Volume 14, No. 1
January 2016
ISSN: 1545-679X

INFORMATION SYSTEMS EDUCATION JOURNAL

In this issue:

The **Information Systems Education Journal** (ISEDJ) is a double-blind peer-reviewed academic journal published by **EDSIG**, the Education Special Interest Group of AITP, the Association of Information Technology Professionals (Chicago, Illinois). Publishing frequency is six times per year. The first year of publication is 2003.

ISEDJ is published online (http://isedj.org). Our sister publication, the Proceedings of EDSIGCon (http://www.edsigcon.org) features all papers, panels, workshops, and presentations from the conference.

The journal acceptance review process involves a minimum of three double-blind peer reviews, where both the reviewer is not aware of the identities of the authors and the authors are not aware of the identities of the reviewers. The initial reviews happen before the conference. At that point papers are divided into award papers (top 15%), other journal papers (top 30%), unsettled papers, and non-journal papers. The unsettled papers are subjected to a second round of blind peer review to establish whether they will be accepted to the journal or not. Those papers that are deemed of sufficient quality are accepted for publication in the ISEDJ journal. Currently the target acceptance rate for the journal is under 40%.

Information Systems Education Journal is pleased to be listed in the 1st Edition of Cabell's Directory of Publishing Opportunities in Educational Technology and Library Science, in both the electronic and printed editions. Questions should be addressed to the editor at editor@isedj.org or the publisher at publisher@isedj.org. Special thanks to members of AITP-EDSIG who perform the editorial and review processes for ISEDJ.

INFORMATION SYSTEMS EDUCATION JOURNAL

Editors

ISEDJ Editorial Board

Developing Capable Undergraduate Students: A Focus on Problem-Based Learning and Assessment

Greg Blundell
gblundel@kent.edu

Victor Berardi
vberardi@kent.edu

Department of Management & Information Systems
Kent State University, Stark Campus
North Canton, OH 44720

Abstract

In today's society, education institutions must strive to develop graduates that are capable of facing the challenges they seek, and who are adaptable to the changes they will encounter post-graduation. Inherently, both institutions and educators must contain and exhibit these same attributes. Developing learners with high-level capabilities requires well developed and implemented curriculum that remains adaptable and relevant. Problem-based learning is a pedagogical choice that is appealing in this endeavor as it has a long history and holds promise for contemporary needs. However, it is complex and can be difficult to implement with confidence and efficacy. This paper looks at the issues surrounding modern learning, including a synopsis on learning theory from Bloom's taxonomy, to objectivism and constructivism, to learning assessment and assurance of learning. Problem-based learning is discussed with the intent to simplify its complexity and facilitate its application. Illustrative examples from the authors' experience are discussed.

Keywords: Learning theory, Pedagogy, Problem Based Learning, Assessment

1. INTRODUCTION

The modern competitive environment increasingly requires individuals and organizations to evolve and improve to remain successful. This is especially true for educators who are challenged with not only maintaining their own relevancy and capability, but who must develop the same in students, too.

The truly strategic instructional choices are ones that support student learning and development, aligning what is best for students with the long-term interests of the institution. In other words, the institutions and programs that serve students well and which allow them to succeed post-graduation in the challenges they choose, are the institutions that will win and best serve society. Faculty members, being the ones who design and deliver the courses and programs offered, are crucial to their students' and institutions' success.

This is not the first time education institutions have faced disruption. Freedman (n.d.) speculates whether higher education has the capability to truly adapt to future evolutions in pedagogy and medium, and suggests that although it "has been challenged in the past and survived," what "forms will prevail now?, [a]nd will the students keep attending?" (p. 6). Given history and the pace of current change, remaining agile and adaptive is as relevant for learners as it is for educators and institutions. Bransford, Sherwood, Vye. & Reiser (1986) note that learning is a confluence of learner-centered, knowledge-centered, and assessment-centered activity within a learning community. Modern

learning communities will have to be responsive in approach, structure, and technology like never before. Dull (n.d.) reinforces these claims, noting "[a]daptive learning technology, as a new pedagogy, suggests we think about learning theory converging with adaptive learning" (para. 7), thereby getting to "a type of self-mapped learning experience while using assessment to measure and adjust direction" (para. 7). This is indeed a tall order to deliver and assure given the complexity of learning theories.

Problem-based learning (PBL) is a pedagogical choice that matches well with these modern needs. Having first appeared in the literature in the late 1960s, PBL is not a new theory or approach, and is generally attributed to medical school education at McMaster's University (e.g., Albanese and Mitchell, 1993). Over the years, PBL has evolved considerably to represent a plethora of techniques and approaches. As such, it provides utility and value for instructors who include it in their teaching repertoire. However, it can be intimidating to undertake and implement. Instructors must be versed on learning theories, make many implementation choices, and then implement PBL skillfully to be successful.

While PBL is a promising approach, assessing and assuring learning is integral to any pedagogical implementation. Assessment and assurance of learning (AOL, should ideally improve insight into decisions and efficacy and, if possible, be integrated into the learning structure itself with students involved throughout. This manuscript considers issues associated with contemporary teaching, concentrating on understanding how learning theories, the pedagogical choice to use PBL, and the concern with assessment and AOL can be managed for success. Some examples from the authors' experience are discussed.

Learning as both a theory and a practice has meandered its way from tried and tested Socratic methods through hermeneutic constructs, andragogy, objectivism, constructivism, social constructivism, etc. to the method focused on in this paper: Problem-based learning.

The musings of academic philosophers and educators such as Thorndike, Skinner, Dewey, Bruner, Ausubel, Bloom & Krathwohl, Vygotsky, Mezirow, Kolb, Knowles, etc. to identify a few, bring society to a point where learning needs to transcend just knowing, and give serious consideration to the resultant competency of a student, i.e. what it is they can do with their knowledge, as opposed to just what they know beyond completing their program of study. The authors advocate that knowing alone is not competence, but the ability to do and explain to others how to do, is. Seely Brown (2008), exemplifies the authors' position: "I think we are really going to see much more learning by doing" (p. 61).

The remainder of this paper is structured as follows: A short review of Bloom's taxonomy of learning will be provided, then, an expansion of learning theories and their importance to contemporary concerns is presented. This expansion includes learning theories such as objectivism and constructivism. It is important to keep in mind that achieving authentic student learning and capability development is a prime concern, and so assessment and assurance of learning (AOL) is discussed next. Then, an overview of PBL approaches and concepts is initiated. There are many issues and choices concerning PBL implementation and this discussion will seek to expand upon a selection of pertinent items while providing a starting point for further explorations. Finally, application examples from the authors' experience and opportunity will be discussed.

2. LITERATURE REVIEW

Bloom's Taxonomy

Bloom's taxonomy of learning (Anderson and Krathwohl, 2001; Bloom & Krathwohl, 1956) describes learning according to a hierarchy of lower and higher order concerns. The lower levels consist of remembering and understanding, while analyzing, evaluating, and creating are categorized as higher-order learning.

Higher Order Learning Concerns	**Creating** **Evaluating** **Analyzing**
Lower Order Learning Concerns	**Understanding** **Remembering**

Figure 1. Bloom's Taxonomy of Learning

Each level of the hierarchy has an appropriate place and value in the learning process, and indeed will be present with varying emphasis in each course. For example; in introductory courses, where learning important vocabulary and foundational concepts are an emphasis, lower order concerns such as remembering and

understanding might be of prime focus. For follow-on or advanced courses, the higher order concerns are often the central interest.

From both a learning and strategic perspective, though, instructors should be seeking ways to integrate the higher-level concerns into their courses and to coordinate the learning levels across curriculum and course sequencing. If this is done well, it leads not only to meaningful and interconnected learning from course to course, but it also ensures the program as a whole is integral to achieving the deep learning that is so highly valued.

To illustrate, consider a statistics course that is a prerequisite for follow-on courses like operations management, and which has a prerequisite itself in a computer applications course. By coordinating the use of technology like spreadsheets across these courses, this sequence can become tightly integrated: Not because a course catalog description denotes the prerequisite, but because learning and student development is truly integrated across the courses and curriculum. This would seem like basic curriculum mapping, and it is, but given surveys of alumni and employers alike concerning how well graduates are prepared for and engaged in their careers, many education programs would be well-served to do this better, and more seamlessly across curricula. Similarly, this integration allows instructors to design their courses differently so, as in the example above, the operations management course can move quickly to higher order concerns of evaluation and analysis, where students can learn how to develop solutions for concerns beyond operations management.

Even though Bloom's taxonomy has been around for nearly 60 years, it has particular relevance to contemporary higher education in its relation to learning theory, and in how it guides instructors and institutions in where and how they choose to compete to add value to the learning process. Furthermore, this should be done in concert with the realities of what current graduates need for success in their careers, and in recognition of the modern competitive landscape in higher education.

Objectivist Learning Theory

One of the fundamental learning theories to consider in developing courses and curriculum is objectivism. Under the objectivist learning theory, the instructor is seen as responsible for student learning, as knowledge is considered independent of and external to the learner himself or herself.

Much of the recent education literature asserts that the orthodox objectivist approach is not effective in many situations. Objectivism, so it is asserted in the literature, is a system where the teacher (the 'sage on the stage') drones out small, predigested dollops of information, where assessment exercises may have no real connection to how the student will apply their skills upon graduation, and where students are implicitly encouraged to adopt a shallow approach to learning (Biggs, 1999; Ramsden, 1991). Thus, in the objectivist paradigm, students may typically observe a lecture by the instructor or other expert and then be expected to retain and recall it on demand.

Objectivism has a role to play in most learning situations, even upper division courses, but its primary function is likely concentrated in introductory and lower division courses. It is not insignificant to note that objectivist approaches provide opportunities for course delivery efficiency.

For example; in the introductory statistics course, some material could be made available for students in a flipped classroom approach, where significant components are recorded once and watched by students outside of the classroom. This flipped approach is often useful for basic, foundational concepts as it is consistent with learning theory and it can be accomplished in a cost-effective manner, as the recordings can be reused and repurposed as desired. This frees instructors to concentrate efforts on meeting the higher-order—and often more instructor-intensive and challenging—learning concerns.

Alternatively, consider a computer modelling/applications development course that teaches students intermediate Excel spreadsheet and Access database skills. This course utilizes the Microsoft Official Academic Courseware (MOAC) that is aligned with the Microsoft Office Specialist (MOS) exams, which students can take at semester's end. The instructor records the Excel or Access lesson while working through that lesson with the students. The students are then at their leisure to revisit the recorded lesson at any time while attempting to complete the associated Knowledge, Competency, Proficiency, and Mastery Assessments at the end of each lesson. Further, students record themselves completing these assessments and the resultant recordings are uploaded to the LMS

(BlackBoard) for supplementary review and feedback by the instructor, and as a learning tool for other students preparing for the MOS exams. In addition to this, students in the course are then challenged to apply these skills to solve business-related problems, extending the course from the objectivist paradigm to the realm of constructivism.

Constructivist Learning Theory

"In education research, proponents of constructivism argue that their learner-centred theory is superior to the teacher-centred orthodoxy of objectivism, and that a paradigm shift is underway" (Lister & Leaney, 2003 p. 429).

In constructivist learning theory, the student, rather than the instructor, is considered the central driver of the learning process. Constructivism challenges students to connect what they are learning in a specific course or lesson to new, relevant issues or situations. Through this process, they "construct" their own knowledge of how what they are learning can be applied to solve problems that are personally important, and do so in an active and experiential manner (Chickering & Gamson, 1991; Kolb & Kolb, 2005; Knowles, 1988).

Under constructivism, instructors become less like experts who merely espouse or transfer their knowledge, and more like facilitators who create a learning environment which encourages students to contemplate how what they are learning applies to their lives and the world at large. Indeed, this links nicely with adaptive, self-adjusting learning espoused by Dull (n.d.). Inherently, a constructivist approach to teaching requires instructors to design courses and experiences to achieve the higher-level learning concerns of analyzing, evaluating, and creating.

Consider under constructivism how the fundamental use of recordings might change. In the constructivist framework, instead of instructor-created videos that are broadcast to students, the students themselves could be challenged to create course videos as a way to demonstrate how what they are learning applies to their personal concerns and interests. Students can even be challenged to do the videos well enough so that their creations can be incorporated into the course, where their peers and future students can learn from their explanations. Furthermore, instead of simply an instructor-based evaluation, student peers could provide feedback to each other. In this way, all students are engaged throughout the learning process, from content generation to evaluation in a high-level, constructivist manner. With such a design, students should know their learning is important not only to themselves, but to other students and the course itself, as well. And, as will be elaborated on in the next section, student output and effort can serve as a means to assess and assure learning has taken place.

The value of constructivism has long been recognized, even before the phrase was coined. In his seminal work, Democracy in Education (1916), Dewey opines that if instructors "give the pupils something to do, not something to learn; and the doing is of such a nature as to demand thinking, or the intentional noting of connections; learning naturally results" (Dewey, 1916, p. 181). This certainly seems prescient as it is not only relevant, but central to modern, adaptive learning systems, as well.

In summary, then, constructivist learning is important not only because it concentrates or reaches the higher levels of Bloom's taxonomy, but also because it allows students to engage in meaningful learning experiences that they can tailor to their needs and values. When integrated with modern technology and approaches like video recordings, student learning can be captured for assurance of learning purposes where students know that their creative efforts both benefit themselves and support other students too. With proper design choices then, the learning structure enhances the meaningfulness of educational experience, which is associated with career success (Belkin, 2014), as it facilitates student involvement and encourages them to think deeply about the material and why it is meaningful to them.

Assessment and Assurance of Learning

Picciano (2002) claims the evidence and measure of a student's performance can be determined in many ways: "[s]uccessful completion of a course, course withdrawals, grades, added knowledge, and skill building …, depending upon the content of the course and the nature of the students" (p. 22). Ellis & Goodyear (2010) claim that "[l]earning activity is the key: what the learner does is what makes a difference to the learning outcomes" (p. 118).

At a fundamental level, one measure of learning effectiveness for higher education is that graduating students should be able to know and do discernably more in their particular fields of study than when they started as freshmen.

Educators strive to create learning environments which allow students to be both academically and pragmatically competent: For students to have dual competency—evidenced in both their knowing and in their doing—and then be able to teach someone else what they have learned, so that they know and can do, too. In their foreword to "Quality on the line-Benchmarks for success in Internet-based distance education," Bob Chase (President, Blackboard Inc.) and Matthew Pittinsky (Chairman of the National Education Association), claimed: "We believe the distance from student to teacher must be measured in results—quality learning—achieved by our students (in Phipps and Merisotis, 2000 p. vii).

Accrediting bodies play an important role in assuring quality. The fundamental principles underpinning the assurance of learning criteria at the authors' institution are the two standards set by the Association to Advance Collegiate Schools of Business [AACSB]: (1) accountability and (2) continuous improvement (AACSB Assurance of Learning Standards: An Interpretation, 2013). "Learning goals should reflect broad educational expectations for each degree program, regardless of major. They also reflect the major intellectual and behavioral competencies a program intends to instill in its students due to the total educational experience across a given program" (AACSB Assurance of Learning Standards: An Interpretation, 2013, p. 6).

The purposeful and systematic instructional design employed in both of the authors' traditional and online courses has endeavored to include both elements of assurance and assessment that hold true to both of the above-mentioned AACSB principles. From an accountability point of view, learning objectives are established and measured in a manner that assesses a student's ability to know and then to do.

As educators, the authors strive to continuously improve the courses offered at their home campus, and put forth that the students and alumni are the proximate arbitrators of whether these efforts held value for them or not. However, the ongoing efficacy and competence of graduates from the authors' institution will invariably be measured by persons beyond the campus environment, i.e. employers, civic leaders, community organizations, advanced degree programs, and the like. Effective improvement efforts that do not align with the implicit needs of these external stakeholders will be for naught, and keeping this in the forefront of the authors' minds hastens their urgency to keep pace with the dynamic environment students will soon enter.

Learning will always be determined by the student, but the measure of their learning and resultant competency will be made by factors beyond their control. It is crucial that as much control as is possible, i.e. the assurance and assessment of learning, is embedded in every course offered.

Problem-Based Learning (PBL)

Problem-based learning (PBL) has been the subject of hundreds of research articles. As Albanese and Mitchell (1993) note, PBL originates with McMaster University in the late 1960s and is now practiced throughout the world in many different forms. While PBL initially was focused on medical education using pure discovery learning, it has been applied to dozens of different problem disciplines with a wide array of implementation approaches and techniques. In addition to Albanese and Mitchell (1993), interested readers may see Savery (2006) for PBL reviews and definitions.

While the flexibility of PBL enhances its potential usefulness and applicability, this also adds complexity that might impair implementation effectiveness as instructors can become overwhelmed. Because of the complexity in PBL implementations, some researchers have attempted meta-analyses and meta-synthesis to reduce and understand it better. Strobel and van Barneveld (2009) review 150 previous studies in eight previous meta-analyses to look at student and faculty satisfaction, knowledge retention, skill performance, and performance when mixed-knowledge and skills are required. For the practicing educator, the basic take-away from this meta-synthesis is that traditional lecture is appropriate for conveying basic information to students. However, for higher-order and longer-term knowledge acquisition and application, PBL is more effective.

While the PBL literature is skewed towards medical education, Walker and Leary (2009) perform a meta-analysis of 82 previous studies across disciplines. They look to understand PBL efficacy on authentic, real-world, and ill-structured problems that might not have a single right answer, and where instructors acting as facilitators or tutors in the learning process might be effective. The authors look at PBL in

disciplines such as teacher education, social science, business, science, and engineering, amongst others. They consider assessment levels, problem types, and implementation methods for which PBL might be effective. Walker and Leary (2009) conclude that PBL students did at least as well as lecture-based counterparts, and impact was actually stronger for disciplines *outside* of medical education, indicating PBL has wide appeal. More specifically, Walker and Leary (2009) note that PBL is particularly useful on semi-unstructured problems where instructors increase and decrease learning support—known as scaffolding—appropriately, which is consistent with and extends the ideas of Strobel and van Barneveld (2009).

Hung (2011) notes that the research into PBL is not universally positive in conclusion and that part of the problem might be the sheer breadth of approaches and factors which make PBL difficult to study. Mayer (2004), for example, notes pure discovery learning, as utilized in some problem-based learning implementations, may not be effective and may even hinder learning, hence some guidance in the learning process is useful. Many factors can impact effectiveness including student attitude and readiness, matching curriculum and PBL design, resource, and workload problems.

In addition, Hung (2011) stresses the need for appropriate assessment methods to measure PBL outcomes, choosing the appropriate PBL approach, teaching about the PBL philosophy and process, to provide appropriate scaffolding or support to students, and to constantly provide motivation and encouragement. Furthermore, Hung (2011) emphasizes the importance of matching PBL curriculum and problem design in successful implementations. These insights, while important, can seem overwhelming.

Woods (2013) addresses this issue by providing a detailed conceptual map into using PBL in 33 learning environment variations, ranging from traditional lecture to pure discovery PBL. This map considers dimensions such as whether the domain concerns primarily knowledge acquisition, skill development, or a combination; the learning technique employed (e.g., lecture, projects, etc.); the learning objective defined and by whom; and the assessment mechanism used. Traditionally, in the knowledge acquisition realm, lecture with subsequent exam questions is a common assessment structure. If one is interested in developing a skill, like in selling or customer service, a script-based approach might be used and students guided or coached on their performance. Woods (2013) also discusses options for situations where a combination of knowledge and skill development is desired. An appropriate choice in this case includes having an instructor pose a problem and challenge students to solve it with the instructor interactively working with learners.

Woods (2013) also emphasizes that in PBL the learning objectives can be developed by the instructor or the student themselves. Hung (2011) notes that for students to be involved in developing learning objectives requires them to be capable in a way that most medical students might be ready for, but that many undergraduates may not be, or for which they may need to be groomed before being ready. Therefore, if undergraduate instructors and programs desire to reach this level, curricular coordination amongst courses and throughout a course of study is pertinent. However, students often can and should be involved in evaluating other students and providing feedback and if this can be integrated into course and assignment structure, an additional learning opportunity results. Appendix 1 contains selected learning environments from Woods (2013) that are likely to be of interest to undergraduate instructors.

3. APPLICATION EXPERIENCES

To this point in the paper, the importance of meeting modern learning needs and some relevant theories have been covered. In this section, two application examples will be discussed. The first example details the implementation of PBL in an operations management course. The focus is on explaining the course objectives then discussing choices made with regard to implementation in terms of the theories in Section 3. The second example concentrates on a course where student assessment is designed into the structure of the course itself. In this case, students not only work on their own projects, but are also integral in assessing other students, and consequently the role of the instructor changes.

A Problem Based Learning Application

A PBL learning approach has been developed for an operations management (OM) course. OM is an upper-division, core course that is quantitative in nature. The material is new for most students so there are basic OM concepts and vocabulary to learn in addition to problem solving. Most of the OM problems studied lend

themselves to spreadsheet solutions and experience shows that while many students have basic solution mechanics, they are challenged by the higher order learning associated with analyzing and evaluating, especially in terms of spreadsheet development.

Hung (2011) provides some guidance on how to address these student limitations, by recommending explicitly teaching PBL philosophy and process, ensuring students have appropriate support and scaffolding, and paying special attention to motivating students to be responsible, active learners. The first class meetings focus on explaining to students how the course will be conducted and how it should help them to learn not only the material at hand but to apply it to other problem areas, as well. The first assignment in particular (see Appendix 2) contains not only a problem to be solved, but also a detailed description of how the course is going to be structured. In practice, this is carried out within and throughout the context of the problem being solved.

The OM course requires both factual knowledge, often as a foundation, and problem solving application using spreadsheets. In terms of Woods (2013), this represents a combination of knowledge acquisition and skill development, or Problem-Based Mixed (#6) on Woods' (2013) conceptual map. This approach can use a lecture or problem-based approach. Hence, the factual course material is covered via pre-recorded lectures done outside of class time with quizzes to check for understanding. The in-class portion is conducted in a skills-based, problem solving, workshop-like manner.

Unfortunately, students are typically not ready for a Problem-Based Lecture-Learn (#13) approach when starting the course. Consequently, the PBL approach is modified over the course of the semester to better match with student development. This is done via four sections or problem areas in the course. These sections include productivity and location analysis, forecasting, statistical process control and process capability, and inventory management.

As seen in Appendix 2, the first course section is conducted with a skill development focus using a Problem-Centered (#8) approach, where text and script is used to pose a series of problems and information is also provided on how to solve them. Students are guided on solution design with an emphasis on skills (e.g., spreadsheet) development. In the next two course sections, the approach is slowly altered to a more Problem-Sequence Skill Focus (#9), with the final course section striving for a Problem-Based Lecture-Learn (#13) orientation.

For example, as the course moves from the first section to the second, the focus shifts from spreadsheet design basics to the concept of how to model the logic of a problem rather than solving for a specific set of numbers. Development progresses in sections two to three by introducing students to advanced spreadsheet functions and capabilities (e.g., optimization, regression, etc.). As the Problem-Sequence Skill Focus (#9) is implemented, support is provided but more emphasis is made on students using the built-in help system to figure out sticking points. In the final course section, inventory analysis, students are introduced to a problem (short case) and then challenged to solve it after a short lead-in lecture. Students are encouraged to work in groups and the instructor circulates throughout the class, interacting with students.

Assessment of student performance is of course important and, although the next section discusses assessment in detail, some coverage is warranted here. Walker and Leary (2009), and Hung (2011) both note the importance of matching assessment with development focus. As a result, while multiple choice assessments are used for factual material, spreadsheet-based application problems are used for exams. These exams are variations of the problems covered in class and even though the context may change to encourage higher-order learning concerns, they are structurally similar and of appropriate complexity so as not to be overwhelming.

An Assessment-Focused Application

Having students participate in not only the production of content but in the assessment regime is an attempt to develop active, intentional learners. This desire applies not only to traditional, in-person courses but to those courses offered online, too: In this case, a global business management course.

One component of the course requires students to develop and present course concepts using lecture capture software (Panopto). Presentations typically include textbook concepts along with researched resources and personal experiences with a process using the process and guidelines as detailed in Appendix 4.

The other students in the course then review the materials and complete a Qualtrics Assessment

[QA] of the Rubric guidelines (Appendix 3). Qualtrics is a surveying tool similar to Survey Monkey. The composite result of the peer assessments is shared with each student following the conclusion of their presentations, with a view to identifying and remedying anomalies and shortcomings, if any. Comments from students range from the basic assessment activities, to how constructive the assessments are in exemplifying the assurance of learning goals that each student receives in the course objectives.

The enduring benefit of this process to students experiencing this assessment approach is that not only do they get to research and present their own findings on a series of topics, they also amass an e-portfolio of evidence to attest their competence and acuity in distilling concepts into discernable components. Additionally, beyond simply presenting the findings of their efforts, they receive constructive feedback from both their fellow students and the instructor. This in itself provides each student with tangible evidence of their competence, beyond something purely anecdotal, which they can present to future employers, as each student can choose to share their work with whomever they choose, even after the course ends.

4. SUMMARY

Active [and deep] learners are engaged in all stages of the learning process, whether individually or collectively, which is critical for success in the modern environment. This paper has presented the authors' attempts to encourage and implement such characteristics in their classes. These efforts include a novel, electronic-based assessment regime carried out by the students themselves, and which was facilitated by the instructor. In addition, the constructivist learning theory is implemented via a problem based learning (PBL) approach. PBL is comprehensive but may be complex and difficult to implement effectively for some. Ideas are presented to help instructors who are interested in PBL and looking for practical ways to get started. These include the process, tips, and tricks by which the authors implement PBL in their own courses, and examples of the tools they used to do so.

5. REFERENCES

AACSB Assurance of Learning Standards: An Interpretation (2013). Retrieved from http://www.aacsb.edu/~/media/AACSB/Publications/white-papers/wp-assurance-of-learning-standards.ashx

Albanese M. & Mitchell, S. (1993). Problem-based Learning: A Review of Literature on Its Outcomes and Implementation Issues. *Academic Medicine*, 68(1), 52-81.

Anderson, L. W., & Krathwohl, D. R. (Eds.). (2001). *A taxonomy for learning, teaching, and assessing: A revision of Bloom's Taxonomy of educational objectives*, New York: Longman.

Biggs, J (1999) *Teaching for Quality Learning at University.* Buckingham, UK: SRHE and Open University Press.

Bloom, B., & Krathwohl, D. (1956). *Taxonomy of Educational Objectives: The Classification of Educational goals by a Committee of College and University Examiners. Handbook 1: Cognitive domain*. New York, NY: Longman.

Bransford, J., Sherwood, R, Vye, N. & Reiser, J. (1986). Teaching thinking and problem solving. *American Psychologist, 41*(10), 1078-1089.

Chickering, A. & Gamson, Z. (1991). Applying the Seven Principles for Good Practice in Undergraduate Education. New Directions for Teaching and Learning. Number 47, Fall 1991. San Francisco: Jossey-Bass Inc.

Daniels, H., & Bizar, M. (2005). *Teaching the best practice way: Methods that matter, K-12*. Portland, OR: Stenhouse.

Dewey, J. (1916) *Democracy and Education*. New York, NY: The Macmillan Company.

Dull, C. (n.d.). Three Technological Trends That Set the Tone for Higher Education's Future. Retrieved from http://www.evolllution.com/distance_online_learning/technological-trends-set-tone-higher-educations-future/

Ellis, R. & Goodyear, P. (2010). *Students' experiences of e-learning in higher education: the ecology of sustainable innovation.* New York, NY: Routledge.

Freedman, G. (n.d.). The Future of Education & Technology: Social Disruption in Higher Education. Retrieved from http://www.gordonfreedman.com/wp-content/uploads/2013/03/Mexico-Presentation-Freedman.pdf

Firestein, S. (2012). *Ignorance: How It Drives Science.* Oxford, UK: Oxford University Press.

Four-Year MYTH (2014). Retrieved from http://completecollege.org/wp-content/uploads/2014/11/4-Year-Myth.pdf

Head, A. (2015). Dan Rothstein: The Necessity of Asking Questions. Retrieved from http://projectinfolit.org/smart-talks/item/144-dan-rothstein-smart-talk

Hung, W. (2011). Theory to reality: a few issues in implementing problem-based learning. *Education Technology Research and Development*, 59, 529-552.

Kelderman, E. (2011). Online Programs Face New Demands from Accreditors. *The Chronicle of Higher Education*. Retrieved on from http://chronicle.com/article/Online-Programs-Face-New/129608/

Knowles, M. (1988). *The modern practice of adult education: from pedagogy to andragogy* (Revised Ed.). New York, Cambridge Books.

Kolb, A. & Kolb, D. (2005). The Kolb Learning Style Inventory—Version 3.1 - 2005 Technical Specifications. Retrieved from www.whitewater-rescue.com/support/pagepics/lsitechmanual.pdf

Lister, R., & Leaney, J. (2003). Bad theory versus bad teachers: Toward a pragmatic synthesis of constructivism and objectivism. Retrieved from http://www.unhas.ac.id/hasbi/LKPP/Hasbi-KBK-SOFTSKILL-UNISTAFF-SCL/Mental Model/Bad teacher.pdf

Mayer, R.E. (2004). Should there be a three-strikes rule against pure discovery learning? *American Psychologist*, 59(1), 14-19.

Phipps, R., & Merisotis, J. (2000). Quality on the line: Benchmarks for success in Internet-based distance education (Report No. 2000-175). Washington, DC: Institute for Higher Education Policy. Retrieved from http://www.ihep.org/assets/files/publications/m-r/QualityOnTheLine.pdf

Picciano, A. (2002). Beyond Student Perceptions: Issues of Interaction, Presence, and Performance in an Online Course. *The Journal of Asynchronous Learning Networks, 6*(1): 22-40. Retrieved from http://faculty.weber.edu/eamsel/research groups/on-line learning/picciano (2002).pdf

Ramsden, P. (1991). A Performance Indicator of Teaching Quality in Higher Education: the Course Experience Questionnaire. *Studies in Higher Education, 16*(2), 129-151.

Rothstein, D. & Santana, L. (2011). Make Just One Change: Teach Students to Ask Their Own Questions. Cambridge, MA: Harvard Education Publishing Group.

Savery, J.R. (2006). Overview of problem-based learning: Definitions and distinctions. *Interdisciplinary Journal of Problem-Based Learning*, 1(1), 9-20.

Stengel, R. (2012, Oct 29). Reinventing College. *Time, 180*(18), 31.

Strobel, J. & van Barneveld, A. (2009). When is PBL more effective? A meta-synthesis of meta-analyses comparing PBL to conventional classrooms. Interdisciplinary Journal of Problem-Based Learning, 3(1). Available at: http://dx.doi.org/10.7771/1541-5015.1046.

Walker, A. & Leary, H. (2009). A problem based learning meta analysis: Differences across problem types, implementation types, disciplines, and assessment levels. *Interdisciplinary Journal of Problem-Based Learning*, 3(1), 6-28.

Woods, D. R. (2013). Problem-oriented learning, problem-based learning, problem-based synthesis, process oriented guided inquiry learning, peer-led team learning, model-eliciting activities, and project-based learning: what is best for you? *Industrial & Engineering Chemistry Research*, 53, 5337-5354.

Appendix 1

Selected learning environment variations for PBL from Woods (2013). The number in parentheses corresponds to the Woods original code number.

Primary Concern	Recommended Approach	Discussion and Implementation Tips
Knowledge Acquisition	Problem-initiated teaching (#7)	Meaningful, subject-oriented problems and learning objectives are created by the instructor and used to develop student interest in the topic and to highlight future course material. Can be done in small groups with a floating facilitator or even tutorless groups.
	Problem-initiated teaching with student generated learning objectives (#16)	A problem is posed to students. Class discussion is used to determine what needs to be covered in lecture. After the lecture, problems are solved individually or in small groups.
	Problem-based lecture learn (#17)	Small groups of students create the learning objectives related to the problem posed. Lecture is conducted accordingly and small groups are used in problem-solving.
	Problem-based learning with given objectives (#24)	Instructor poses problem and gives learning objectives. Students research, teach, discuss, and reflect. This approach requires students to already have necessary technical skills.
Skill Development	Problem-centered (#8)	In this approach, a text and script is used to pose a series of problems where information is also provided on how to solve them. There is a known solution to the problems and students are guided on the solution design with an emphasis on skills development.
	Problem-sequence skill focus (#9)	A series of activities in a workshop format with peers are conducted. Workshops are designed to develop process skills and learning objectives are accomplished by completing the activities designed by the instructor. Activities increase in complexity and scaffolding support is provided, as needed, and tailored to decrease appropriately as student capability and confidence is developed.
Combination: Knowledge Acquisition and Skill Development	Problem-based mixed (#6)	This approach can use a solid lecture based approach or a more PBL centric one and may evolve as needed. Students may be given the choice of which they prefer.
	Problem-based, lecture-learn (#13)	A lecture-oriented version of PBL. A problem is posed by the instructor complete with learning objectives. Students then work to solve problems, usually in small groups while the instructor circulates around the class.
	Problem-based, lecture learn skills (#18)	Similar to (13) Problem-Based Lecture-Learn except students, not the instructor, determine learning objectives. Often the problem cases are multi-week in nature. This is a high level of PBL requiring capable, motivated students.

Appendix 2

Cover page for initial course activity in operations management to emphasize PBL implementation concerns of Hung (2011) including the PBL philosophy and process, motivating students to become responsible, active learners, and providing appropriate support.

Excel Exercise—Productivity

A few words on course approach

In this course, students learn about operations management (OM) theories and concerns. In particular, students are challenged to solve quantitative OM problems, and to do so in a manner that builds decision modeling and problem solving abilities. Hence, spreadsheets and other computer-based tools, are used extensively.
A guided problem-based learning approach is utilized—where the amount of guidance provided and the focus on skills developed—vary through the semester and as appropriate for the topic being explored. In other words, OM theories and concerns will be used as drivers to develop student ability and confidence to solve problems more generally, especially using spreadsheets. It is intended, then, that upon course completion, students will not only "*know*" but can "*do*" as well. And that the knowledge, skills, and abilities developed by the student will translate to other courses and to their work careers. This approach is carried out in a workshop approach during class.

Productivity

Problem overview

The owner of the small business where you intern has become interested in measuring the efficiency of company operations. She wants a better view on how well her business is operating overall and how well it is using inputs (factors) like labor and materials. She asks you to create a spreadsheet model to calculate productivities from the single-factor and multifactor perspectives as she wants to monitor how productivity changes over time. She notes that while you will create the spreadsheet, one of the production clerks will maintain it and while she wants you to start on it today, she will not have the initial data for you until sometime tomorrow.
In addition, she notes several items to keep in mind as you build this model. The spreadsheet should be…

1) Correct with no errors.
2) Designed to prevent mistakes in use.
3) Informative and easy to understand.
4) Efficient to develop, use, and update.

A hint on how to begin

Any spreadsheet model you create must, first and foremost be, correct with no errors. How to ensure this? Check, double check, and then check again is a good start. Additionally, if you can get others to verify your work, great, but this is not always possible. Another idea is to find a problem related to the one you want to solve, where you already know the answers, and use that as a guide for building your spreadsheet. Where can you find such a problem? Company reports and similar spreadsheets currently in use are possible sources. Another is to find a solved problem, like in a textbook, and replicate that. Then, once you have your confidence, convert it or create a new one, for the problem you need to solve.

Appendix 3

RUBRIC: Preparation and Presentation of Course Materials
GLOBAL BUSINESS MANAGEMENT

Group No.		Chapter No.		Date/s		

Your group will be tasked with presenting the materials for Chapters/Topics throughout the semester, details of each are provided in the respective Syllabus.

It goes without saying that your preparation is a shared experience in your group that will culminate in you collaboratively facilitating the presentation and ensuing discussion for each chapter/topic assigned.

Each group is required to research the concepts – both as shared in the group and as available in peer reviewed or refereed research - as you find fit either online or via our campus library records. Any other materials you wish to introduce, e.g. video, audio, written, etc. that will emphasize and support your positions on said concepts, is strongly encouraged.

Your group has 2 hours and 30 minutes split between the two assigned days, to present the materials for each assigned Chapter. As indicated in the **Guidelines for Class Presentations *Worksheet***, on the course site, it is incumbent upon each group to keep the discussion healthy and constructive and to strongly encourage all your classmates to contribute regularly and appropriately. The following rubric applies;

Presentation Rubric				
MEASURE	**POOR - 1**	**GOOD - 2**	**VERY GOOD - 3**	**EXCELLENT - 4**
Preparation	Lack of organization, too much off-the-cuff material and/or unsubstantiated "facts"	Lack of organizational clarity once or twice, resource use limited to the assigned material	Generally clear organization, command of the assigned material, and apparent use of additional resources	Clear evidence of organization, command of the assigned material, and use of additional resources
Organization	Audience cannot understand presentation because there is no sequence of information.	Audience has difficulty following presentation because Members jumps around.	Members present information in logical sequence which the audience can follow.	Members present information in logical, interesting sequence which the audience can follow.
Subject Knowledge	Members do not have a grasp of the information; Members cannot answer questions about subject.	Members are uncomfortable with information and are able to answer only rudimentary questions, but fail to elaborate.	Members are at ease and answer most questions with explanations and some elaboration.	Members demonstrate full knowledge (more than required) by answering all class questions with explanations and elaboration.
Visual Aids	Members use superfluous visual aids or no visual aids.	Members occasionally use visual aids that rarely support the presentation.	Members' visual aids relate to the presentation.	Members' visual aids explain and reinforce the presentation.
Mechanics	Member's presentation has four or more spelling errors and/or grammatical errors.	Presentation has three misspellings and/or grammatical errors.	Presentation has no more than two misspellings and/or grammatical errors.	Presentation has no misspellings or grammatical errors.
Eye Contact	Members make no eye contact and only reads from notes.	Members occasionally use eye contact, but still read mostly from notes.	Members maintain eye contact most of the time but frequently return to notes.	Members maintain eye contact with audience, seldom returning to notes.
Verbal Techniques	Members mumble, incorrectly pronounces terms, and speak too quietly for audience in the back of class to hear.	Members' voices are low. Members incorrectly pronounce terms. Audience has difficulty hearing presentation.	Members' voices are clear. Members pronounce most words correctly. Most audience members can hear presentation.	Members use a clear voice and correct, precise pronunciation of terms so that all audience members can hear presentation.
Group Work	Cannot work with each other in most situations. Cannot share decisions or responsibilities.	Work with each other, but have difficulty sharing decisions and responsibilities.	Work well with each other. Takes part in most decisions and shares in the responsibilities.	Work very well with each other. Assumes a clear role in decision making and responsibilities.

Adapted from: http://ed.fnal.gov/lincon/w01/projects/library/rubrics/presrubric.htm AND: http://facstaff.elon.edu/bissett/Honors%20Discussion%20Rubric,%20Version%202.mht

Please score the group presenting according to the guideline in this rubric above.

This will constitute your peer reviewed grading of their classroom management, facilitation and presentation efforts.

Appendix 4

Guidelines for Online Presentations and their related Panopto Recordings

Technological Competencies

Please be advised that students must be tech- and net-savvy. Learning online is a difficult challenge and students, particularly those registered in a senior-level writing-intensive course, should already be well familiar with all aspects of learning technologies used in this course. Contact me if you are concerned.

It is expected for students to have become familiar with **Panopto**, an online presentation capture software system, by the time they prepare their assigned Chapter recording. To aid in this, all necessary training materials are accessible via links from our BBL9 course page.

1. **You need to download the Panopto recorder to your home computer—links to both the PC & MAC versions of the recorder are on BlackBoard [BBL9].**
2. **You need to be logged on to BBL9 to locate the correct recording folder when starting your Panopto recording.**
3. **All recordings must be located in the Panopto DropBox folder associated with our course, i.e.;**
   - **15375.201560: MIS-44163-601-201560: GLOBAL BUSINESS MANAGEMENT [drop box]**
   - ***Only recordings located in the proper DropBox will earn points for the assignment. Be forewarned.***

The specific requirements for Panopto Recording is as follows;

1. Please name each recording you make with the following 4 components;
   - **Your [1] LAST NAME [2] CH # [3]CHAPTER ELEMENT [4] FULL DATE**
     - Example: **Jones CH05 Opening Case Monday, March 16 2015**
     - Example: **Jones CH05 LO2 Monday, March 16 2015**
     - Example: **Jones CH05 Video Case Monday, March 16 2015**
2. You are most welcome to experiment with the Panopto Recorder, but when you are done, please delete all irrelevant recordings from the DropBox folder.
3. You are welcome to make use of the publisher's PowerPoint content loaded on BBL9, but I trust you have taken my lead from the recordings I have provided as examples, to enhance and embolden your presentation by adding not only your own anecdotal content, but also relevant external research content too.
4. By conducting valid and reputable outside research and including your findings in the recording/s, further convinces me that you have immersed yourself in the materials and have fully familiarized yourself with both the historic and contemporary perspectives on and practices of the relevant subject matter.

5. Preparing a "script" lends a professional touch and gives the recording modularity while presenting your understanding of the materials, and providing a more sequential guide to the materials in the Lesson, as delivered.
6. Please ensure that you include in your recordings, the following elements of each Chapter:
    - The Opening Case, all Debates, the Closing Case and your assigned Video Case (presenting your findings and responses to the associated questions).
7. You will notice that I have used a number of methods to make my recordings [located from the link>>>**Past Semesters: Chapter Recordings By Instructor** under the heading **PRIOR SEMESTERS**], please feel free to break up your recording into as many pieces and parts as you like.
8. You are also welcome [***and strongly encouraged***] to add whatever you like to the recording/s
    - ***Please Note: The total length of your Chapter Recording should not be less than 90 minutes, and should not exceed 120 minutes.***
9. Please email me the all the Panopto Recording Links, Narratives, PowerPoints*, References, etc. by the deadlines as indicated both on in the Course Schedule and in the Individual Student Chapter Assignment Schedule.
10. If you would like to, please share your experiences through the recording session highlighting what you found user-friendly, frustrating, etc. and please make recommendations on what you feel could be done to improve the Panopto process.
    - ***Your feedback is invaluable to course improvements and research efforts.***

In summary:

- ***Using your FlashLine username and password, you need to log on to Panopto and must then choose the correct Dropbox folder for our Course to locate your recordings,***
- ***Please name your recording, before you start each Recording,***
- ***All recordings you make will be stored on the computer where you make the recordings, once you click STOP in the Recorder and provided you are still logged into the Panopto server, your recording will automatically upload to that Panopto server.***
    - ***Once successfully uploaded, you will receive an auto-generated email from Panopto confirm receipt on the server and will provide all the necessary links to your recording.***
    - ***You need to copy and paste all the VIEW links for all your final recordings in one email to me along with your Narratives, PowerPoints*, References, etc.***
    - ***Please remove all "trial" attempts on the Panopto Server – these clutter the DropBox.***
    - ***If you do not get an email from Panopto you will need to contact me directly.***
- ***Thereafter, I will upload all your content to a separate content area in BBL9 for the other members of the course to view and review*.***

** Please see the Presentation Rubric on BBL9 for more specific details*

- ***As indicated in the Course Schedule, you will be required to conduct an Assessment, via Qualtrics, offering your perceptions and scores of each other student's efforts.***
- ***Again, it goes without saying, that I am able to, through specific audit trails and statistical tracking mechanisms, reconcile each student's commitment and effort applied in viewing and reviewing the content on both Panopto and BBL9.***
- ***Students not viewing and reviewing the fellow student's efforts on BBL9 will incur 5% penalty for not complying with course requirements.***

As always, please make copious use of my many virtual and in-person office hours.