mLearning - A Mobile Learning / Teaching Methodology

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Technology has changed how teachers and students interact. The use of devices: laptops, iPhones, iPods, iPads, and other mobile devices along with applications like: Apple TV, Responseware, and web based Learning Management Systems (LMS) have dramatically changed both the dynamics and definitions of the classroom as well as the relationships and expectations of both faculty and students. This paper presents some examples of changes in class teaching methodology that takes these new mobile tools, expands the classroom environment outside the walls of the institution, and allows the students to exist in a new mLearning environment.

INTRODUCTION

Technology has changed how teachers and students interact. The use of devices like: laptops, iPads, mini iPads, iPhones, iPods, tablets, and other mobile devices, along with applications like: Apple TV, Responseware, McGraw Hill's Connect, and web based Learning Management Systems (LMS) have dramatically changed the dynamics and definition of the classroom as well as the relationships and outcome expectations of both faculty and students.

From the faculty's perspective, the capabilities of on-line document storage, uploads and downloads, online quizzes, online tests, discussion boards, e-texts, flashcards, iterative grading technologies, polling software, online office meetings, variable seed number assignments, blogs, journals, and other activities, require faculty to rethink how they teach. What is the classroom? Where is the classroom? When is the classroom? How do we redesign the traditional classroom to be a "mobile learning environment" that is constantly available, that uses and reinforces skills in cutting edge technology that remains flexible enough to be used by instructor and student inside and outside the classroom?

The classroom is no longer within the four walls of the traditional face-to-face brick and mortar classroom. The advent of mobile devices and their use in industry requires faculty to rethink about, not just the use of devices in the classroom for education and technology training purposes, but also about how these devices can be used both inside and outside the traditional classroom walls to maintain a constant rich and engaging learning environment. This new learning environment can be called mLearning – Mobile Learning - which is a paradigm shift in the teacher-student-learning relationship.

Rethinking the traditional course to enable this new mLearning experience can be a daunting task for faculty. Students rightly expect to graduate with skills that set them apart in the workplace. As business educators, we often find ourselves at the forefront of new technologies. New business technologies

require faculty to learn and incorporate these new technology skills. Students are investing in themselves to be more prepared and desirable in the marketplace. Faculty must expand the goal of teaching beyond the attainment of certain core competencies of knowledge of content into the realm of competency in the applicable business field. We must provide students the opportunity to become more productive and efficient through both subject knowledge and technology skills taught in the course.

From the student's perspective, the use of these new technologies has dramatically changed the traditional classroom experience. Technology use changes the learning covenant that students have traditionally embraced. "I will show up prepared for class" is no longer a sufficient basis for learning. Students must now show up ready to learn in an environment that can be "student led." Students can no longer depend solely on the faculty to "tell them" what they need to know. This shift is exciting and refreshing as we move away from a faculty-driven traditional classroom to a student-driven learning environment. These new "student teachers" must be competent, not only in subject matter, but also in technology proficiency, to be successful in this new mLearning environment.

True mLearning for the student implies that there is constant access to all course materials allowing the student to grab available moments to expand their learning. MLearning requires students to rethink traditional class schedules, requirements, and preparations. The economics class at 8 a.m. on Tuesday morning (traditionally prepared for the night before class) can now be worked on in available moments during the week prior to class. The bus ride becomes a learning moment. Quiet time on the bench at the park allows the student to record thoughts on a class blog. The textbook that traditionally resided on the desk in the dorm is now available at any moment in any location, on any device.

This new mLearning environment requires the student to be more engaged in the learning process. In the past a typical student might read a paper text at a desk in the dorm from 7:00 to 9:00 p.m. the night before class. The new mobile student has to be retrained to take advantage of mobile moments when the e-text is constantly available. Students must expect new mLearning to provide them the opportunities to learn course content, technology, and time management skills. To accomplish these changes in the learning environment, the coursework of a traditional classroom must change.

This paper presents some examples of changes in class teaching methodology that uses these new mobile tools, expands the classroom environment outside the walls of the institution, and allows the students to exist in a new mLearning environment.

THE MEANING OF MOBILITY

There are many definitions of mobile learning. Terminologies such as eLearning and distance learning can cause us to confuse the meaning of mLearning. Elearning refers to the use of technology in learning. Typically eLearning technology refers to the methodology of delivery. A good example would be multi-media technology, internet based instruction, computer based training or web based training. Distance learning involves two or more parties, separated by distance and time. Historically, this type of learning could be accomplished by paper based lessons mailed to the remote learner at a fixed location. MLearning differs from both eLearning and distance learning. MLearning expands on these two definitions. Kant (2012) states that mLearning is,

> "Any sort of learning that happens when the learner is not at a fixed, predetermined location, or learning that happens when the learner takes advantage of the learning opportunities offered by mobile technologies. In other words mobile learning decreases limitation of learning location with the mobility of general portable devices."

Historically, distance learning was handled with the student at a fixed remote address. The addition of mobile devices that make the delivery of educational materials to any remote location expands on this traditional definition. MLearning now operates "out of location" and "out of time." The one limitation of this new mLearning is accessibility. The student needs access to the web through either a wireless network internet connection or mobile telephone connection. The new limitation on mLearning is

accessibility or coverage of your carrier. In addition, traditional learning was a covenant between the instructor and the student. MLearning expands on this learning covenant to include other students who are engaged in the study of the same materials. Thus, the mobile device is redefining the traditional learning model.

THE MOBILE DEVICE

For the purposes of this paper we define mobile devices as any portable device that enables the student to enter their learning environment. Kant (2012) defines mobile devices as follows:

> "The term covers: learning with portable technologies including but not limited to handheld computers, notebooks and mobile phones."

We conclude that "not limited to" would include new delivery methods such as tablets along with the traditional laptop or desktop computer. It should also be noted that Kant does not rule out learning within the classroom or taught by instructors in the definition.

DOES MLEARNING MAKE A DIFFERENCE?

Whether in class or on the road, the objective of mLearning is to encourage the student to take responsibility for his or her own learning. From within the traditional classroom to remote locations, the mLearning student can choose the preferred method of concept reinforcement. In-class lectures can be reinforced by remote mobile readings, videos, discussions, questions, and collaboration that occur outside of the regular classroom. Research in the accounting discipline shows that by switching from the traditional lecture method to a flexible method of delivery for the student led to improved outcomes (Downling, 2003). Downling used a variety of methods along with the traditional face-to-face lecture to reinforce the student's learning preferences. This research found that the addition of information outside of traditional lectures did have a positive effect on student grades. Downling also stresses extending the learning covenant with the student to cover engagement. Engagement enhances learning (Laurillard, 2002). If the students are engaged, he or she takes ownership of his or her learning experience. Engagement ensures focus. Focus leads to understanding by disengaging distractors to the learning process.

Laurillard also stresses that students have traditionally had few out of class options to gain knowledge. The traditional lecture where the students frantically took notes may not have been each student's preferred method of learning. MLearning, using mobile devices, expands the methods by which students can assimilate new information. These devices allow the students to choose moments and methods by which they can learn. Students move from being passive learners to being active learners responsible for their learning outcomes. In this environment, the teacher becomes more of a guide than a lecturer.

Elen, et. Al. (2007), studied students' perceptions on what they consider to be high quality education processes. They conclude that rather than having a specifically student-led or teacher-led class environment, the students preferred what they called "a powerful learning environment."

> "In students' minds student-centredness and teacher-centredness seem to be mutually reinforcing features of high quality education. From a curricular point of view, and especially with regard to teacher training, the results warrant to argue for the development of so-called powerful learning environments rather than for the transition from teacher-centred towards student-centred learning environments."

The mLearning environment empowers both the student and the instructor, leading to the possibility of this "powerful learning environment" through the use of mobile technologies.

TYPES OF LEARNING

The impact of mLearning on different learnings styles can also be very positive. Research has identified three main styles of learning as identified in the Fleming's (2001) Visual Auditory Kinesthetic (VAK) model (Gholami, Shahin, Bagheri, Mohammad S, 2013). Fleming, a teacher in New Zealand, created this model to explain why different people learn differently. These styles include; visual learners, auditory learners, and kinesthetic (tactile) learners. Each of these styles works well within the mLearning environment when they are structured in such a way as to utilize the unique interaction and freedom provided by an individualized custom approach. It is this individualized custom approach and freedom from many of the common restraints that gives mLearning such an advantage in instructional design and usage areas.

Visual learning is a learning method of acquiring new skills and learning new information through the visual (seeing) process. It is experiencing through seeing and the more pictures, charts, painting, activities to create visual images and even to manipulate images, the better for the learning process. The mobility and technology foundation of mLearning provides an unlimited resource for expanding the visual learning experience. Imagine the possibilities of utilizing remote or totally different locations to direct a visual experience and even challenging each student's creative thinking ability to adapt an assignment based on what he or she sees. The answer, or the learning experience, might be totally different for each student, and at the same time it might fully satisfy the defined learning outcome. The mLearning process brings a whole different meaning to the word "seeing." The student not only has the capability to see with his or her own eyes, but can now use the mobile device to enhance, expand, and even redefine the visual experience. The 'seeing' experience expands to be much more than what normally happens in the typical classroom. It has moved to wherever the student wishes to be and brings all the learning tools to the student at the time and place of their choosing to enhance the learning experience.

Auditory learning is a learning method of acquiring new skills and learning new information through the listening (verbal) process. Learners with auditory preference normally think or reason in words rather than pictures. They possess the ability to relate to stories, understand and value the full meanings of words, and even enjoy discussions (talking things through for understanding). Auditory learners value listening and digging deeper into the conversation in order to experience fuller understanding. The power of mLearning provides the opportunity to take the story with you and spend the time required to fully understand the words. The ability to analyze language usage and repeat or play back key passages of text gives the learner a distinct advantage as he or she seeks to understand the material. Students have all the normal class resources with them all the time and choose their own pace to listen and absorb the content. The mLearning process allows each student to explore the context for each word or phrase and analyze the proper meaning. It truly opens up a new dictionary of unequalled depth and breadth for the auditory learner.

Kinesthetic (Tactile) learning is a learning method of acquiring new skills and learning new information through doing, or taking a hands-on approach to the activity. This learning style is truly blessed by mLearning. The kinesthetic learner is provided the tools and opportunities to actually do something much more than just seeing or listening. He or she can touch and create using the mLearning format. One of the common challenges facing a kinesthetic learner is dealing with a short attention span when he or she needs to learn a new skill that may require a long learning curve. The mLearning process gives each student the foundation to build and perform many of the learning assignments in a hands-on environment while taking advantage of additional available time because of this new mobility. Kinesthetic learners get the sense and satisfaction of doing something, and the learning outcome is actually a by-product to the activity. Learning becomes fun and exciting when utilizing mLearning.

With the use of mLearning, the student becomes the driver behind the learning process. Their particular learning style does not matter. The mLearning process can adapt and address any particular need they may have. Each student has the capability to see, hear, or do an assignment many different ways and repeat many of the assignments to master the required skills (Deeb, Buthaina, Hassan, Zainuddin, 2011).

Järvelä, et. al. (2007), in their research stressed;

> "…that there is a need to place students in various situations in which they can engage in effortful interactions in order to build a shared understanding. Wireless networks and mobile tools will provide multiple opportunities for bridging different contents and contexts as well as virtual and face to face learning interactions in higher education." (71-79)

These new opportunities and tools allow students with different learning styles the flexibility to choose suitable and desired learning options.

RETHINKING THE DELIVERY OF MLEARNING WITH NEW TECHNOLOGY

The challenge of meeting the expectations of each student with his or her background, skill level and learning needs in the traditional classroom is a daunting one. Expanding this environment outside of the traditional classroom dramatically increases the burden on the instructor (in the initial class coursework development process). In order to meet these new requirements and student expectations, the instructor must draw deeply on his or her own business, education, and personal experiences, and be willing to embrace new methods to meet these expectations.

Each and every student is unique in his or her style of learning, in his or her motivation to succeed, and in his or her level of comfort with technology. Our task as mLearning educators is to demonstrate the relevance of content theory, to show its application to everyday life, and to use technology to expand this learning experience. By drawing on current events and real life case studies and experiences, the instructor can show the relevance of the concepts being taught in the course content. These real world applications using technology tools help reinforce the topic being discussed and create a reference point on which the student can draw to recall the content theory (Hedberg, 2003).

Savery and Duffy (1996) propose four principles in application of technology to mLearning.

1. Learning is an active and engaging process. Activities engage the learners with tasks that authenticate real world activities. The creation of price / demand tables can generate graphic output that shows how data can visually be represented.
2. Learning is a process of constructing knowledge. Learners build knowledge on foundations of previous experience. An example in macroeconomics would be to take your original demand table and graphical output, add more demand, and revisit the graphical outputs. These visual changes help the student understand the differences between shifts of demand (the curve itself) versus changes in quantity demanded.
3. Learning is focused on thinking skills. Learners focus on developing a solution rather than a right answer. By building models of demand the user can answer the question, "What happens when a demander drops out of the picture?" The resulting leftward shift of demand visually reinforces the student's learning process.
4. Learning involves social negotiation. Collaboration with other students encourages each learner to challenge his or her understanding of the concepts being studied. Good collaboration can be had when students try to resolve differences in understanding using these new tools. Students can use models to explain why they feel their answer is more correct.

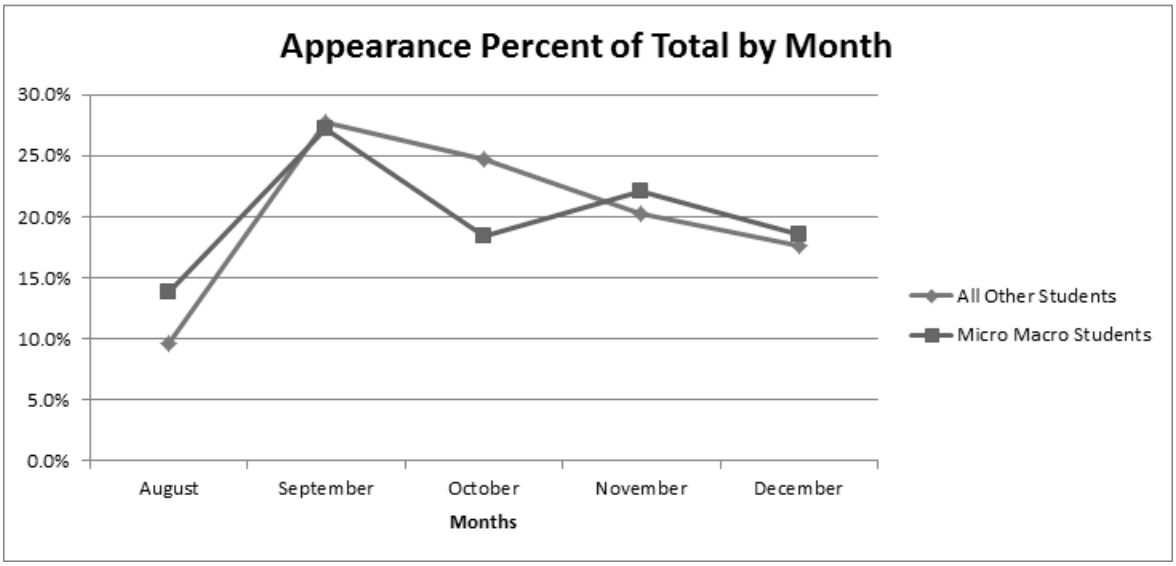
The design of our classroom and its activities addresses each of these four principles.

In mLearning, the instructor must use a wide variety of media and technology in presenting his or her course materials. Variety in the mLearning environment helps to capture the interest of the students and to provide examples to them of the types of tools that they will be expected to utilize when they enter the workplace. Variety also allows the student to select his or her preferred method of learning. Based on their learning styles, some students may prefer reading the e-text. Other students may prefer reviewing a

podcast of the class lecture where verbal content can be reviewed. With mLearning, each learning style can be addressed, opening the door to a better learning outcome.

Preparation for mLearning use in remote locations does not preclude the use of these same tools in face-to-face classes. Data from our research indicates that both the traditional non-mLearning student's (students not in macroeconomics or microeconomics classes taught by the author – All other) and the mLearning student's use of technology drops off as the semester progresses. Refer to Figure 1 comparing non-mLearning (All other) students and mLearning (Micro Macro) students us of Blackboard. This trailing off effect could indicate a lack of consistent daily use of mobile technologies and tools, or it could be indicative of the assignments schedules, and types of Blackboard applications used in classes.

FIGURE 1
BLACKBOARD APPEARANCE HOURS BY GROUP PER MONTH



Students also show a change in device preferences across the semester as they move from one device to another dynamically selecting their preferred method of delivery for varying content. Note in Figure 2 – Activity Change by Device how students tend back towards their iPhone by the end of the semester. Typing intensive activities trended back to the laptop as the semester progressed.

It has been said, "Practice makes perfect!" Consistent technology tool use in the classroom ensures student practice and in the long run it ensures competency in the field. Within the classroom, a combination of interactive discussions accompanied by slides (hard copy or electronically projected from presentation packages), blackboard/whiteboard notes, video, spreadsheet/database data manipulation, handouts, and worksheets also creates an environment where the student must participate and engage. In the past, students could act as "free riders" and not be held accountable for participative work during face-to-face lessons.

Student participation in simulations within the classroom makes the topic real. It also forces the student to engage the technology in an environment where the instructor can reinforce the skills required to be successful while using the technology. An example of this activity is a step-by-step proof where the student follows (on their mobile device) the same steps as the instructor. Both student and instructor work through a data creation process revealing the economic concept being taught (Shepherd, et. al., 2013.) Thus, the use of technology provides immediate feedback to both student and teacher in the classroom, ensuring classroom participation. Once the student is outside the classroom, these same technology tools

can be used remotely to reinforce their personal learning experience. Refer to Shepherd, et. al. (2013), regarding immediate Excel feedback to students on class activities.

FIGURE 2
ACTIVITY CHANGE BY DEVICE

% Change Start to Finish of Semester						
Blackboard Activities	Computer	iPad	iPhone	iPod Touch	Unknown	Other
Announcement	-5.72%	-1.19%	5.76%	0.67%	0.01%	0.46%
Assignments	0.38%	-3.19%	2.49%	-0.15%		0.46%
Blogs	32.08%	1.03%	1.96%	0.24%	-35.30%	0.00%
Calendar	-19.44%	-4.38%	21.77%	1.58%	0.47%	
Cases	-100.00%					
Collaboration	9.39%	-0.90%	-7.36%	-3.45%	2.33%	
Contacts	-3.37%	-0.51%	2.33%	0.64%		0.91%
Content	-3.42%	-0.96%	3.68%	0.32%	0.45%	-0.06%
Discussion Board	2.03%	-2.10%	0.21%	0.19%		-0.34%
Email	-0.13%	0.10%	0.20%	-0.45%		0.27%
Essay	-100.00%					
Evaluation	-100.00%					
Excel	-3.63%	1.21%	2.42%			
Forum	1.24%	-2.04%	0.45%	0.18%		0.18%
Grades	-13.21%	0.29%	10.79%	1.26%	0.00%	0.87%
Groups	-15.27%	0.89%	11.27%	2.35%		0.76%
Help	-100.00%					
Homework	4.61%	-8.70%	4.08%			
Information	0.72%	-0.33%	0.50%	-0.67%		-0.23%
Journals	-2.01%	1.96%	-0.15%	0.13%		0.06%
Links	-4.02%	-2.27%	4.13%	1.08%		1.08%
Notifications	18.92%	-3.45%	-12.37%	-3.10%		
PDf	6.31%	-3.03%	-2.96%	0.15%		-0.48%
PowerPoint	3.91%	-0.26%	-1.97%	0.52%		-2.20%
Project	-100.00%					
Quizzes	-3.33%	1.83%	1.65%	-0.24%		0.10%
Roster	2.68%	-0.24%	-3.19%	0.06%		0.69%
Schedule	-100.00%					
Search	-53.85%	53.85%				
Syllabus	-0.67%	-2.69%	4.14%	-0.63%		-0.15%
Tasks	-9.14%	7.30%	0.44%			1.41%
Tests	-3.35%	2.26%	0.87%	0.32%		-0.10%
Tools	-10.75%	-0.95%	9.80%	0.91%	0.00%	0.99%
video	0.63%	-1.26%	0.63%			
Word Document	-1.63%	0.61%	0.51%	-0.04%		0.55%

Experiencing technology in the classroom can be daunting for both the instructor and student. The instructor is wary of technology failure, while the student is wary of using tools which are not familiar or require the development of skills outside his or her normal comfort zone. With proper preparation and backup the instructor can easily overcome these fears. The more constant the use within the classroom, the more constant the use will be outside the classroom. Refer to Figure 1 for the Micro Macro experience example. Familiarity of use breeds a sense of ease with the student and instructor. We can actually say “practice makes perfect!” Accountability in the classroom can be achieved by making in-class-activities gradeable. Students who do not participate fail to get the required in-class grades for these activities.

MLEARNING DELIVERY

To teach on the cutting edge of technology the instructor must rely on new learning tools provided by typical Learning Management Systems (LMS) companies and publishers to ensure they are providing the best outcomes and learning alternatives for the student. From experience, instructors do not have to re-invent the wheel. There are content and delivery providers out there that support the use of all these new technologies.

MLearning relies on two technology variants: the delivery system and the tools (applications) to perform certain tasks. We define the delivery system that contains the learning environment as a Learning Management System (LMS). Examples of an LMS are: Blackboard, Moodle, Open Class, and Course Sites. This list is not exhaustive. These systems vary from institutionally maintained systems, where each school maintains its own system, to web based systems that reside on servers outside the school and are maintained by an LMS provider. An example of this is Blackboard that can be maintained by your own school, as compared to Course Sites (Blackboard) that is web based and maintained by Blackboard and individual users on the web.

This paper will not focus on any LMS specifically. Suffice it to say that an LMS is important to allow centralized entry and content containment for learning processes. Traditionally, the LMS was used to store documents, make announcements, email class groups, hold grades, and upload and download files. It is important to note that publishers now integrate closely with each major LMS. Historically, LMS and publishers required dual storage of information (as publishers acted like an LMS system). Closer integration now allows the instructor to have one entry point (the LMS) that integrates with all the publisher functionality, e.g., Course Sites and McGraw Hill Connect.

Publisher sites now provide eText access, testing, review, video reinforcement, group work areas, etc. With seamless integration, these new tools dramatically reduce instructor workload and enhance the instructor's ability to ensure the student has alternative methods of learning in the mLearning environment.

Table 1 sets out mLearning technology and methodology examples used by the authors that have helped students expand their mLearning experiences. Grey bars indicate the beginning, use and cessation of tried, tested, and sometimes discarded methodologies in and outside of the classroom. The purpose of the table is to display the expansion of activity types to meet the needs of the mLearning classroom. As instructors we should adopt new methods, try them out, and then expand or discard them as desired to ensure a rich mLearning experience. The instructor should always remember that student feedback is important to gauge the effect of the mLearning activity. Methods thought to be cumbersome to the instructor may be extremely beneficial to the student. For example, Responseware comments from students indicated that this type of questioning was extremely beneficial to them while frustrating to the instructors, as they had to wait for student responses.

Readers should note that innovations of technology-enabled and gradable learning tools have pushed additional personal responsibility onto the student. For example, the authors use flashcard reinforcements for each chapter, requiring all students to complete flashcards successfully before being awarded full participation points for the chapter. Students who persist in completing this activity always earn full grade points for the exercise. If there is a class meeting, these flashcard activities must be completed prior to class. This ensures participation at a level where, at a minimum, the student has read the chapter and practiced questions to a point of competency.

As instructors, we should always strive to use a full range of technology tools to achieve the learning goals for each class module. At a minimum, each class should attempt to use available iPhones and/or laptops to complete activities and assignments. The advent of the iPad and iPad mini has given instructors a new technology with which to challenge the students to rethink their learning choices both inside and outside the traditional classroom. The average Macroeconomics or Microeconomics class in our study has two outside of class preparatory gradable activities and at least three in-class gradable activities for each chapter.

TABLE 1
INNOVATIONS IN TEACHING BY SEMESTER

Innovations in Teaching by Semester																	
		2009			2010			2011			2012				2013		
Class	Type of Innovation	Spring	Summer	Fall	Spring	Summer	Fall	Spring	Summer	Fall	Spring	Summer	Fall	Winter	Spring	Summer	Fall
Macroeconomics	Apple TV in the Classroom												X		X		X
Macroeconomics	Automated Random Block Questions							X	X	X	X		X	X	X	X	X
Macroeconomics	Automated Random Block Tests	X		X	X		X	X	X	X	X		X	X	X	X	X
Macroeconomics	Baumol and Blinder Textbook	X		X	X		X	X	X	X	X						
Macroeconomics	Discussion Boards										X		X	X	X	X	X
Macroeconomics	eTextbook												X	X	X	X	X
Macroeconomics	Flashcards													X	X	X	X
Macroeconomics	iPad														X	X	X
Macroeconomics	Iterative In Class Gradeable Technology Activities - Required													X	X		X
Macroeconomics	Iterative Out of Class Excel Homeworks	X		X	X		X	X		X	X		X		X		X
Macroeconomics	Laptop	X		X	X		X	X		X	X		X	X	X	X	X
Macroeconomics	Rwpoll - Class Polling software												X	X	X	X	X
Macroeconomics	Online Office Hours										X	X	X	X	X	X	X
Macroeconomics	Schiller Textbook													X	X	X	X
Macroeconomics	Variable Number Quizzes													X	X	X	X
Microeconomics	Apple TV in the Classroom												X		X		X
Microeconomics	Automated Random Block Questions	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X
Microeconomics	Automated Random Block Tests	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X
Microeconomics	Baumol and Blinder Textbook	X	X	X	X	X						X					
Microeconomics	Discussion Boards						X	X		X	X		X		X	X	X
Microeconomics	eTextbook						X	X		X	X		X	X	X	X	X
Microeconomics	Flashcards													X	X	X	X
Microeconomics	iPad						X	X		X	X		X		X	X	X
Microeconomics	Iterative In Class Gradeable Technology Activities - Required														X	X	X
Microeconomics	Iterative Out of Class Excel Homeworks	X		X	X		X	X		X	X		X		X		X
Microeconomics	Laptop	X		X	X		X	X		X		X	X	X	X	X	X
Microeconomics	Rwpoll - Class Polling software												X		X		X
Microeconomics	Online Office Hours										X	X	X	X	X	X	X
Microeconomics	Schiller Textbook						X	X		X	X		X	X	X	X	X
Microeconomics	Variable Number Quizzes													X	X	X	X

Note: The grey bars indicate the beginning, availability for use, and cessation of tried, tested, and sometimes discarded methodologies in the classroom.

Because of our personal educational experiences, we recognized the need to apply theory immediately to a situation with which we could relate. By direct application to relevant situations, we recognized the value of the theory being taught, and reinforced the concept in our own minds. When an instructor used immediate practical applications to a theory, we – as the students – learned the concept being taught much better and faster. This self-knowledge has influenced us to develop simulations and games that can be used to create data that can be analyzed and discussed in class. The activity creates a hook for the student to grasp the source of information and the data analysis shows the student how the data builds and how the data can change using the technology tools available.

We believe the responsibility to learn does not lie solely with the student. The educator and the student must collaborate in the mLearning experience as a team. Teaching is not just the transmission of information; it is a means by which the teacher can help each and every student discover his or her potential. The design of multiple methods of learning ensures that we enable the learning styles of each student.

A MOBILE CLASSROOM TEACHING PHILOSOPHY

The author's philosophy of teaching has evolved over the past eleven years to include several key aspects:

We encourage students to do their best to:

a. Learn new and sometimes difficult subjects that draw on both concepts covered in the learning environment and upon real world events and data.
b. Think critically about economic situations, question each and every economic statement, and analyze these statements for economic truth based on learned economic modeling behaviors.

c. Plan, schedule, and meet deadlines through a comprehensive effort and a reward-based system that tracks students' timely responses to many small timed requirements throughout my classes.
d. Push their skills to the limit using technology both inside and outside the classroom through hands-on training (one-on-one if needed) and systematized feedback that allows the student to make mistakes, correct them, learn, and move on to other difficult tasks.
e. Take responsibility for their learning outcomes by enabling students to control their own grade outcomes through retesting and/or iteration to improve grade outcomes.
f. Expand their user choices from the laptop to a full range of mobile tools that allow them to take advantage of new mLearning moments.

A MOBILE CLASSROOM TEACHING METHODOLOGY

In encouraging students to do their best to learn, we attempt to make classes challenging, yet reasonable in terms of work load and conceptual difficulty. Through research and experience we have modified the requirements of all our courses. Each class period requires preparation to ensure that the student is ready to engage the topic at hand. We expect the students to: read, reflect, reinforce, and re-examine to ensure that the course content is understood.

Read

We use an e-text in both Macroeconomics and Microeconomics that is supported by supplemental publisher tools to allow the student access to the class topic. These e-texts are available on any device from any location with wireless or 4G access to the web. The e-text reading covers the topic at hand but is also linked to reinforcing information that helps broaden the student's knowledge of the topic.

Reflect

To ensure preparation through reading, each chapter has an associated assignment using flashcards that require the student to determine their own level of understanding. These flashcards ask the student first what they think their level of understanding is on the question at hand: "Guessing" through "I am sure" of the answer. This questioning over topics gauges the student's level of comfort with the topic. If the answers are incorrect or if the student is guessing, the same or a slightly different question will be recycled through the assignment to gauge later if the student has sufficiently understood the topic.

These flashcard assignments are scheduled for 10 to 15 minutes of review, but can take longer based on the level of correctness demonstrated by the student. These flashcards are extremely flexible in their use, allowing us to set both times and or topics to be covered.

Reinforce

In-class or out-of-class activities can be given to reinforce the concept in the students' minds. These assignments typically involve generating numbers through an activity that builds the data to be examined. We use excel in the classroom to model these examples. A simple example is: The class is broken into 10 groups and each group is given a paper template that can be made into either a car or a house. The group then hand tears the house or car out of each template. At the end of each three minute production period, we count the number of houses and cars each team produces. We then enter each team's production, creating a production possibilities curve for each team and ultimately for our class world.

A second round of production is set up, but this time we add scissors to hasten the production process for the three minute round. Again, the students count the number of cars and houses that were produced. We enter the data for the second round, gauging how we might expect the data to change and talking about what changes occurred. The introduction of this new technology (scissors) expanded our productivity and allowed us to produce more of each output. Rather than a statement of a concept (which may or may not be understood by the student) each student now has a basis for understanding that concept

and its implications through a hands-on experience. This personal experience on the part of the student ensures a basis for success.

At the completion of each activity, the students submit their Excel templates for grading. Each assignment (three for each class) is worth twenty points for a total of sixty points for class participation (if the student gets all the work correct in the assignment).

Reexamine

The use of Blackboard and McGraw Hill Connect as tools to administer and grade tests allows me to give students the ability to control the speed of their mLearning and the possibility of redoing work for credit when performance was poor. This flexibility, coupled with the use of our Chexel.com grader for Excel spreadsheets, allowed the students to attempt and to correct Excel spreadsheets that developed both economic concepts and technology/business skills (Shepherd, et. al., 2013). After the class, the students can complete online quizzes covering the topics covered during activities throughout the mLearning process.

eText and Content Support

The authors are currently using McGraw Hill Connect for both classes. We use "The Micro Economy Today" (Schiller 2013) and "The Macro Economy Today" (Schiller 2013) as our texts for these classes. Using these online texts, students have access to their text in real time twenty four hours a day from any location and any device.

LMS - Blackboard

Blackboard's Course Sites is a learning management system (LMS) that allows faculty to add resources for students to access online to PowerPoint, video, audio, animation, and other applications that are created outside of Blackboard and added into Blackboard. Links from Blackboard to McGraw Hill Connect automatically redirect students from the central class LMS to external activities. McGraw Hill Connect then automatically updates grades in the LMS when students complete tasks. This minimizes the workload of the instructor when it comes to grade updates.

In-Class Activities

In addition to regular class lectures, we typically have five types of in-class activities:

1. *PowerPoint or Keynote presentation of lecture slides.*

Both macroeconomics and microeconomics classes involve a multitude of data presentations. These presentations can be from the class being presented, or they can be supportive presentations that offer additional understanding for student review.

2. *In-Class Activity Excel Data Analysis.*

In class the students download a spreadsheet template for the class activity from Chexel.com. A typical class has three activities that are interspersed throughout the class, requiring either "follow me" or "do it yourself" activities.

3. *Responseware*

Students were asked to download Responseware and to create accounts required for participation in-class activities. Primary uses in our classes were taking roll and participative feedback on mathematic or economic questions. Certain presentations had real-time assignments included that required the students to answer questions. As instructors, we could wait for answers during the presentation while the students decided on their response, and then present the distribution of answers from the class for discussion. Percentages for each response were shown and then we would discuss what differences might have caused the answers to vary. Before moving on to the next screen, the students would be informed of the correct answer.

If there were a significant number of problems in understanding the concept, I received immediate feedback allowing me to re-cover the concept immediately before moving on. An additional benefit of using Responseware was my ability to force “free riders” into action. A major problem with large classes is student engagement. Responseware helped me engage every student during every class. Students are informed that they must log into their Responseware account and be prepared to answer any questions that I might have for them. These questions range from “Are you here today?” to “What do you think the right answer is for this question?” Non-response to questions indicates that you are “not here mentally” and therefore has an impact on the participation grade.

Responseware data is downloaded daily to Excel to generate reports by user and by question so that it is easy to see who is not participating in the class activity. Vindictive users might impact the class through blatant wrong answers to group polling, but as the instructor it was up to me to gauge when it was appropriate to move on to another topic rather than hold up the rest of the class.

4. Discussion-board Blog Activities.

Classes also used discussion activity on the Blackboard system. Authors used the system to assign a random group number to each student who would then receive an email containing their group leader and the discussion paper, question, and supporting documents.

With this prior notice, the students were well prepared for their in-class group work the next day. With notification each student knew his or her group, the task and the required output. During class, students were issued additional props (such as cups or materials for operations activities) and sent to locations of their choice to collaborate, complete the application, and report back their findings. These activities required that all students complete spreadsheet templates with their data findings. A videographer was assigned to each group who would video the activity using his or her iPhone or iPad and submit the video along with the group solution for grading. Completion of the group task required spreadsheet submissions by all students, group video submission, and a blog analysis of the situation.

The iPad has essentially freed the student from the classroom with a manageable device that is connected, mobile, and functional, allowing true collaboration with real student learning.

5. Tests and Quizzes

The textbook provides a bank of questions which can be used in quizzes or major tests. These particular quizzes were designed to have each student given a variable number question so that each student had different answers to the same question. Quizzes became more mathematical in nature, rather than typical multiple choice. For major tests I used traditional multiple choice or true / false questions to speed up feedback to the students. Tests and quizzes can have the following criteria:

a. Random Block Test – the questions can be pulled randomly for each student with each student getting different test questions.
b. Single or Multiple Attempt – I could chose if the students could have more than one attempt at the quiz or test.
c. Forced or Delayed Completion – I could allow the student to open the test, save it and when finished, submit the test, or I could force completion of the test once opened.
d. Set Timer – I could allow unlimited time or set an elapsed time for the test.
e. Feedback – There are many levels of feedback available to the student. Initially, score and submitted answers were given at the completion of the test.
f. Questions Presented One at a Time or Show All Questions – the students could see only one question at a time or they could see all the questions on the quiz.
g. Prohibit Backtracking – the student could not return to already completed questions.
h. Randomized Questions – answers within the question can be randomized.

Innovative Teaching Characteristics found in mLearning

Among the innovative characteristics of this mobile methodology are:

1. *Iteration*

Depending on the semester and content being covered, I offer the students the opportunity to iterate their Excel work assignments, Flashcards, or even quizzes prior to deadlines to improve their grades. Each Excel assignment is graded iteratively and individual feedback is given to each student. This type of teaching was previously impossible due to grading burdens for large class sections. The use and mastery of my teaching tool and the development of a new philosophy in teaching have improved student grades, increased technological knowledge, and improved economic knowledge. Over 7,800 (52 assignments x 3 classes x 50 students) Excel assignments were graded iteratively providing individual feedback to students during the spring semester of 2013. This capability allows me to make every activity a gradable activity forcing classroom participation at levels previously not possible because of grading burdens. Up to sixty activity points were dependent on class activities; consequently, I noticed a reduction of in-class absences during this last semester. Students did not want to miss the activities. These in-class activities assisted in two ways: first, activity points were kept up to date; and second, the activities assisted the students with the more difficult mathematics of real-world numbers and calculations found in the McGraw Hill Connect Quiz system.

2. *Preparation*

Preparations for my class always begin early. I feel that it is important to be in the classroom and ready to begin exactly on time. Prior to class I ensure that students are kept up to date on schedules by cycling slides with course announcements, to-do lists to get ready for class, and schedules for future requirements. This reminder encourages the students to focus on what the class will cover, what documents or tools they will need to successfully complete a particular class, and what deadlines loom for assignments. Students arriving in the room can read the slides and be prepared to begin immediately at the beginning of class. These cycling announcements were also reinforced remotely by announcements in Blackboard, helping the students to prepare for class and teaching good business skills in preparation for the real workplace.

3. *Teaching*

Class time is precious. My intent is to keep face-to-face class time purely for lecture, application, or questions. My course designs have changed to use eTexts, RWPoll polling for attendance and content feedback, online testing, and online homework management, thus freeing class time for pure student interaction on the required topic. This change has allowed me to focus on giving classes a full one hour and twenty minutes of pure teaching.

a. Macroeconomics

I view my role in Macroeconomics, a sophomore-level class for non-business and business majors, as a “tool builder for all general education courses.” The class engages in group discussions and frequent application exercises. I employ a lecture format in this class, interspersed with practical applications to expand on the personal application of economics in the students’ lives. The students are expected to understand the course content by pre-reading the text in preparation for class, by reviewing online course modules that expand on these readings, by taking the online flashcard exercises, and by beginning and reading the chapter quiz prior to class.

After the class members have completed a textbook reading and flashcards for the module, I cover the topic with a short lecture; and then we work examples of applications of the topic in-class. These are in-class activities that are usually Microsoft Excel-based and cover concepts and mathematical requirements that assist the student in both quizzes and testing questions. Class work is supported by extensive online module backup information which allows a student to review the class lecture, review specific topics, and recreate in-class activities from any location or time through the web.

b. Microeconomics

I view my role in Microeconomics, a sophomore-level class for non-business and business majors, as a "tool builder for business and accounting courses." As in Macroeconomics, the class engages in group discussions and frequent application exercises.

I employ a lecture format in this class, interspersed with practical applications to expand on the personal application of economics in the students' lives. The students are again expected to read and understand the course content through pre-reading the text in preparation for class and reviewing online course modules that expand on these readings.

After the students have completed a textbook reading and some simple flashcard exercises on a particular concept, I cover the topic with a short lecture, and then we work accounting examples of applications of the topic in-class. Once again, class work is supported by extensive online module backup which allows a student to review the class lecture, review specific topics, and, if needed, recreate activities studied in-class. Extensive use of Microsoft Excel allows the class to focus on developing costing examples required to understand the economics of small business.

4. Technology Infusion

First, the primary intent of these courses is economic content mastery, but the second intent is the development of technological skills that improve the student's ability to conduct business electronically. These classes require the ability to use the web for class activities, to download and upload files for class applications and grading, to interact through online chat and discussion boards, and to collaborate through the web on economic discussions using iPhones, iPads, and laptops.

Students who successfully complete this course find themselves better suited to work with and handle the technologies found in the business environment. Comments from past students have indicated what a great help the requirements of both Macroeconomics and Microeconomics courses were to success in their business careers. These students have indicated that their ability to complete Excel spreadsheets, upload and download files with ease, and use the web for research and remote communication is a direct result of my classes.

5. Microsoft Excel

I have designed the Excel assignments in these classes to fulfill two requirements:

a. To develop the Excel skills to ensure the student's ability to:
   I. Create formulas that allow the student to calculate answers by means of self- developed formulas and / or Excel formula functions.
   II. Format data that enables the student to quickly interpret and visualize solutions.
   III. Graph data that is complex, moving interpretation from table-based analysis to visual trend analysis.
b. To develop economic interpretive skills by:
   I. Interpreting data presented in table form.
   II. Interpreting graphs based on table data.
   III. Manipulating interpretive graphs in order to understand data interactions.

6. Assignment Methodology

Over the past nine years I have refined assignment methods to speed distribution of assignments, to minimize the chances of academic integrity problems, and to allow iterative feedback to the students. This process is unique to ACU and was designed in collaboration with Dr. Brent Reeves. The software and website developments are proprietary to a company owned principally by Dr. Brent Reeves, Dr. Charles Small, and me. (Refer to last journal article here)

The current system has been in use for nine years. It is now a web-based system (replacing the old laptop-based system) that grades Excel-based assignments and responds to individual deficiencies within those assignments. This methodology was detailed in the *Journal of Applied Business and Economics*

paper, “Grading Technology Allows Teachers to Infuse Technology in the Economics Classroom” (Shepherd, Reeves, and Jinkerson 2013).

7. Teacher Availability

With mLearning the student is often not in a situation where one-on-one teaching or mentoring can take place. This requires new and innovative methods to ensure the student has access to faculty mentoring.

a. Email: The use of email to handle problems or questions is the most preferred method to answer questions. Students find it easy to fire off an email regarding a problem rather than schedule an appointment for a meeting.
b. Online: The use of Online Office hours is another way to handle student problems. These hours can be scheduled or arranged by request so that the instructor can have a face-to-face meeting where you can observe problems, share screens, and show the student solutions to their questions. These online hours can be through any group or meeting system.

Student Data Profiles

During the school year we collected every Blackboard transaction for every student at our university. Using data analysis tools and examining over forty million records we were able to examine the typical user patterns of students. Data points are based on time records. If a student used Blackboard during any hour of the day or week, that use counted as an academic appearance in Blackboard. Multiple appearances during the hour by the same user counted once as an appearance (not multiple appearances). Using this methodology we can use the data points to show user patterns by hour of day, day of week, and month. This data was then divided into two types of users: Non-Economic class students and Economic class students.

During the fall semester, Economic Students represented 3.8% of the student body in number but generated on average 8% of all educational Blackboard transactions. It should be noted that Blackboard transactions were only a small part of our class and its activities. The tracking of Excel and Responseware use in the class was not done and is not reflected in the activity numbers reported. Refer to Table 2 “Student Blackboard Appearance Hours per Month,” to show the comparison between the mLearning intensive students and other students. “Percent” in Table 2 represents the percent of transactions compared to all other students.

TABLE 2
STUDENT BLACKBOARD APPEARANCE HOURS PER MONTH

Student Appearance Hours Per Month					
Months	*All Other Students*	*Transactions as a Percent of All Other Students*	*Micro Macro Students*	*Transactions as a Percent of Micro Macro Students*	*Total Student Transactions*
August	367,830	9.7%	40,628	13.8%	408,458
September	1,053,665	27.7%	79,988	27.2%	1,133,653
October	939,267	24.7%	53,989	18.4%	993,256
November	769,830	20.2%	65,119	22.1%	834,949
December	672,820	17.7%	54,426	18.5%	727,246
Total	***3,803,412***	***100%***	***294,150***	***100%***	***4,097,563***
Average	***760,682***		***58,830***		***819,513***
Students	***3,850***		***150***		***4,000***
Per Student Total	***988***		***1,961***		***1,024***

A final comparison of student groups was made using heat maps. This heat map comparison compares how intensely students use the Blackboard system to complete their classwork. (Again, other activities in Excel were not included in this data.) The data tracks appearances by student by hour of day and day of week. The author's class periods during this semester were Tuesday, Thursday at 8:00 a.m. and 9:30 a.m. for Macroeconomics and 1:30 p.m. Tuesday, Thursday for Microeconomics. Figure 3 "Student Blackboard User Profiles Appearances by Hour and Day of Week," shows intensity of use. White to light grey shows less activity while dark grey to black shows more activity. The blended greys show the growing intensity of use the closer to black the cell becomes. Note the intense user patterns during regular class times, showing that the authors forced use of the system during these normal class hours, then compare the intensity of use outside those normal class hours. Students in the Economics classes used their Blackboard class tools more intensely outside of normal class hours when compared to non –economic students.

FIGURE 3
STUDENT BLACKBOARD USER PROFILES APPEARANCES
BY HOUR AND DAY OF WEEK

Microeconomics and Macroeconomics Student User Profile

Hour of Day	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
12:00 AM	0	0	0	0	0	0	0
1:00 AM	0	0	0	0	0	0	0
2:00 AM	0	0	0	0	0	0	0
3:00 AM	0	0	0	0	0	0	0
4:00 AM	0	0	0	0	0	0	0
5:00 AM	0	0	0	0	0	0	0
6:00 AM	0	0	0	0	0	0	0
7:00 AM	0	0	0	0	0	0	0
8:00 AM	0	0	0	0	0	0	0
9:00 AM	0	0	0	0	0	0	0
10:00 AM	0	0	0	0	0	0	0
11:00 AM	0	0	0	0	0	0	0
12:00 PM	0	0	0	0	0	0	0
1:00 PM	0	0	0	0	0	0	0
2:00 PM	0	0	0	0	0	0	0
3:00 PM	0	0	0	0	0	0	0
4:00 PM	0	0	0	0	0	0	0
5:00 PM	0	0	0	0	0	0	0
6:00 PM	0	0	0	0	0	0	0
7:00 PM	0	0	0	0	0	0	0
8:00 PM	0	0	0	0	0	0	0
9:00 PM	0	0	0	0	0	0	0
10:00 PM	0	0	0	0	0	0	0
11:00 PM	0	0	0	0	0	0	0

Non - Microeconomics and Non - Macroeconomics Student User Profile

Hour of Day	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
12:00 AM	0	0	0	0	0	0	0
1:00 AM	0	0	0	0	0	0	0
2:00 AM	0	0	0	0	0	0	0
3:00 AM	0	0	0	0	0	0	0
4:00 AM	0	0	0	0	0	0	0
5:00 AM	0	0	0	0	0	0	0
6:00 AM	0	0	0	0	0	0	0
7:00 AM	0	0	0	0	0	0	0
8:00 AM	0	0	0	0	0	0	0
9:00 AM	0	0	0	0	0	0	0
10:00 AM	0	0	0	0	0	0	0
11:00 AM	0	0	0	0	0	0	0
12:00 PM	0	0	0	0	0	0	0
1:00 PM	0	0	0	0	0	0	0
2:00 PM	0	0	0	0	0	0	0
3:00 PM	0	0	0	0	0	0	0
4:00 PM	0	0	0	0	0	0	0
5:00 PM	0	0	0	0	0	0	0
6:00 PM	0	0	0	0	0	0	0
7:00 PM	0	0	0	0	0	0	0
8:00 PM	0	0	0	0	0	0	0
9:00 PM	0	0	0	0	0	0	0
10:00 PM	0	0	0	0	0	0	0
11:00 PM	0	0	0	0	0	0	0

These patterns inform us that the tools used in class are being used outside of class in preparation for learning the next day. Practice makes perfect, and practice is occurring outside of class as desired by the authors.

Data was also collected for those students using the Chexel Excel grader for the semester. Table 3 – Student Appearance Hours in Chexel per Month sets out a comparison of student use by month. Our Micro / Macro class processed three times the grading transactions as all other students using the grading system. Three in class activities for eighteen chapters (plus two introductory assignments) were graded using the system. If the student did not get a perfect score the student could rework and resubmit the assignment for the full twenty point grade.

The intent of the in class activities is to force the student to engage and use the Excel system to generate both competency and economic understanding. Figure 4 – Student Chexel User Profiles Appearances by Hour and Day of Week shows the preferred hours of use for the average student. Note the intense use (darker grey areas) during the Tuesday and Thursday classes (though not exactly during class time.) The intent of the assignments is to engage, instruct, and reinforce economic concepts. Allowing the students to rework assignments at their leisure lets the students complete the assignments at times of their choosing. It is always informative to see real data patterns. Note the strange hours that students turn in work.

TABLE 3
STUDENT APPEARANCE HOURS IN CHEXEL PER MONTH

Months	*All Other Students*	*Transactions as a % of All Other Students*	*Micro Macro Students*	*Transactions as a % of Micro Macro Students*	*Total Student Transactions*
August	207	6%	648	6%	855
September	1,227	37%	3,342	30%	4,569
October	1,117	33%	3,660	32%	4,777
November	546	16%	2,805	25%	3,351
December	257	8%	852	8%	1,109
Total	***3,354***	***100%***	***11,307***	***100%***	***14,661***
Average	***671***		***2,261***		***2,932***
Students	***133***		***150***		***283***
Per Student Total	***25***		***75***		***52***

FIGURE 4
STUDENT CHEXEL USER PROFILES APPEARANCES BY HOUR AND DAY OF WEEK

Microeconomic and Macroeconomic Student User Profile - Chexel

Hour of Day	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
12:00 AM	0	0	0	0	0	0	
1:00 AM	0	0	0	0	0	0	
2:00 AM		0	0	0	0	0	0
3:00 AM	0	0	0	0	0	0	
4:00 AM		0	0	0	0	0	0
5:00 AM			0	0	0	0	
6:00 AM				0		0	
7:00 AM							
8:00 AM							
9:00 AM					0		
10:00 AM					0		
11:00 AM		0		0			
12:00 PM			0		0		
1:00 PM		0	0	0		0	
2:00 PM		0	0	0	0		
3:00 PM		0	0	0	0	0	0
4:00 PM		0	0	0	0	0	0
5:00 PM		0	0	0	0	0	0
6:00 PM	0	0	0	0	0	0	
7:00 PM	0	0	0	0	0	0	0
8:00 PM		0	0	0	0	0	0
9:00 PM	0	0	0	0	0		
10:00 PM	0	0	0	0	0	0	0
11:00 PM	0		0	0	0	0	

Non-Microeconomic and Macroeconomic Student User Profile - Chexel

Hour of Day	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
12:00 AM		0	0	0	0	0	0
1:00 AM	0	0	0	0	0	0	
2:00 AM	0	0	0	0	0	0	0
3:00 AM	0	0	0	0	0	0	0
4:00 AM		0	0	0	0	0	
5:00 AM		0	0	0			
6:00 AM			0	0			0
7:00 AM				0			0
8:00 AM							0
9:00 AM							
10:00 AM							
11:00 AM							0
12:00 PM		0					0
1:00 PM		0	0	0		0	
2:00 PM			0	0	0	0	
3:00 PM		0	0	0	0	0	
4:00 PM	0	0	0	0	0	0	0
5:00 PM	0	0	0	0	0	0	0
6:00 PM	0	0	0		0	0	0
7:00 PM	0	0	0	0	0	0	0
8:00 PM	0	0	0	0	0	0	0
9:00 PM	0	0	0	0	0	0	0
10:00 PM	0	0	0	0	0	0	0
11:00 PM	0	0	0	0	0	0	0

Student Responses to the mLearning Environment

Prior to completing the class we asked the students to reflect on their performance and experiences with regard to the levels of technology involved in this mLearning class. With regard to the use of laptops in the classroom we asked the student to determine their level of competency at the end of the semester compared to the beginning of the semester. Thirty one percent said that their skills improved to the point of being above average or advanced with regard to laptop usage. Refer to Table 4 for Laptop Computer Skills Improvement.

Within the classroom the student had to work 52 different individually gradeable Excel assignments for grades. These assignments required the use of the laptop to: create accounts, download templates, upload completed assignments, gather feedback on errors, correct errors, and resubmit assignments until the assignment is perfect. The 140 students responding (ten did not participate) to our questionnaire

represents 7,800 gradeable assignments throughout the semester. Each assignment could be iterated as many times as needed to complete the assignment successfully.

TABLE 4
LAPTOP COMPUTER SKILLS IMPROVEMENT

#	Question	Responses						
1	Prior to this class how would you rate your laptop computer skills? On a 1 to 5 scale from no skills = 1 to Advanced skills = 5. How would you rate yourself?	No Skills	Below Average Skills	Average Skills	Above Average Skills	Advanced Skills	Unanswered	Total
		1%	4%	46%	34%	15%	1%	100%
2	Now that this class is over how would you rate your laptop computer skills? On a 1 to 5 scale from no skills = 1 to Advanced = 5 how would you rate yourself?	No Skills	Below Average Skills	Average Skills	Above Average Skills	Advanced Skills	Unanswered	Total
		0%	1%	16%	59%	24%	0%	100%
2a Improvement	Now that this class is over how would you rate your laptop computer skills? On a 1 to 5 scale from no skills = 1 to Advanced = 5 how would you rate yourself?	No Skills	Below Average Skills	Average Skills	Above Average Skills	Advanced Skills	Unanswered	Total
		-1%	-3%	-28%	24%	9%	-1%	0%

With a major portion of data development being completed in Excel (a laptop based product) it was to be expected that students' perceptions with regard to improved skills on their mobile devices were not as dramatic. There was a 12% improvement in either above average or advanced skills when using mobile devices such as iPads and iPhones. Refer to Table 5 for Mobile Device Skills Improvements.

TABLE 5
MOBILE DEVICE SKILLS IMPROVEMENT

#	Question	Responses						
3	Prior to this class how would you rate your mobile device skills? On a 1 to 5 scale from no skills = 1 to Advanced skills = 5. How would you rate yourself?	No Skills	Below Average Skills	Average Skills	Above Average Skills	Advanced Skills	Unanswered	Total
		0%	3%	26%	51%	19%	1%	100%
4	Now that this class is over, how would you rate your mobile device skills? On a 1 to 5 scale from no skills = 1 to Advanced skills = 5 how would you rate yourself?	No Skills	Below Average Skills	Average Skills	Above Average Skills	Advanced Skills	Unanswered	Total
		0%	1%	15%	55%	29%	0%	100%
4a Improvement	Now that this class is over, how would you rate your mobile device skills? On a 1 to 5 scale from no skills = 1 to Advanced skills = 5 how would you rate yourself?	No Skills	Below Average Skills	Average Skills	Above Average Skills	Advanced Skills	Unanswered	Total
		0%	-1%	-10%	3%	9%	-1%	0%

The mobile classroom must be ready to take all levels of experience. Thirty nine percent of users had not used technology at a level comparable to these classes prior to taking Micro or Macroeconomics. Refer to table 6 for Previous Technology Experience.

TABLE 6
PREVIOUS TECHNOLOGY EXPERIENCE

#	Question	Responses						
5	Prior to or during this class, in how many other classes have you experienced (other than Dr. Shepherds classes - Macro or Micro – past or present) the use of technology on a level found in this class?	0	1	2	3	4 or more	Unanswered	Total
		39%	27%	21%	6%	6%	0%	100%

With the use of technology comes distraction. The students have not only their own technology to deal with, but also each surrounding student's technology. In some cases students complain that while they were focused on task, others around them were not, and that these distractions were problematic for them as individuals. Table 7 sets out Classroom Technology Distraction by Row. The classroom used was a tiered class with 5 levels of seating. The front row would only be distracted by students on either side, while back row students would have a view of all rows, left, right, and forward. It is interesting to note that about one in two considered themselves distracted by others but when asked if they thought others were distracted by them it they were less inclined to agree.

TABLE 7
CLASSROOM TECHNOLOGY DISTRACTION BY ROW

#	Question	Responses						
6	What row in the classroom did you usually sit on?	Front row 1	Second row 2	Third or middle row 3	Fourth Row 4	Back row or 5	Unanswered	Total
		15%	19%	26%	20%	20%	0%	100%
6a - YES	Did the use of technology in this economics classroom (with Dr. Shepherd) cause you to be distracted from the class content delivery?	8%	11%	12%	8%	11%	0%	49%
6a - NO		7%	9%	14%	12%	9%	0%	51%
6b - YES	From where you sat in the classroom, and from what you could see of other students computer screens, did the use of technology in this economics classroom (with Dr. Shepherd) cause OTHERS to be distracted from the class content delivery?	6%	7%	9%	4%	11%	0%	37%
6b - NO		9%	12%	16%	16%	9%	0%	63%

Table 8 sets out eText Perceptions and Usage. The use of eTexts in the course proved somewhat difficult to difficult for 34% of the users in the class. Fifty three percent of these were first time users.

This indicates that the functionality of eTexts may require further development work to do before we completely adopt the etext as a preferred method of distribution. Thirty eight percent of the class said they would not recommend continuing to use an eText. Forty one percent of the students did use the eText functionality to read in places that were unusual due to the online nature of the text. This finding is not out of line with our other findings where students have to be trained to think about learning differently. You may carry your iPad with you for photos or music, but unless you are told and reminded that you can read the chapter while sitting in the park, you do not take advantage of that situation.

TABLE 8
ETEXT PERCEPTIONS AND USAGE

#	Question	Responses						
7	On a scale of 1 to 5 with 1 being extremely easy to 5 being difficult, how would you rate your experience with handling the reading of the etext?	Extremely Easy	Somewhat easy	Manageable	Somewhat difficult	Difficult	Unanswered	Total
		9%	26%	30%	23%	11%	1%	100%
8	On a scale of 1 to 5 with 1 being inexpensive to 5 being expensive - when compared to regular texts, how would you rate your experience with the price of the etext?	Inexpensive	Somewhat Inexpensive	Average Price	Somewhat Expensive	Expensive	Unanswered	Total
		4%	13%	41%	27%	14%	0%	100%
20	Was this your first experience with an eTextbook?	Yes	No	Unanswered	Total			
		53%	46%	1%	100%			
29	Would you recommend continuing to use an eText in this class?	Yes	No	Unanswered	Total			
		61%	38%	1%	100%			
30	Did you find yourself reading the eText in circumstances or places where you may not have normally had your paper textbook?	Yes	No	Unanswered	Total			
		41%	59%	0%	100%			

MLearning requires publisher support systems to hasten access to both eText and text support software. This often requires that students create multiple accounts in each support system. While this can be cumbersome, publishers have done a good job of making this part of the process fairly easy and painless. With our courses we simply create a small quiz with a single setup question that the student will click on for a few extra credit points. This one question quiz directs the student to the publisher site, checks to see if the student has an account, then directs the student to either log in to their existing account, or create an account. Once the account is created the publishers system drives the student through purchase of the text (or a free trial period) and then allows the student to take the one question quiz. Once this process is complete, the class is linked between the student's LMS and the publisher's system. Note that in Table 9 few of our students had trouble setting up accounts.

Flashcards and quizzes are at first daunting for the students. Flashcards review the text content in a repetitive manner with the intention that everyone gets full points if they finish the effort and correctly review the work. Quizzes are based on the level of difficulty chosen in the questions to be answered. In our case, we used random block questions using real number generators making each student calculate

different answers for the same question. Throughout the semester, the students continued to think the questions for quizzes were hard, but they did appreciate the instant feedback given when they answered the questions.

TABLE 9
MCGRAW HILL CONNECT PERCEPTIONS

#	Question	Responses						
9	On a scale of 1 to 5, how easy was the account setup at McGraw Hill? 1 is easy to 5 is hard?	Easy	Somewhat Easy	Ok	Somewhat Hard	Hard	Unanswered	Total
		51%	19%	24%	5%	1%	1%	100%
11	On a scale of 1 to 5, at the beginning of the semester did you find the flashcard reviews to be 1 easy to 5 hard?	Easy	Somewhat Easy	Ok	Somewhat Hard	Hard	Unanswered	Total
		8%	11%	31%	33%	17%	0%	100%
12	On a scale of 1 to 5, at the end of the semester did you find the flashcard reviews to be 1 easy to 5 hard?	Easy	Somewhat Easy	Ok	Somewhat Hard	Hard	Unanswered	Total
		21%	31%	30%	13%	5%	0%	100%
12a Improvement	On a scale of 1 to 5, at the end of the semester did you find the flashcard reviews to be 1 easy to 5 hard?	Easy	Somewhat Easy	Ok	Somewhat Hard	Hard	Unanswered	Total
		12%	19%	-1%	-19%	-12%	0%	0%
13	On a scale of 1 to 5, at the beginning of the semester did you find the Quizzes to be 1 easy to 5 hard?	Easy	Somewhat Easy	Ok	Somewhat Hard	Hard	Unanswered	Total
		2%	7%	20%	31%	39%	1%	100%
14	On a scale of 1 to 5, at the end of the semester did you find the Quizzes to be 1 easy to 5 hard?	Easy	Somewhat Easy	Ok	Somewhat Hard	Hard	Unanswered	Total
		4%	17%	32%	24%	23%	0%	100%
14a Improvement	On a scale of 1 to 5, at the end of the semester did you find the Quizzes to be 1 easy to 5 hard?	Easy	Somewhat Easy	Ok	Somewhat Hard	Hard	Unanswered	Total
		1%	10%	12%	-6%	-16%	-1%	0%
32	Do you think that the immediate feedback from the flashcard reviews helped you do well during the semester on quizzes and tests.	Yes	No	Unanswered	Total			
		62%	37%	1%	100%			
33	Do you think that the Quizzes helped you prepare for the real mathematics of economics?	Yes	No	Unanswered	Total			
		77%	23%	0%	100%			
34	Do you think that the immediate feedback from the Quizzes helped you do well during the tests throughout the semester?	Yes	No	Unanswered	Total			
		76%	24%	0%	100%			
35	Do you think that the immediate feedback from the Major Tests helped?	Yes	No	Unanswered	Total			
		84%	15%	1%	100%			

Table 10 sets out the student's comfort level with the Excel grader used throughout the semester. Account setup was easy for the students, and as the semester progressed they found the instant feedback to become more beneficial and easy to use. From an instructor's perspective, this grader allowed us to quickly grade, making it possible to assign more content and create more accountability during the class periods.

TABLE 10
CHEXEL EXCEL ASSIGNMENT ITERATION PERCEPTIONS

#	Question	Responses						
10	On a scale of 1 to 5, how easy was the account setup at Chexel.com? 1 is easy to 5 is hard?	Easy	Somewhat Easy	Ok	Somewhat Hard	Hard	Unanswered	Total
		64%	14%	20%	1%	1%	0%	100%
15	On a scale of 1 to 5, at the beginning of the semester did you find the feedback and iteration capability of Chexel (I can fix and resubmit items for a better grade) to be 1 easy to 5 hard?	Easy	Somewhat Easy	Ok	Somewhat Hard	Hard	Unanswered	Total
		55%	17%	21%	5%	1%	1%	100%
16	On a scale of 1 to 5, at the end of the semester did you find the feedback and iteration capability of Chexel (I can fix and resubmit items for a better grade) to be 1 easy to 5 hard?	Easy	Somewhat Easy	Ok	Somewhat Hard	Hard	Unanswered	Total
		66%	14%	16%	4%	1%	0%	100%
16a Improvement	On a scale of 1 to 5, at the end of the semester did you find the feedback and iteration capability of Chexel (I can fix and resubmit items for a better grade) to be 1 easy to 5 hard?	Easy	Somewhat Easy	Ok	Somewhat Hard	Hard	Unanswered	Total
		10%	-3%	-6%	-1%	1%	-1%	0%

Table 11 sets out student perceptions with regard to technology keeping the class interesting and causing increased usage of mobile technology in more and varied locations. Between eighty and ninety percent say that these goals were achieved. Eighty six percent of the students thought that the skills learned and used in these classes would benefit them in the future workplace.

TABLE 11
TECHNOLOGY PERCEPTIONS

#	Question	Responses						
17	Now that this class is over how would you rate your Excel computer skills? On a 1 to 5 scale from no skills = 1 to Advanced = 5 how would you rate yourself?	No Skills	Below Average Skills	Average Skills	Above Average Skills	Advanced Skills	Unanswered	Total
		1%	2%	24%	55%	19%	0%	100%
18	Now that this class is over how would you rate your comfort level with uploads and downloads? On a 1 to 5 scale from no skills = 1 to Advanced = 5 how would you rate yourself?	No Skills	Below Average Skills	Average Skills	Above Average Skills	Advanced Skills	Unanswered	Total
		0%	0%	17%	51%	32%	0%	100%
21	Did the inclusion of technology in this class cause you any concerns during the first two weeks of the semester?	Yes	No	Unanswered	Total			
		40%	59%	1%	100%			
22	At the end of the semester did you become more comfortable with the inclusion of technology in this class?	Yes	No	Unanswered	Total			
		96%	4%	0%	100%			
22a Improvement	At the end of the semester did you become more comfortable with the inclusion of technology in this class?	Yes	No	Unanswered	Total			
		56%	-56%	-1%	0%			
23	Having completed this class, do you think the technology activities in this class helped keep the class interesting and relevant?	Yes	No	Unanswered	Total			
		90%	10%	0%	100%			
24	Compared to other semesters and other classes, did this class cause you to use your electronic and mobile devices more often?	Yes	No	Unanswered	Total			
		91%	9%	0%	100%			
25	Compared to other semesters and other classes, did this class cause you to use your electronic and mobile devices in more and different places?	Yes	No	Unanswered	Total			
		80%	20%	0%	100%			
26	Compared to other semesters and other classes, did this class cause you to use MORE and Different electronic or mobile devices than in past semesters?	Yes	No	Unanswered	Total			
		62%	38%	0%	100%			
36	Is immediate and detailed feedback on assignment work important to you?	Yes	No	Unanswered	Total			
		93%	6%	1%	100%			
41	Do you think that in the future the technology skills covered in this class will benefit you in your employment?	Yes	No	Unanswered	Total			
		86%	13%	1%	100%			
42	Did the overall inclusion of all these technologies make this class better than you expected?	Yes	No	Unanswered	Total			
		85%	15%	0%	100%			

Table 12 addresses activity in the classroom and across the semester. With constant access and constant use of gradable items, student behaviors had to change. Interest in the class rose. Constant activities that were gradeable and covered daily class requirements caused the student to attend lectures more often (for fear of falling behind) and to complete work outside of class using their mobile devices. Students' overall participation rose in these classes when compared to other non-technology classes. Given the course content (Microeconomics and Macroeconomics), students felt that the inclusion of these technologies made these classes better than they expected.

TABLE 12
CLASSROOM AND OVERALL COURSE EXPERIENCE PERCEPTIONS

#	Question	Responses			
23	*Having completed this class, do you think the technology activities in this class helped keep the class interesting and relevant?*	*Yes*	*No*	*Unanswered*	*Total*
		90%	10%	0%	100%
38	*Classes typically have large waypoints such as mid-term and final exams. This class uses constant activity and involvement in class through In Class Activities and simulations. Did the constant activities cause you to attend class more often than other classes?*	*Yes*	*No*	*Unanswered*	*Total*
		84%	16%	1%	100%
39	*Every activity in this class was "grade able" and required for the course grade. Did this cause a change in behavior on your part both during and outside of class?*	*Yes*	*No*	*Unanswered*	*Total*
		76%	23%	1%	100%
40	*Do you feel that you participated more or less in these class activities when compared to other non-Dr. Shepherd classes because each activity had a grade?*	*Yes*	*No*	*Unanswered*	*Total*
		90%	10%	0%	100%
42	*Did the overall inclusion of all these technologies make this class better than you expected?*	*Yes*	*No*	*Unanswered*	*Total*
		85%	15%	0%	100%

CONCLUSIONS

1) MLearning technologies can improve content delivery both inside and outside the classroom.
2) The question of "what" and "where is" the classroom has been answered. The classroom is now everywhere, anywhere, and at any time given connectivity to the web.
3) MLearning content can lead to increased engagement inside and outside the classroom and leads to better prepared students in both content and mLearning technology skills. Practice makes perfect!
4) MLearning caters to all learning styles allowing students to pick and choose a delivery method that works for them.
5) The question of "How do we redesign our classes?" continues to evolve.
    a) We have to use the technology tools required in the workplace to accurately create situations within the mLearning environment that closely replicate those workplace requirements.
    b) We have to find, develop, and apply methodologies that support the multiple goals and learning styles found in the mLearning environment.
    c) As technologies evolve, the process of integrating a new device, adapting the device capabilities to relevant content topics, and adopting consistent use within the mLearning environment is important.
6) From a faculty perspective, preparation for the mLearning environment requires a willingness to:
    a) Try new things
    b) Fail occasionally
    c) Fix what fails
    d) Adapt when necessary
    e) Discard when necessary
    f) Be flexible with regard to new technologies
7) The value of mLearning and its practical applications are not lost on the student. The student is now free to learn in any location and at any time using any tool. We must train them to leverage this capability.
8) As faculty we must expand our mLearning covenants to include not just our students but also ourselves. Both student and teacher must now work together in this new environment to learn.

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