and decision-making capabilities of learners (Williams, 2006), and authentic depiction of the emergent learning process (Naughton et al., 2011) are facilitated by deep familiarity with the capabilities of online learning management systems. One note of caution is that some electronic devices other than laptop and desktop computers limit the accessibility of all features available on a web-based learning management system. More empirically based literature on counselor educator digital literacy, including consideration of the constructive nature of the education process and best methods of both formative and summative assessments, may contribute to accurately, efficiently, and productively assess learner knowledge, awareness, and/or skills in online counselor education.

References

American School Counselor Association (2005). *The ASCA National Model: A framework for school counseling programs* (2nd ed.). Alexandria, VA: Author.

Barbera, E. (2009). Mutual feedback in e-portfolio assessment: An approach to the netfolio system. *British Journal of Educational Technology, 40*(2), 342–357. DOI:10.1111/j.1467-8535.2007.00803.x

Berry, J. W., & Chew, S. L. (2008). Improving learning through interventions of student-generated questions and concept maps. *Teaching of Psychology, 35*(4), 305–312. DOI: 10.1080 /00986280802373841

Black, P., & Williams, D. (1998). Inside the white box: Raising standards through classroom assessment, *Phi Delta Kappan, 80*(2), 139–148.

Brookes, D. T., & Lin, Y. (2010). Structuring classroom discourse using formative assessment rubrics. Paper presented at the Physics Education Research Conference. Retrieved from http://www.compadre .org/per/items/detail.cfm?ID=10367

Bonk, C. J., & Cummings, J. A. (1998). A dozen recommendations for placing the student at the centre of Web-based learning. *Educational Media International, 35*(2), 82–89.

Collins, A., Brown, J. S., & Newman, S. E. (1989). Cognitive apprenticeship: Teaching the crafts of reading, writing, and mathematics. In L. B. Resnick (Ed.), *Knowing, learning, and instruction: Essays in honor of Robert Glaser* (pp. 453–494). Hillsdale, NJ: Lawrence Erlbaum Associates.

Escudier, M. P., Newton, T. J., Cox, M. J., Reynolds, P. A., & Odell, E. W. (2011). University students' attainment and perceptions of computer delivered assessment; a comparison between computer-based and traditional tests in a "high-stakes" examination. *Journal of Computer Assisted Learning, 27*(5), 440–447. DOI: 10.1111/j.1365-2729.2011.00409.x

Eyal, L. (2012). Digital assessment literacy: The core role of the teacher in a digital environment. *Educational Technology and Society, 15*(2), 37–49. Retrieved from https://csuglobal.blackboard.com /bbcswebdav/library/Article%20Reserve/OTL532K/Digital%20assessment%20literacy%20—The %20core%20role%20of%20the%20teacher%20in%20a%20digital%20environment.pdf

Freire, P. (1970/2000). *Pedagogy of the oppressed.* (30th Anniversary). (Trans. M. B. Ramos). New York, NY: Continuum.

Gikandi, J. W., Morrow, D., & Davis, N. E. (2011). Online formative assessment in higher education: A review of the literature. *Computers and Education, 57*(4), 2333–2351.

Glassmeyer, D. M., Dibbs, R. A., & Jensen, R. T. (2011). Determining utility of formative assessment through virtual community: Perspectives of online graduate students. *The Quarterly Review of Distance Education, 12*(1), 23–35.

Hargreaves, E. (2007). The validity of collaborative assessment for learning. Assessment in education: principles. *Policy & Practice, 14*(2), 285–299.

Hanson, J. M., & Mohn, L. (2011). Assessment trends: A ten-year perspective on the uses of a general education assessment. *Assessment Update: Progress, Trends, and Practices in Higher Education, 23*(5), 1–15. DOI: 10.1002/au.235

Herrington, J., & Standen, P. (2000). Moving from an instructivist to a constructivist multimedia learning environment. *Journal of Educational Multimedia and Hypermedia*, *9*(3), 195–205.

Hewson, C. (2012). Can online course-based assessment methods be fair and equitable? Relationships between students' preferences and performance within online and offline assessments. *Journal of Computer Assisted Learning, 28*(5), 488–498. DOI: 10.1111/j.1365-2729.2011.00473.x

Knowles, M. S., Holton III, E., & Swanson, R. A. (1998). *The adult learner. The definitive classic in adult education and human resource development* (7th ed.). City, UK: Taylor & Francis.

Lave, J., & Wenger, E. (1991). *Situated learning: Legitimate peripheral participation.* Cambridge England, New York: Cambridge University Press.

Leppisaari, I., Vainio, L., Herrington, J., & Im, Y. (2011). International e-benchmarking: Flexible peer development of authentic learning principles in higher education. *Educational Media International, 48(3),* 179–191. DOI:10.1080/09523987.2011.607321

Lesnick, A., Cesaitis, A., Jagtiani, U., & Miller, R. (2004). Curriculum design as re-writing: Online "chat" as a resource for radicalizing the teaching of a canonical text. *Curriculum & Teaching Dialogue*, *6*(1), 35–47.

Levia Jr., D. F. & Quiring, S. M. (2008). Assessment of student learning in a hybrid PBL capstone seminar. *Journal of Geography in Higher Education, 32*(2), 217–231. DOI:10.1080/03098260701514041

Naughton, C., Smeed, J., & Roder, J. (2011). Delimiting the prospect of openness: An examination of the initial student approaches to e-learning. *International Review of Research in Open and Distance Learning*, *12*(2), 103–120.
Nicol, D. (2007). Laying foundation for lifelong learning: Case study of e-assessment in large first-year classes. *British Journal of Education Technology, 38*(4), 668–678.
Oosterhof, A., Conrad, R., & Ely, D. (2008). *Assessing learners online.* Upper Saddle River, NJ: Prentice Hall.
Pachler, N., Daly, C., Mor, Y., & Mellar, H. (2010). Formative e-assessment: Practitioner cases. *Computers & Education, 54*(3), 715–721.
Perera-Diltz, D. M. (2009). Assessment purposes. In E. Bradford (Ed.), *ACA encyclopedia of counseling* (pp.38–39). Alexandria, VA: American Counseling Association.
Perera-Diltz, D. M., & Moe, J. (2012). Online instruction of counselor education coursework: Maximizing strengths and minimizing limitations. In G. R. Walz, J. C. Bleuer, & R. K. Yep (Eds.), *Ideas and research you can use: VISTAS 2012 (Article 41).* Retrieved from http://www.counseling.org/Resources/
Pittenger, A. L., & Lounsbery, J. L. (2011). Student-generated questions to assess learning in an online orientation to pharmacy course. *American Journal of Pharmaceutical Education 75*(5), Article 94.
Rovai, A. P., Ponton, M. K., Derrick, M. G., & Davis, J. M. (2006). Student evaluation of teaching in the virtual and traditional classrooms: a comparative analysis. *Internet and Higher Education, 9*(1), 23−35.
Russell, J., Elton, L., Swinglehurst, D., & Greenhalgh, T. (2006). Using the online environment in assessment for learning: A case-study of a web-based course in primary care. *Assessment & Evaluation in Higher Education*, *31*(4), 465–478. DOI:10.1080/02602930600679209
Smith, G. (2007). How does student performance on formative assessments relate to learning assessed by exams? *Journal of College Science Teaching, 36*(7), 28–34.
Stewart, B. L., Waight, C. L., Norwood, M. M., & Ezell, S. D. (2004). Formative and summative evaluation of online courses. *The Quarterly Review of Distance Education, 5*(2), 101–109.
Swan, K., Shen, J., & Hiltz, S. R. (2006). Assessment and collaboration in online learning. *Journal of Asynchronous Learning Networks, 10(1),* 45–62. Retrieved January 30, YEAR, from http://www.new .kent.edu/ehhs/dl/upload/assessment-and-collaboration.pdf
Thelwall, M. (2000). Computer-based assessment: A versatile educational tool. *Computers & Education, 34(1),* 37–49.
Vonderwell, S., Liang, X., & Alderman, K. (2007). Asynchronous discussions and assessment in online learning. *Journal of Research on Technology in Education, 39*(3), 309–328.
Wang, L. (2010). Integrating communities of practice in e-portfolio assessment: Effects and experiences of mutual assessment in an online course. *Internet and Higher Education, 13*(4), 267–271.
Wang, T., H., Wang, K., H., & Huang, S. C. (2008). Designing a web-based assessment environment for improving pre-service teacher assessment literacy. *Computers & Education, 51*(1), 448–462.
Williams, J. (2006). The place of the closed book, invigilated final examination in a knowledge economy. *Educational Media International*, *43*(2), 107–119.
Williams, J., & Wong, A. (2009). The efficacy of final examinations: A comparative study of closed-book, invigilated exams and open-book, open-web exams. *British Journal of Educational Technology*, *40*(2), 227–236.

About the Authors

Dilani M. Perera-Diltz
PhD, Associate Professor of Counselor Education
Department of Counseling, Administration, Supervision, and Adult Learning
College of Education
Cleveland State University
Cleveland, OH
Email: d.pereradiltz@csuohio.edu
Research interests: counselor education practice, school counselor practice, assessment

Jeffry L. Moe
PhD, Assistant Professor of Counseling
Department of Counseling & Human Services, Darden College of Education

Old Dominion University
Norfolk, VA
Email: jmoe@odu.edu
Research interests: LGBTQ issues in counseling, consultation, counselor education practice, marginalized populations

Toward a More Effective and Useful End-of-Course Evaluation Scheme

S. R. Subramanya

Abstract
The primary objectives of end-of-course (EoC) evaluations are (should be) to improve the quality of teaching and student learning. Despite being administered for over 50 years and studied extensively, no single scheme or set of schemes has emerged which are considered fair, objective, and valid. At the core of the problems is the lack of mechanisms to accurately map the subjective (biased) answers to objective (fair) numerical quantities. This paper examines issues in the current EoC evaluation schemes and proposes improvements. It also presents the major issues and challenges in the implementation of the proposed improvements.

Key Words
End-of-course evaluations, student evaluations, course evaluations, course assessment, effective evaluation

Introduction

The course and instructor evaluations at the end of the courses in higher education institutions started to be used increasingly in the 1960s. Their administration and use have increased over the years. Now, the end-of-course (EoC) evaluations are performed at the end of the courses in most institutions of higher learning. These evaluations generally consist of questions addressing three components: (a) the instructor's teaching, (b) the course content and activities, and (c) students' own learning assessment/experience. The ultimate objectives of these course and instructor evaluations should be to improve the quality of instruction, the learning outcomes, and the teaching/learning experience. However, it appears these schemes just gather the EoC evaluation data and pass on the raw data to the instructors and administrators, stopping short of deriving valuable information/knowledge from the data and making effective use of such information/knowledge in facilitating improvements in the instruction and the learning experiences.

The evaluations of the course and instructor performed at the end of the courses, overall, have remained unchanged. The process consists of the students filling out a survey, developed ten or more years ago, as a means of providing feedback to the instructors about how the students feel about their learning experiences, the course content, and the instructor's teaching.

In addition to the dated evaluation forms, there have been significant changes in many aspects of teaching and learning: the delivery modality of the course, the use of new teaching methods, use of newer technologies, changes in programs resulting in course modifications, offerings of newer programs and courses, etc. Thus, the evaluations are no longer accurate indicators of the metrics they are trying to evaluate; they are ineffective in their overall objective and irrelevant in the present day.

In the current EoC evaluation model, the surveys are administered and data is collected, which is then made available to the instructors and administrators. This is shown in Figure 1.

After obtaining the raw data, it is expected that the instructors will interpret it suitably and use the information to improve the course and/or their own teaching. The administrators use the data either to reward or remediate the instructor. This is like an "open–loop" system where the

feedback from the students (end users) about the system (instruction) is not utilized in a systematic manner in improving the very system (instruction) that was evaluated.

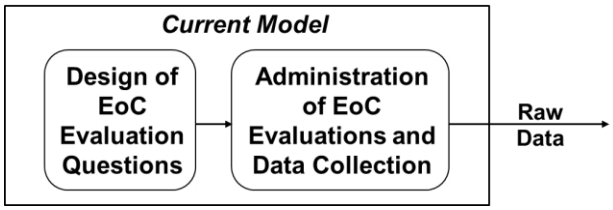

Figure 1. The current model of end-of-course evaluations.

It could be argued that the ultimate objective of this process should be to use the collected data to facilitate improvements in instruction and to enhance the learning experience of the students. This is akin to a closed–loop system, where the feedback is used to control the system to act/behave in a better/optimal manner. We believe there is value in the EoC evaluation data gathered, which should be utilized in a systematic manner to improve instruction and learning. Thus, in the proposed *enhanced model* shown in Figure 2, there are several aspects to the EoC evaluations: (a) the design of the questionnaire, (b) the administration of EoC evaluations and data collection, (c) the analysis of the data gathered from the EoC evaluations to derive information/knowledge, and (d) the ways in which the information/knowledge derived from analysis of EoC evaluation data are used. These form the "eco-system" of the enhanced model.

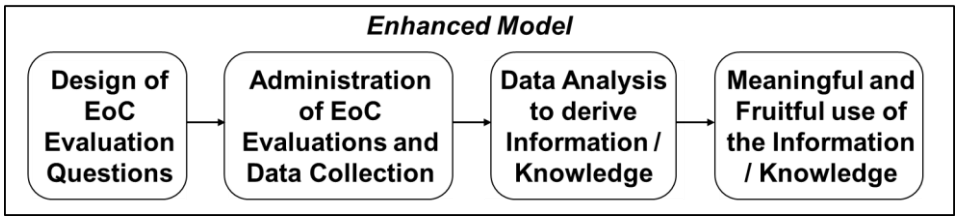

Figure 2. The "eco-system" of the enhanced model.

While each one of these aspects in the proposed enhanced model is deserving of a lengthy discussion, due to the nature of this article, the focus is on the limitations of the current evaluation process, the administration concerns of the evaluations, and solutions for improvement. Subsequent research will address the details of the proposed model. Please also note that this discussion is of a general nature, and concepts will need to be applied on an individual basis.

The EoC evaluations are not very effective in achieving their primary objectives for a variety of reasons: (a) use of a common set of evaluation criteria across all courses and disciplines which may not capture the course/discipline specific idiosyncrasies and characteristics, (b) often-dated evaluation schemes that are in many cases irrelevant, given the changes in course content and technologies and methodologies of teaching, (c) inadequacy of the questionnaires to accurately

capture the elements constituting effective teaching, (d) lack of clear instructions/examples to students to map the answers in the questionnaire to the proper number (in the Likert-type scale); (e) changes in the background and preparations of the students; (f) improper use of technologies that hinder learning (i.e., overreliance of online and readily available content; (g) social networking technologies adding to distractions in classes, and so forth.

We use the terms "end-of-course (EoC) evaluations," "student evaluations," and "student evaluations of teaching" synonymously.

Background

End–of-course (EoC) evaluations seek to find out the students' perception and experience of the instruction of the course, several traits of the instructor relevant to course instruction/delivery, and course content. The ultimate objectives of these evaluations are (should be) to use them as productive feedback in order to improve the quality of instruction and enhance the learning experience of the students. This section gives several samples of work done in this area, starting with some old ones (from almost 35 years ago) and through the years to the more recent ones. This is done to sample the kinds of issues researchers in the area have tackled over the years, and to present the observation that the same or similar problems have persisted over time.

Studies have been made over the decades and literally thousands of research papers have been published, focusing on the nature, methodology, and validity of student evaluation of teaching (EoC evaluation data). At the end of 2010, there were 2,875 references in the ERIC database using the descriptor "student evaluation of teacher performance." By the additional descriptor "higher education." the number was 1,852 (Benton & Cashin, 2012). Positions have been taken about (a) the capability of students to evaluate objectively, (b) the parameters that can effectively cover the aspects of teaching effectiveness, (c) factors that introduce biases into the evaluations, (d) the very validity of the evaluations, (e) the effectiveness of the evaluations in contributing to the improvement of teaching effectiveness and learning experience, (f) the ways the results of evaluations are (should be) used by the faculty and administration, etc.

Deficiencies in student evaluations of teaching that contribute to inaccuracies in the measurement of teaching effectiveness were widely discussed (e.g., Beardsley, Haertel, & Rothstein, 2012; Calkins & Micari, 2010; Darling-Hammond, Williams & Ceci, 1997; Wines & Lau, 2006). Many cases of invalidity of student evaluations of teaching were given in Fish (2005), as well as Gray and Bergmann (2003). An extreme case of the absurdity of student evaluations was documented in the "Dr. Fox Experiment" (Naftulin, Ware, & Donnelly, 1973), in which a charismatic actor giving a charismatic lecture, devoid of any worthy educational content, was rated highly by a well-educated audience. The validity and reliability of the evaluation questionnaires have been the topic of study of a number of papers; just as grades in a course or a set of courses are not any real measures of student talents and achievements, so are the student evaluations of teachings not any real measure of teaching effectiveness. Kember and Leung (2008) provided procedures for establishing the validity and reliability of questionnaires so that the strengths and weaknesses in teaching are easily identified in order that appropriate remedial measures can be taken. Summative student evaluation of teaching has been widely criticized for not being an accurate measure of teaching effectiveness (Dunegan and Hrivnak, 2003; Emery, Kramer, & Tian, 2003; Merritt, 2008). Many studies have dealt with the organizing principles of students' evaluations. Several studies have addressed the objectivity of student evaluations. For example, in Felton, Mitchell, & Stinson (2004a, 2004b) and in Johnson

(2002), it was shown that evaluation scores are influenced by factors not related to the actual instructions, and in addition to the instructor's giving high grades for very little work.

Cohen's (2005) study distinguished the factors that directly relate to the course or teacher, and the ones that relate to the interaction between the course or teacher and the students. The study in Mohanty, Gretes, Flowers, Algozzine, and Spooner (2005) showed that it is more effective, for the purposes of helping instrucvturs improve and enhance their teaching skills, to have formative evaluations early and frequently during the course, as opposed to the EoC evaluations.

Studies have been performed for determining the factors for higher scores in EoC evaluations. For example, in Isely and Singh (2005), Kidd and Latif (2004), and Krautmann and Sander (1999), it was shown that closeness of the students' expectation of grades and the actual grades obtained resulted in higher evaluation scores. In Love and Kotchen (2010), the authors presented a model that provides a theoretical basis for the relationship between grades inflation and the behavioral response of the students. They showed that a link between grades and student evaluations can lead to grade inflation, lower student efforts, and a disconnect between institutional expectations and faculty incentives.

In Kidd and Latif (2004), 5,399 student evaluations from 138 course offerings over 4 years were analyzed to find correlations between students' grade expectations, actual grades, and student evaluations of teaching. They found a strong positive correlation between student grades and student evaluations of teaching and concluded that the validity of using students' evaluations as the primary measure of teaching performance is questionable. Several surveys have shown that a majority of the teachers believe that a teacher's higher level of academic standards would result in worse student evaluation of teaching.

In Felder and Brent (2004), the authors claimed that the student evaluations of teaching had a high level of validity. However, they stated that it made little sense to use *only* student evaluations, since few students are well equipped to judge whether the course is up-to-date, the exams and assignments are appropriately challenging, the content and learning outcomes are aligned with program learning outcomes and/or accreditation requirements, etc. They suggested that in order to have an effective teaching evaluation, multiple sources other than student evaluations must be used, such as (a) peer evaluations, (b) the teaching portfolio, and (c) evidence of scholarship of teaching and learning.

Moore and Kuol (2005) offered a set of eight individual strategies for analyzing student feedback for the purposes of using them to properly reflect and improve the aspects of teaching. Also, the student evaluations are biased in favor of or against certain qualities of teachers, such as personalities, looks, disabilities, gender, and ethnicity (Birnbaum, 1999). Perry (1988) observed that different worlds can exist within the same classroom setting and showed how the student evaluations could be used to gain better understanding of the different worlds in more meaningful ways.

A summary of research on the reliability, validity, and usefulness of student evaluations of teaching was given in Cashin (1998). Cohen (1980) performed a meta-analysis of 17 studies on the effect of giving feedback of student evaluation on improving teaching. One of these studies used three groups of teachers, where all the groups were administered two student evaluations of teaching—one at the middle of the course, and the other at the end. The first group never got the evaluations feedback, the second group received the evaluations feedback, and the third group received the evaluations feedback and some consultation. The results showed improved teaching.

With evaluations of the first group set at the 50th percentile, the EoC evaluations of the second and third groups were in the 58th and 74th percentile, respectively.

Based on unique data to measure student performance in mandatory follow–on classes, Carrell and West (2010) presented evidence that professors who excel at promoting contemporaneous student performance, teach in ways that improve their student evaluations but harm the follow–on achievement of the students in more advanced classes. Felder (1992), Greenwald and Gilmore (1997), Johnson (2003), and Marsh and Roche (2000), among numerous other studies, have shown that not all student evaluations accurately reflect the quality of learning and teaching, and that students favor teachers and courses with little work and easy grading. Emery et al. (2003) have given a qualitative and quantitative review of student evaluations as a measure of teaching effectiveness, the problems therein, and suggestions to improve them.

Several empirical studies have suggested that the student evaluations of teaching can be influenced by factors totally unrelated to teaching, for example, instructor's physical attractiveness (Freng & Webber, 2009), physical classroom environment (Hill & Epps, 2010), students' belonging to specific demographic groups (Kherfi, 2011), and students' perceiving an instructor as boastfully self-promoting (Farreras & Boyle, 2012).

Based on data, among numerous other studies (Aleamoni, 1987; Arreola, 1995; Dooris, 1997; Feldman, 1978; Sproule, 2000; Theall & Franklin, 1990) have found that student evaluations of teaching have little to do with learning. These works have been cited here as representative to indicate that over the years, the same problems have persisted. Emery et al. gave a very good account of the inconsistencies of student ratings and administrative interpretations of them, based on factual evidence and the personal experience of the authors, along nine different dimensions (attributes): (a) reliable in meeting class, (b) available outside class, (c) grading fair and reasonably, (d) prepared for class, (e) knowledge of subject, (f) excellent credentials but considered average, (g) beneficial lab work, (h) when is "good" good enough?, and (i) composition of the composite group.

Although numerous problems with the administration and use of student evaluations of teaching have persisted for decades, studies continue to analyze the problems and propose solutions.

Drawbacks of Existing Schemes

This section highlights several issues/problems that have existed through the years, described only briefly in the current perspective. The major characteristics and issues of the existing system are summarized in Figure 3.

Some of the issues/problems described here have received little previous attention. The questionnaire, its administration, and the subsequent use of the data have remained largely unchanged since the questionnaire was first instituted or it has not undergone many significant changes, despite significant changes in many other aspects of teaching and learning. For each of the problems described in this section, the next section discusses the corresponding solution.

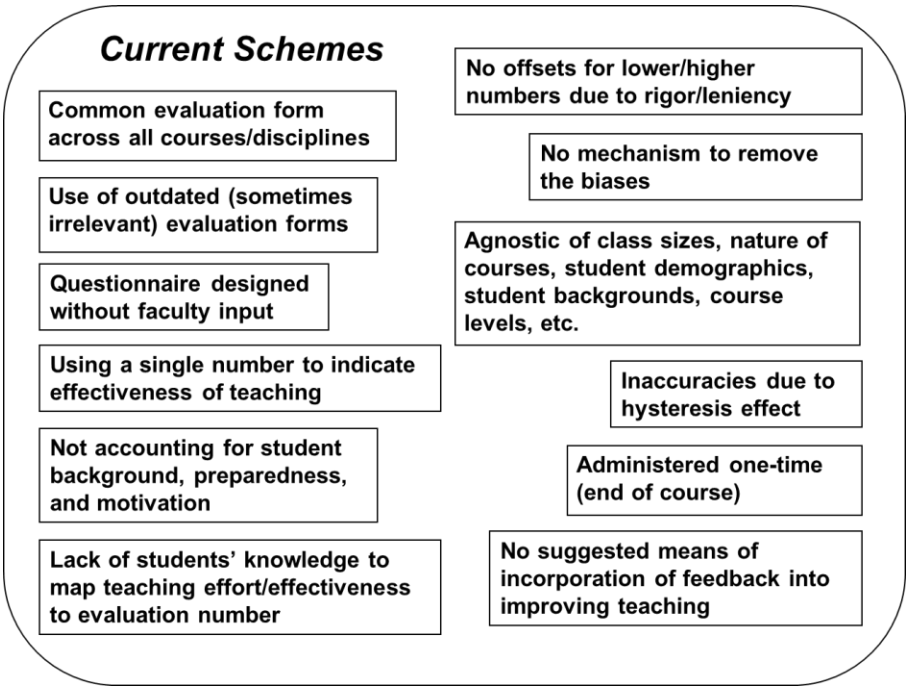

Figure 3. A summary of the major characteristics and issues within the existing system.

Common Evaluation Questionnaire

The student evaluations of teaching started to be increasingly used in institutions of higher learning in the 1960s. In the 50 years since then, numerous new programs and courses have been developed, several disciplines of study that were nonexistent at that time have been established, and newer instructional technologies have been developed and deployed. In addition, several studies (e.g., Cashin, 1990; Feldman, 1978) have shown that courses in different disciplines get rated/evaluated differently. Although many institutions are moving towards supporting web–based evaluations, the questionnaires themselves have not changed drastically. The questionnaires have not taken into account the changes in teaching modalities, offerings of newer programs and courses, changes in student demographics, motivations, aspirations, learning modalities, etc.

Questionnaire Designed Without Faculty Input

In several institutions, the questionnaire development is outsourced to companies that have no knowledge of teaching and learning in the institution. The development is done in isolation, without consultation with the faculty who actually teach the courses.

Use of a Single Number to Indicate Effectiveness of Teaching

The questionnaire for the student evaluations of teaching consists of several questions. The Students' Evaluation and Educational Quality, or SEEQ (Marsh, 1984) identifies 9 dimensions. Feldman (1987) categorized student ratings into as many as 19 dimensions. However, there is invariably a single question that asks for the "overall teaching effectiveness" (or similar

attribute), and the single number as the answer corresponding to this question is being used for making several decisions.

Not Accounting for Student Background, Preparedness, and Motivation

Students who do not have the adequate background for the program/course, who are not well prepared, or who lack motivation for doing the course work tend to easily get out of tune/sync with the class activities. The instructors have only limited times to take care of the excessive needs of several students in the class. Despite the best efforts of instructors, such students are very likely to blame instructors for their shortcomings; their evaluations of teaching are likely to be lower, and thus removed from reality.

Lack of Students' Knowledge to Map Teaching Effort/Effectiveness to Evaluation Number

Most evaluations use the Likert scale from 1 (the lowest rating) to 5 (the highest rating). However, for each of the questions (attributes), there is absolutely no clear-cut and unambiguous method that the students are required to follow in assigning a number to that question. For example, for a statement such as "Class time was used effectively"; absolutely no instruction or direction is given to students regardomg what constitutes the activities or the topical coverage that is deserving of a numeric score of 1 or 2 or 3, etc. In these cases, the evaluation numbers are merely whimsical.

Rigor and Tough Grading vs. Grading Leniency

Studies by Felder (1992), Greenwald and Gilmore (1997), Johnson (2003), and Marsh and Roche (2000), among numerous other studies, have shown that not all student evaluations accurately reflect the quality of learning and teaching, and that students generally favor instructors and courses with little work and easy grading, while downgrading those instructors who are demanding and rigorous.

No Mechanism to Remove the Biases

One of the definitions of bias has been the factors that are not under the control of the instructor. Several studies (e.g., Birnbaum, 1999) have shown that student evaluations are biased in favor of or against certain qualities of teachers, such as personalities, looks, disabilities, gender, and ethnicity. Several empirical studies have suggested that student evaluations of teaching can be influenced by factors totally unrelated to teaching, for example, instructor's physical attractiveness (Freng & Webber, 2009) and students' belonging to specific demographic groups (Kherfi, 2011). Several other factors may exist that contribute to bias, resulting in skewed student evaluations of teaching. Currently, no mechanisms are in place to identify and remove (or least minimize) the biases.

No Differentiation among Varying Factors

In the current system, no differentiation exists among several classroom/course factors, such as (a) undergraduate vs. graduate course (UG v/s G), (b) large class size vs. small class size, (c) classroom only vs. classroom + lab, (d) regular course vs capstone course, (e) traditional students vs. adult learners; or (f) onsite class vs. online class.

Hysteresis Effect

Students remember either positive or negative experiences (which have significant deviations from the normal) of the immediate past, or other courses running concurrently. Thus the current evaluation might not be independent, but somewhat in inverse proportion to the previous/other current ones. For example, if the previous/other current experience had been extremely good (or bad), then the current course, even though good, might get a relatively lower (or higher) rating compared to a rating it would have received from a similar/comparable past experience or an unbiased rating.

Administered Just Once Over the Course Duration

Almost all student evaluations of teaching are done at the end of the course, which is like giving students just one exam at the end of the course, and evaluating their performance. This timing would have the tendency of allowing the most recent experiences to influence the ratings. For example, if the course topics become tougher, or if the lectures become just a little too fast paced for some students, or if the students have pressures of work, then most of the good experiences in the earlier part of the course are masked by these more recent factors, and the ratings are likely lower.

No Suggested Means of Incorporation of Feedback into Improving Teaching

Currently there is no systematic way of using the student evaluations of teaching in a closed-loop feedback system to improve teaching or learning experience. It is mostly up to the individual instructors to interpret the evaluation results and take any corrective actions based on their judgment. Even in instances where procedures and guidelines exist for following up on the feedback, they may not be practiced in a systematic and effective manner.

The time is now ripe for making use of available mature technologies such as the Internet, web, blogging, messaging, and mobile computing in the development and administration of newer EoC evaluation schemes, or at least revisions and updates to existing schemes. Further, by employing data analytics, text analysis, and data mining on gathered data, useful information/knowledge can be derived that can be used to enhance the quality of instruction and learning.

Proposed Scheme

The primary objectives of the proposed scheme are to make the course/instructor evaluations by students more objective, relevant, and effective. It is made more objective if the factors injecting subjectivities and biases toward the course and/or the instructor are identified and removed, or at least minimized. It is made more relevant by taking into account the significant changes that have taken place in teaching, as well as learning and designing the questionnaire accordingly. It is made more effective by developing mechanisms for a closed-loop system that incorporates data analysis, consultations, and remedial measures, if any, to develop measures for teaching improvements and learning enhancements.

As mentioned in the background of this article and in the previous section, one of the core problems and discontent with the EoC evaluation data is that the data is not devoid of subjectivity and biases. To the present author's knowledge, no efforts have been made in the post-processing of the data to make them fair and objective. Although it is a non-trivial task,

based on numerous technologies which are mature, such as statistical analysis, text analysis, and data mining, it is possible to transform the raw data to incorporate fairness and objectivity and make the data more relevant. The outline of this process is shown in Figure 4.

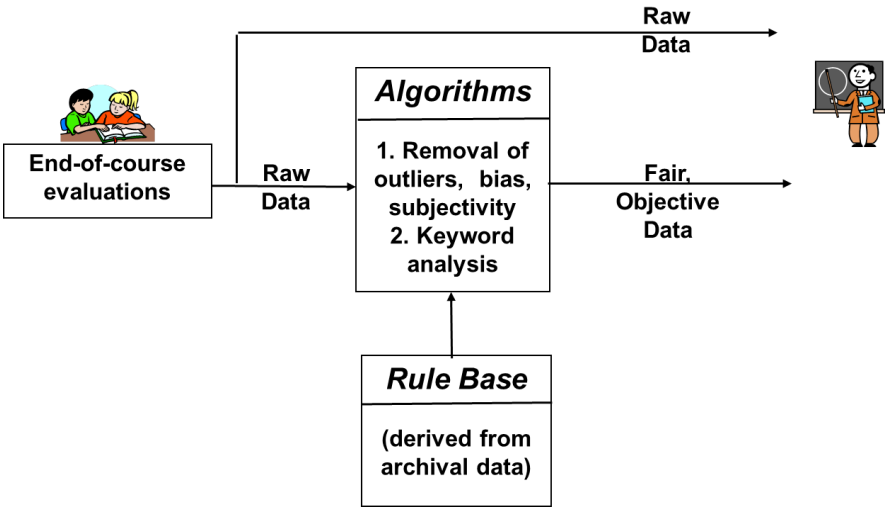

Figure 4. Transformations to enhance the relevancy of raw data.

In the process described in Figure 4, instructors are provided with both raw data and processed data. This enables them to get a better view of the effectiveness of their efforts and methodologies and helps them make adjustments in order to improve their instruction. This also gives administrators a uniform view of performance across all courses and instructors. However, as mentioned earlier, due to the scope and emphasis of this paper on the EoC evaluations, the details of transforming the raw data into more meaningful, fair, and objective data will not be presented in this paper.

The major characteristics and improvements/remedies in the proposed system over the corresponding issues of the existing system are shown in Figure 5.

In the following subsections, the proposed improvements are briefly described. It should be noted that this paper does not consider a specific EoC evaluation scheme, but rather addresses several issues that are common denominators across several schemes. In this paper, when problem in the existing system is described, it is meant to be the case in most institutions. It may not be applicable to a few specific instances, which are more exceptions than rule. The generality of the proposed improvements enables them to be incorporated in any scheme.

Use of Customized Evaluation Questionnaire

A common evaluation questionnaire across all disciplines/programs/course is ineffective and would not capture their characteristics and idiosyncrasies. It is recommended that an appropriate set of general/common questions, together with discipline-, program-, and course-specific questions, be used. Adoption of the Internet and mobile technologies for administering and managing student evaluations of teaching would help streamline the process.

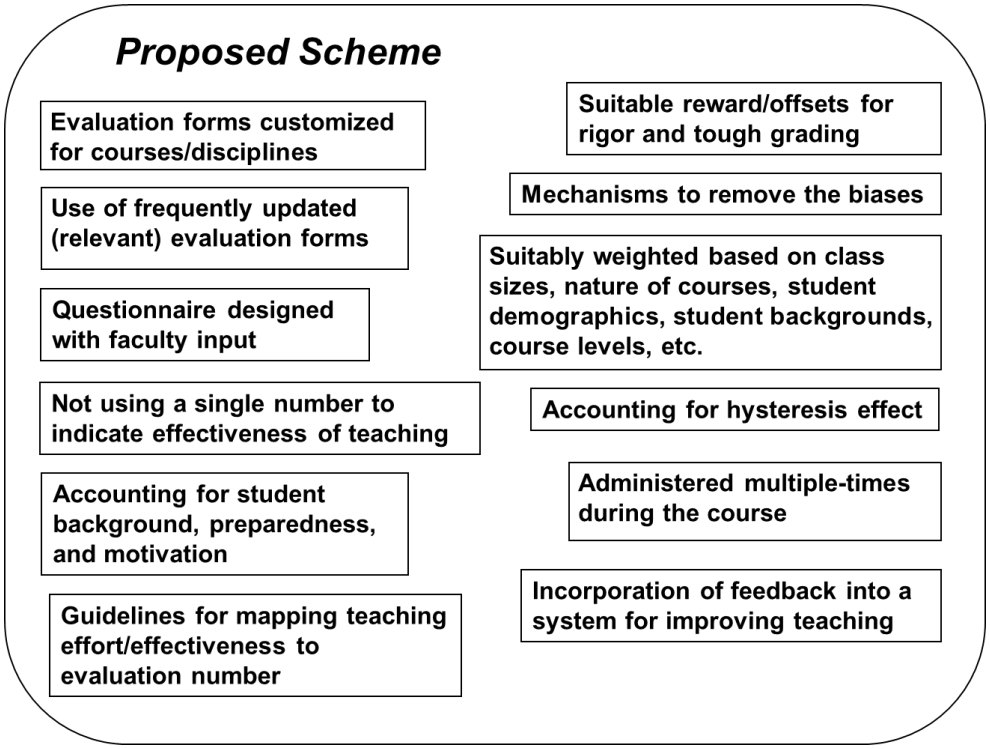

Figure 5. A summary of the major characteristics and improvements of the proposed system.

Questionnaire Designed with Faculty Input

Faculty members are the ones directly involved with all aspects of teaching; they would be the ones who are knowledgeable about the various facets of teaching effectiveness and learning. Faculty input is valuable in (a) designing the questionnaire, (b) compiling and analyzing the results, (c) identifying the various kinds of biases and the mechanisms of their removal, (d) providing a means of making use of the results of the evaluations. Thus it is important for questionnaire developers to work closely with experienced faculty members.

Not Using a Single Number to Indicate Effectiveness of Teaching

Teaching involves numerous dimensions, starting from the choice of textbook for the course to getting the final exam/project done. It involves, among other things, (a) survey and choice of the most appropriate textbook, (b) developing the course syllabus consisting of the topical coverage, designing the course activities, mapping the contents to learning outcomes, grading components, etc., (c) developing the course presentation material—PowerPoint slides, handouts, and supplemental material, (d) design of homework, quizzes, exams, projects, and their solutions, (e) grading the student work and handing it back on time, (f) holding office hours and being available for students, and last, but not least, (g) teaching in classroom (or online). Thus, student evaluations should not only collect data along multiple dimensions, but also use the data effectively. A single number to indicate teaching effectiveness would be not only inadequate but unjust. Some kind of weighted average of the various components must be used as indicators of the teaching effectiveness.

Accounting for Student Background, Preparedness, and Motivation

Appropriate weighted measures must be used to take into account the variations in student background, preparedness, and motivation in order to bring uniformity and objectivity into the student evaluations of teaching effectiveness.

Guidelines for Mapping Teaching Effort/Effectiveness to Evaluation Number

Clear guidelines should be developed and put into place, which map the aspects/attributes of teaching to the numbers in the student evaluations. For example, on a scale of 1 to 5, and for the attribute, say, "Makes efficient use of class time," specify as clearly and specifically as possible, how the time spent in the class period would qualify for a rating of 1, 2, 3, 4, or 5. The students should be made aware of these guidelines. In spite of these, there may still be biases. However, it will minimize errors due to students' incompetence in assigning proper numbers to the corresponding teaching aspects.

Suitable Reward for Rigor and Tough Grading

Suitable measures of assigning weights for the course content, coverage, and rigor of student work should be developed. Since rigor, together with teacher effort, would benefit students in terms of learning outcomes, the probable lower student evaluations of teaching due to rigor should be suitably offset based on the effort put in by the instructor in maintaining rigor as well as providing the students with supplemental material.

Some Mechanisms to Remove the Biases

This requires quite a bit of tracking and data mining aspects. For example, a student (or a set of students) across an instructor (or set of instructors) might have to be tracked to determine if there has been a case of biased evaluations. Once such bias has been determined, appropriate offset mechanisms can be used to make adjustments/corrections to the evaluation numbers.

Differentiation among Varying Factors

Appropriate weights should be developed to account for the several inherent differences among several classroom/course factors, such as (a) undergraduate vs. graduate course (UG vs. G), (b) large class size vs. small class size, (c) classroom only vs. classroom + lab, (d) regular course vs. capstone course, (e) traditional students vs. adult learners, and (f) onsite vs. online classes.

Accounting for Hysteresis Effect

Students remember either positive or negative experiences (which have significant deviations from the normal) of the immediate past or other courses running concurrently. Thus the current evaluation might not be independent but somewhat relative to the previous/other current ones. To account for this effect, the ratings of a course might have to be looked at in the light of the previous/other current ones. This could be controversial. These require sophisticated algorithms and must be well tested before gaining acceptance.

Conduct Evaluations Several Times over the Course Duration

Just as students are not evaluated by giving just one exam at the end of the course, but rather several different works spread over the duration of the course, such as homework, quizzes,

exams, class participation, discussions (in online classes), and project(s), faculty also need to be evaluated several times and along different dimensions/aspects over the duration of the course. This gives a better idea of the consistencies and does not penalize for the moods and whims of a few of the students at the end of the course. This poses several practical/logistical issues. But appropriate use of the Internet and mobile technologies could make this feasible.

Some Means of Incorporation of Feedback into Improving Teaching

The current system is an open-loop system, where the EoC evaluation data is delivered to the instructors a couple of weeks after administering them. This has to be turned into a closed-loop system, where systematic mechanisms of data analysis, consultations, and action plans must be put into place to address the issues (if any) revealed by the evaluation data.

The proposed system is a work in progress. Pilot studies need to be conducted to gather preliminary results and to evaluate their effectiveness. Several of the features of the proposed system would be unfeasible using the current standards of practice. However, making judicious use of technologies which are now mature (such as Internet and mobile applications), the proposed system would become feasible.

Implementation Issues and Challenges

Two broad categories of challenges exist in the implementation of the proposed improvements to the EoC scheme: one related to human nature and the other related to logistics and cost-effectiveness. The possible challenges in adopting a new system from the human-nature standpoint could include the following: (a) the inherent resistance of human nature to changes, (b) lacuna for adapting to a newer system, (c) perception that the new system has not been tested, and (d) instructors' apprehension that the new system might work to their disadvantage.

The possible challenges in adopting a new system from the logistics point of view could include (a) practical difficulties in making changes to existing systems, (b) practical difficulties in implementing a totally new system, (c) incorporation of new technologies, (d) preserving anonymity, (e) getting the students to evaluate multiple times, and (f) apprehensions about anonymity with use of Internet and mobile technologies (as opposed to use of paper).

Factors Facilitating the Acceptance of the Proposed Improvements

Factors that facilitate the acceptance of the proposed improvements to the EoC evaluation scheme and their implementation include (a) having a small pilot project and getting enough feedback from a variety of cross sections of the stakeholders—faculty, students, administrators, and involved staff and IT personnel, (b) using the new system in conjunction with existing system for some time, (c) keeping the EoC evaluation system extremely simple and limited to the bare essentials while still serving the required purpose, (d) designing the evaluations as games that the students play, (e) encouraging the students to blog about the course/instructor, which forms part of the evaluations, (f) automating the data-gathering mechanism for faster turnaround of the feedback, (g) providing comparisons of the evaluations with and without using the various weights used to remove the biases, and (h) implementing a trusted intermediary (software) system for maintaining the anonymity of the evaluation providers for the cases where the evaluations are provided using mobile devices and blogs.

Conclusions

The end-of-course (EoC) evaluations are performed at the end of the courses in almost all institutions of higher learning. Numerous studies over the years analyzing the compiled data have suggested that the EoC evaluations have not been effective in their ultimate objective, and in many cases have been irrelevant. Devising a student evaluation of teaching effectiveness that is useful and effective is complex and elusive. In this paper, only a few of the factors of the existing system were examined that contribute to the ineffectiveness/irrelevancy of the evaluation schemes. and a new scheme was proposed with a few factors intended to alleviate the existing problems. The paper also noted the issues and challenges of implementing the proposed improvements. The design and administration of the evaluation schemes—keeping in mind (a) the significant changes in teaching methodologies, (b) the instructional technologies, (c) the changing expectations and aspirations of students, and (d) the incorporation of the Internet and mobile technologies—are expected to make the student evaluation of teaching more effective and relevant.

References

Aleamoni, L. (1987). Student rating: Myths versus research facts. *Journal of Personnel Evaluation in Education, 1*, 1987, 111–119.

Arreola, R. A. (1995). *Developing a comprehensive faculty evaluation system.* Boston, MA: Anker Publishing.

Benton, S. L., & Cashin, W. E. (2012). Student ratings of teaching: A summary of research and literature. IDEA Paper No. 50. Center for Faculty Education and Development, Kansas State University.

Birnbaum, M. H. (1999). A survey of faculty opinions concerning student evaluations of teaching. *The Senate Forum* (California State University, Fullerton), *14*(1), 19–22.

Calkins, S., & Micari, M. (2010, Fall). Less-than-perfect judges: Evaluating student evaluations. *The NEA Higher Education Journal, Fall 2010,* 7–22.

Carrell, S. E., & West, J. E. (2010). Does professor quality matter? Evidence from random assignment of students to professors. *Journal of Political Economy, 118*(3), 409–432.

Cashin, W. E. (1990). Students do rate different academic fields differently. In M. Theall & J. Franklin (Eds.), *Student ratings of instruction: Issues for improving practice (New directions for teaching and learning)*, No. 43 (pp. 113–121). San Francisco, CA: Jossey-Bass.

Cashin, W. E. (1998, September). Student ratings of teaching: A summary of the research. IDEA Paper No. 20. Center for Faculty Education and Development, Kansas State University.

Cohen, E. H. (2005). Student evaluations of course and teacher: Factor analysis and SSA approaches. *Assessment & Evaluation in Higher Education, 30*(2), 123–136.

Cohen, P. A. (1980). Effectiveness of student–rating feedback for improving college instruction: A meta-analysis of findings. *Research in Higher Education, 13*(4), 321–341.

Darling-Hammond, L., Beardsley, A. A., Haertel, E., & Rothstein, J. (2012, February 29). Evaluating teacher evaluation. *Education Week*, (online), 1–9. Retrieved from http://www.edweek.org/ew/articles/2012/03/01/ kappan_hammond.html

Dooris, M. J. (1997). An analysis of the Penn State student rating of teaching effectiveness: A report presented to the University Faculty Senate of the Pennsylvania State University. Retrieved from www.psu.edu/president/cqi /srte/analysis.html

Dunegan, K. J., & Hrivnak, M. W. (2003). Characteristics of mindless teaching evaluations and the moderating effects of image compatibility. *Journal of Management Education, 27*(3), 280–303.

Emery, C. R., Kramer, T. R., & Tian, R. G. (2003). Return to academic standards: A critique of student evaluations of teaching effectiveness. *Quality Assurance in Education, 11*(1), 37–46.

Farreras, I. G., & Boyle, R. W. (2012). The effect of faculty self-promotion on student evaluations of teaching. *College Student Journal, 46*(2), 314–322.

Felder, R. (1992). What do they know anyway? *Chemical Engineering Education, 26*(3), 134–135.

Felder, R. M., & Brent, R. (2004). How to evaluate teaching. *Chemical Engineering Education, 38*(3), 200–202.

Feldman, K. A. (1978). Course characteristics and students' ratings of their teachers: What we know and what we don't. *Research in Higher Education, 9*(3), 199–242.

Feldman, K. A. (1987). Research productivity and scholarly accomplishment of college teachers as related to their instructional effectiveness: A review and exploration. *Research in Higher Education, 26*(3), 227–298.

Felton, J., Mitchell, J., & Stinson, M. (2004a). Cultural differences in the student evaluations of professors. Proceedings of the Academy of Business Education. Retrieved from http://www.abeweb.org/proceedings /proceedings04/felton2.pdf

Felton, J., Mitchell, J., & Stinson, M. (2004b). Web-based student evaluations of professors: The relation between perceived quality, easiness and sexiness. *Assessment & Evaluation in Higher Education, 29*(1), 91–108.

Fish, S. (2005, February 4). Who's in charge here? *The Chronicle of Higher Education, 51,* C2–C3. Retrieved from http://chronicle.com/article/Whos-In-Charge-Here-/45097/

Freng, S., & Webber, D. (2009). Turning up the heat on online teaching evaluations: Does "hotness" matter? *Teaching of Psychology,* 36(3), 189–193.

Gray, M., and Bergmann, B. R. (2003). Student teaching evaluations: Inaccurate, demeaning, misused. *Academe Online.* American Association of University Professors. Retrieved from www.aaup.org/AAUP/pubres /academe/2003/SO/Feat/gray.html

Greenwald, A. G., & Gilmore, G. M. (1997). No pain, no gain? The importance of measuring course workload in student ratings of instruction. *Journal of Educational Psychology, 89*(4), 740–743.

Hill, M. C., & Epps, K. K. (2010). The impact of physical classroom environment on student satisfaction and student evaluation of teaching in the university environment. *Academy of Educational Leadership Journal, 14*(4), 65–79.

Isely, P., & Singh, H. (2005). Do higher grades lead to favorable student evaluation? *Journal of Economic Education, 36*(1), 2005, 29–42.

Johnson, V. E. (2002). Teacher course evaluations and student grades: An academic tango. *Chance, 15*(3), 9–16.

Johnson, V. E. (2003). *Grade inflation: A crisis in college education*. New York, NY: Springer-Verlag.

Kember, D., & Leung, D.Y.P. (2008). Establishing the validity and reliability of course evaluation questionnaires. *Assessment & Evaluation in Higher Education, 33*(4), 341–353.

Kherfi, S. (2011). Whose opinion is it anyway? Determinants of participation in student evaluation of teaching. *Journal of Economic Education, 42*(1), 19–30.

Kidd, R. S., & Latif, D. A. (2004). Student evaluations: are they valid measures of course effectiveness? *American Journal of Pharmaceutical Education, 68*(3), 2004, Article 61.

Krautmann, A. C., & Sander, W. (1999). Grades and student evaluations of teachers. *Economics of Education Review, 18*(1), 1999, 59–63.

Love, D. A., & Kotchen, M. J. (2010). Grades, course evaluations, and academic incentives. *Eastern Economic Journal, 36,* 151–163.

Marsh, H.W. & Roche, L.A. (2000). Effects of grading leniency and low workload on students' evaluations of teaching: popular myths, bias, validity or innocent bystanders? *Journal of Educational Psychology,* 92, 2000, 202–228.

Marsh, H. W. (1984). Students' evaluations of university teaching: Dimensionality, reliability, validity, potential biases, and utility. *Journal of Educational Psychology, 76*(5), 707–754.

Merritt, D. (2008). Bias, the brain, and student evaluations of teaching. *St. John's Law Review*, 82, 2008, 235–287.

Mohanty, G., Gretes, J., Flowers, C., Algozzine, B., & Spooner, F. (2005). Multi-method evaluation of instruction in engineering classes. *Journal of Personnel Evaluation in Education, 18*(2), 139–151.

Moore, S., & Kuol, N. (2005). A punitive bureaucratic tool or a valuable resource? Using student evaluations to enhance your teaching. In G. O'Neill, S. Moore, & B. McMullin (Eds.), *Emerging issues in the practice of university learning and teaching* (pp. 141–148). Dublin: AISHE.

Naftulin, D. H., Ware, J. E., & Donnelly, F. A. (1973). The Doctor Fox lecture: A paradigm of educational seduction. *Journal of Medicinal Education, 48,* 630–635.

Perry, W. G. (1988). Different worlds in the same classroom. In P. Ramsden (Ed.), *Improving learning: New perspectives.* Dubuque, IA: Nichols Pub. Co.

Sproule, R. (2000). Student evaluations of teaching: Methodological critique of conventional practices. *Educational Policy Analysis Archives,* 8(50), 125–142.

Theall, M., & Franklin, J. (Eds.). (1990). *Student ratings of instruction: Issues for improving practice.* (*New directions for teaching and learning)*, No. 43. San Francisco, CA: Jossey-Bass.

Williams, W. M. & Ceci, S. J. (1997). How am I doing? Problems with student ratings of instructors and courses. *Change, 29*(5), 12–23.

Wines, W. A., & Lau, T. J. (2006). Observations on the folly of using student evaluations of college teaching for faculty evaluation, pay, and retention decisions and its implications for academic freedom. *William & Mary Journal of Women and the Law*, *13*(1), 167–202.

About the Author

S. R. Subramanya
PhD, Associate Professor
School of Engineering, Technology and Media
National University
La Jolla, CA
ssubramanya@nu.edu
Research interests: algorithm design, digital content services, mobile computing, innovative teaching

Book Review

Innovative Educational Leadership through a Cycle of Change

Larry Powell

Edited by Daniel Cunniff, Donna Elder, and Wayne Padover

4050 Westmark Drive, Dubuque, Iowa 52004-1840
ISBN 978-1-4652-1884-1 ◆ 233 pages

When theory and practice come together, you can expect something good. *Innovative Educational Leadership Through a Cycle of Change* is more than expected; it is not only good, it is a genuine "how to" textbook for current and future administrators who really want to have an impact! It is written and edited by educational leaders who have real-world experience and have taken the time necessary to include valuable theory as well.

When reading the book, you get the feeling that the text is speaking to you on a personal level about real situations and circumstances. It is not just another academic exercise that will be set aside when you finish reading. I found myself in a very comfortable place: I was pleased with the personal style and also with the concrete suggestions that showed me the writers knew what was happening in the real world of educational leadership. In addition to their vast shared experience, their practical tips were supported by theory and thought.

Often textbook writers betray themselves through the widely accepted and unwritten rule that a textbook must be dominated by theory in order to meet the mark of a good scholarly textbook. It is the marriage of theory, experience, and practice from successful educational leaders that gives this textbook such high marks and a unique standing. It is theoretically sound and it also provides practical tips for the new and practicing administrator.

As the title of the text suggests, *Innovative Educational Leadership Through a Cycle of Change* focuses on what outstanding educational leaders do to successfully address the inevitable conditions that challenge their educational organizations over the cycle of time. The experience of successful leaders and the literature indicate that outstanding educational leaders need to (a) innovate as part of their leadership style, (b) inspire as part of their style of leadership, (c) interact throughout their organizations and beyond to bring about outstanding instructional leadership, and (d) continually change to improve organizational conditions through the use of an entrepreneurial style of leadership. The text provides examples of what successful educational leaders have done to address the aforementioned issues. It also invites readers to think creatively to predict what can be done as educational leaders and be prepared for the cycle of change, such that those conditions can be used for the betterment of the students, school, and community.

The book also offers some worthwhile cautions for future administrators. Administrative positions can be hard on marriages and family life. The reality check also includes such things as now being in a job with far less security than previous faculty positions; and that the salary difference, when considering the increased hours and responsibilities, is not as great as anticipated. It is refreshing to see these included in a textbook and gives a strong sense of credibility to the work.

This textbook is strong on the value of relationships, and how the quality of a leader is enhanced by how the leader develops those relationships. At a time of increased emphasis on

cold, hard statistics and test results, it is so encouraging to see a textbook that seeks to show the value and effectiveness of improving and developing relationship skills.

Administrators do not supervise the production of widgets; rather, they seek to develop creative and innovative students who become positive, contributing members of a dynamic society. The timeliness of this textbook is that it seeks to create leaders who will help keep America academically strong but without losing our creative history and advantage.

Many of the chapters are aligned with one or more of the Interstate School Leaders Licensure Consortium (ISSLC) Standards, and all use activities, role play, discussion, and examples to develop conversations around leadership. The intended purpose, I believe, is to help administrators internalize the content and, more importantly, define who they want to become as leaders. This process is further strengthened by presenting multiple perspectives, rather than the opinion and voice of a single author.

This approach blends theory with practice and creates a balanced and well-written textbook on leadership and change. It is refreshing and right on target. I highly recommend it to every educational administrator.

About the Author

Larry Powell
EdD, Superintendent of Schools
County Office of Education
Fresno, CA

Note to the Authors

Journal of Research in Innovative Teaching

An Annual Peer-Reviewed Publication of National University

The journal's mission is to collect and disseminate advanced research-based information on teaching and learning, particularly focusing on innovative methodologies and technologies applied primarily but not exclusively in higher education, to enhance student learning outcomes.

The Journal of Research in Innovative Teaching (JRIT) publishes carefully selected, original articles describing original research on the following topics:

- New pedagogic theories and approaches in teaching and learning
- Innovative educational technologies and their applications
- Knowledge management
- Accelerated, short-term, and intensive pedagogy
- Effective instructional methodologies
- Specific methodology of teaching particular subjects
- Online/distance/hybrid education
- Adult learning
- Curriculum development and instructional design
- Psychology of learning, of the learner, and of the group
- Time- and cost-efficiency of education
- Best practices

Submission of Manuscripts

The Journal of Research in Innovative Teaching invites authors to submit their research for publication in the 2015 issue. Submissions must be innovative and original, demonstrate a valid contribution to educational science and teaching, and be formatted according to JRIT guidelines based on the style described in the Sixth Edition of the *Publication Manual of the American Psychological Association* (APA). Articles on topics outside the aforementioned JRIT focus will not be considered.

Every submitted paper will be acknowledged and refereed.

A manuscript is to be submitted in electronic form to the Editor-in-Chief or to any of the members of the Editorial Board in a camera-ready form (e.g., single spaced and with tables and figures properly placed within the manuscript.) Manuscripts are accepted for review with the understanding that the same work has not been published, that it is not under consideration for publication elsewhere, and that its submission for publication has been approved by all authors and by the institution where the work was carried out; further, that any person cited as a source of personal communications has approved such citation. Written authorization may be required at the editor's discretion. Articles and any other material published in JRIT represent the opinions of the author(s) and should not be construed to reflect the opinions of the editor(s) and the publisher.

Copyright

Upon acceptance of an article, authors will be asked to transfer copyright to National University. This transfer will ensure the widest possible dissemination of information. By submitting the article, the authors agree to this condition. A letter will be sent to the corresponding author confirming receipt of the manuscript.

If substantial material from other copyrighted works is included, authors must obtain written permission from the copyright owners and credit the source(s) in the article. The APA manual offers guidelines regarding what is considered "fair use" under copyright law and when written permission is appropriate. Authors do not have to request written permission when they are paraphrasing another author's work or when they are directly quoting brief passages.

Form of Manuscript

Manuscripts should be prepared using Microsoft Word (.doc or .rtf format). The text should be set in 12 point Times New Roman, and the manuscript should not exceed 12 to 15 single-spaced pages (6000-7500 words), not counting the references and about the author information. The manuscript will be edited according to the style of the journal, and authors must read the proofs carefully.

NO FORMATTING STYLES ARE TO BE APPLIED

Please do not number the pages or apply headers or footers to your file. **Also, refrain from applying style formats to your text.** The manuscript should be prepared in "Normal" mode. Paragraph formatting should not have any extra space added above or below headings or other elements.

Manuscripts must be submitted with the following information shown for each author: full name, degree(s), position in the author's department, school, name of institution, full address, telephone and fax numbers, and email address.

The manuscript, including the abstract, references, tables, figures, and figure captions, should be prepared to fit on letter-size paper, single-spaced, with one-inch (1") margins on top, bottom, left, and right. The first page should contain the article title, author and co-author names, abstract, and key words.

Abstracts must not exceed 100 words.

Key words (6–8) should be listed immediately after the abstract, in lowercase type.

Notations (if required) should be legible and compact and conform to current practice. Each symbol must be clear and properly aligned so that superscripts and subscripts are easily distinguishable. Numerical fractions should preferably be put on one line—e.g., ½ or 1/2.

Equation numbers should be placed in parentheses at the right margin. References to equations should use the form "Eq. (3)" or simply "(3)."

In-text citations should follow APA style. Example: (Smith & Jones, 2008; Thomas, Adams, & Schumann, 2006). Be careful to spell authors' last names accurately and show the same publication year as listed in the references.

Footnotes, if necessary, should be indicated in the text with superscript numbers (1, 2, 3, etc.), using Microsoft Word's Footnoting feature.

References should be listed in Microsoft Word's hanging-indent (first-line indent) style; whereby the Enter key is struck only at the end of each reference listing, and the Tab key is never

used to force an indent. List all references in alphabetical order by author's last name. The format for each reference should correspond to APA style. Here are examples of a book entry, Web-based text, and a journal article, respectively:

Miller, R. I. (1972). *Evaluating faculty performance*. San Francisco: Jossey-Bass.

Nation, P. (2003). The role of the first language in FL learning. *Asian EFL Journal, 33*(2), 63–66. Retrieved from www.asian-efijournal.com/june_2003_pn.pdf

Stapleton, R. J., & Murkison, G. (2001). Optimizing the fairness of student evaluations: A study of correlations between instructor excellence, study production, learning production, and expected grades. *Journal of Management Education, 25*(3), 269–291.

References should be listed at the end of the text material. When including URLs, please remove the hotlinks (hypertext links); there should be no hotlinks in the article or in the References.

Figures should be numbered with Arabic numerals in the order of mention in the text and should be inserted at the nearest convenient location following that mention. The Figure number and caption should be horizontally centered on separate lines below the figure, and the caption should use sentence-style capitalization and punctuation for titles (for example: "*Figure 1*. Comparison of online and onsite enrollments."). Figures must be horizontally centered between the margins.

Tables should be numbered with Arabic numerals in the order of mention in the text and should be inserted at the nearest convenient location following that mention. Every table must have a title, which should be horizontally centered above the table, and the caption should use title-case capitalization (for example: "Table 1. *Results of Survey Respondents*"). Tables must be horizontally centered between the margins.

About the Author will appear at the end of your article. List each author in the same sequence as shown below your article title. For each author, provide full name, degree(s), title(s), department/school, college/institution, email address, and a brief list of major research interests.

Submission deadline. Submissions for the next, 8th issue will be accepted until October 1, 2014. Please email your manuscript to Dr. Peter Serdyukov at pserdyuk@nu.edu.

Formatting Guidelines

Title (14pt bold, followed by 12pt white space)

Author 1 Name (no degree or title)
Author 2 Name (no degree or title)
Etc. (followed by 12pt white space)

Abstract (10pt bold)
Contents (10pt regular, maximum 100 words), full justified, followed by 12pts white space).

Key Words (10pt bold)
Contents (10pt regular, maximum 6 to 8 key words), full justified, sentence case (but no period), followed by 24pts white space)

Level 1 Subheading (12pt bold, followed by 12pts white space)

First paragraph not indented; full justified; no white space between paragraphs.

Subsequent paragraphs indented 0.25"; last paragraph followed by 12pts white space if next subheading is Level 2, or 24pts if the next item is a table, figure, Level 1 subheading, or References.

Level 2 Subheading (followed by 6pts white space)

First paragraph not indented, full justified, no white space between paragraphs.

Subsequent paragraphs indented 0.25”; last paragraph followed by 12pts white space if next subheading is Level 2 or 3, or 24pts white space if the next item is a table, figure, Level 1 subheading, or References.

This is a Level 3 subheading, which is shown in sentence case. Note that there is no first-line indent, and the subheading is run-in with the first paragraph.

However, subsequent paragraphs within this Level 3 subheading section will have first-line indents, as usual; and the last such paragraph will be followed by 12pts white space if next subheading is Level 2 or 3, or 24pts white space if the next item is a table, figure, Level 1 subheading, or References.

Tables. In general, lacking more sophisticated and attractive formatting by author, format with thick upper border (2.25pts), thin left, right, and bottom borders (no border between columns), and thin horizontal line below column headers. Strive for 12pt type if possible, but as small as 10pt type is acceptable if needed. Table should begin in the nearest convenient location following its first mention in the text, bearing in mind that entire table should be kept on same page, unless table is longer than a page; in that case, it may either start table at top of page and finish on next, or else start partway down the page (e.g., after first mention), as long as the remainder of the table fully occupies the next page; use repeating header row when table is longer than a page. Separate table from surrounding text with 24pts white space preceding table caption and 24pts white space following table.

Table 1. *Italicized Title in Centered, Single-Spaced, Reverse-Pyramid Style (with 12pts white space following)*

Centered Column Header	Centered Column Header	Centered Column Header
Make judicious use of vertical line spacing in body. Top border of table is 2.25" thick. No vertical lines are used between columns. No horizontal lines are used between individual entries.	Decimal-align numbers.	Don't artificially widen table if contents of columns don't warrant it; just horizontally center the table.

Figures. Keep entire figure on same page. Separate figure from surrounding text with 24pts white space preceding figure and 24pts white space following figure caption.

Figure 1. Figure name and number are italicized; title is shown in sentence case, using reverse-pyramid style, and ending in a period.

References (10pt bold, followed by 12pts white space; full-justified contents have 0.25" hanging indent)

All entries in this section are also 10pt, and there is no white space between entries. If necessary to achieve a visually pleasing effect for fully justified entries, URLs may be divided between lines prior to a punctuation mark such as a period or forward slash. If taking this action still is insufficient to assure full justification, then expanded or condensed character spacing may be applied to one line of the URL.

Here are three examples of reference entries; note that the third line of the third reference has character spacing condensed by 0.5pt so the line will be more nearly full justified:

Bernhardt, E., & Hammadou, J. (1987). A decade of research in foreign language teacher education. *Modern Language Journal*, *71*(3), 289-299.

Brown, H. (2007). *Principles of language teaching and learning.* White Plains, NY: Pearson Longman.

European University Association. (2010, May 26). A global crisis: New report looks at the effects of the economic recession on European universities. *Education Insider.* Retrieved from http://education-portal.com/articles/A_Global_Crisis_New_Report_Looks_at_the_Effects_of_the_Economic_Recession_on_European_Universities.html

Appendix A (12pt bold)

Title (12pt bold, followed by 12pts white space)

Text of appendix in 12pt, full justified, followed by 24pts white space before next appendix or About the Author(s).

About the Author (10pt bold, followed by 12pts white space; all type in this section is also 10pt)

Shelley G. Ashdown
Ph.D. Adjunct Professor
School of Education
Amazing University
Dallas, TX
Eshelley_ashdown@gial.edu

Major research interests: cognitive anthropology, world view, and African Studies