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Editorial

Technological Revolution in Education – Part 2

Donald G. Perrin

The advent of the printing press magnified the power of the printed word. Charnel Anderson[1] notes that the first textbook was Coote's *English Schoolmaster* published in 1596. The *Orbis Pictus* was published in Germany in 1657. In 1783 *Webster's Blue Back* provided a textbook that could be used in the home. In 1836 the *McGuffy Reader* was printed with movable type. After 1840 it was printed from plates, allowing for explosive growth in school books. Map coloring, photography, and other technologies continued to improve textbooks to this day.

American schools were closed during the civil war. It was not until the 1830s that Horace Mann and other educators gave direction to education. During this period the blackboard, slate, and maps were added to the classroom. Various apparatuses were designed, school furniture and architecture were improved, and the goose quill gave way to the steel pen. The blackboard and bulletin boards continued as the primary display devices until late in the twentieth century[1].

The gramophone and Projected media were widely used for education in the first half of the twentieth century. Kirscher'*s magic lantern,* demonstrated in Rome in 1646, was used in Europe as an entertainment medium for two centuries. The invention of photography and the light bulb made glass *lantern slides* a viable educational medium. In 1889, George Eastman's celluloid-based film enabled Edison to develop the 35 mm motion picture. This same film became the basis of filmstrips that were widely used for training and education until the late 1970's. 16mm safety film was introduced in 1923; sound was added in 1936. 16mm sound films were used extensively for training during World War II and widely adopted by schools when the war ended.[2]

Up till 1960, educational media were used primarily for group instruction. In the second half of the twentieth century, there was increasing emphasis on individualized instruction and interactive multimedia. During the first Technological Revolution, Finn and Hoban determined that audiovisual was too limiting a term to describe the new media and methods. In 1970, the Commission on Instructional Technology adopted their definition:

> Instructional technology can be defined in two ways. In its more familiar sense, it means the media born of the commutations revolution which can be used for instructional purposes alongside the teacher, textbook, and blackboard. …
>
> The second and less familiar definition of instructional technology goes beyond any particular medium or device... *It is a systematic way of designing, carrying out, and evaluating the total process of learning and teaching in terms of specific objectives, based on research in human learning and communication, and employing a combination of human and non-human resources to bring about more effective instruction.*[3]

Over the next 50 years, there was extensive research to optimize use of instructional technologies for education and training. The advent of affordable digital computers, networks, and displays enabled integration of many different devices and technologies into a set of ubiquitous technologies for individual and group learning.

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1. Charnel Anderson, *History of Instructional Technology, I: Technology in American Education, 1650-1900*. Occasional Paper No.1, NEA Technological Development Project, 1961.

2. L. Paul Saettler, *History of Instructional Technology, II: The Technical Development of the New Media*. Occasional Paper No.2, NEA Technological Development Project, 1961

3. Tickton, Sidney G. (Ed.) To Improve Learning: An Evaluation of Instructional Technology. Bowker: New York, 1971

Editor's Note: In 1912, Edward Thorndike wrote the following in ***Education****, published by McMillan:*
"If, by a miracle of mechanical ingenuity, a book could be so arranged that only to him who had done what was directed on page one would page two become visible, and so on, much that now requires personal instruction could be managed by print." Thorndike had anticipated what is now accomplished by branching programs, hypermedia, and learning management systems. This study of best practices takes the next step.

Best Practices for Using Conditional Release in Online Classes

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Abstract

With advances in online course delivery methods, teachers have a variety of options to control the release of course content based on specific criteria. Despite the availability of such conditional release tools, no best practice recommendations are available to guide the implementation of these tools. In this paper, we define the concept of conditional release, review relevant literature, report a series of case descriptions and lessons learned from courses where conditional release was used, and generate a list of best practices for use of conditional release. These recommendations provide teachers and course designers with guidance regarding the use of conditional release tools. Implications for course design, delivery, and research using these tools are also discussed.

Introduction

With the development of comprehensive course management systems, online teachers have a wide variety of course design tools at their disposal, including optional tools providing the ability to release course content based on specific criteria. At its simplest level, *conditional release* refers to efforts to make course content available based upon specific student behavior, activities, or achievements. In particular, with these tools, teachers can make the release of course material contingent upon students meeting a particular condition or reaching a predetermined criterion. When a general behavioral condition is used (e.g., requiring students to open a file or complete a self-introduction), the teacher is using *action-based* conditional release. When teachers base the release of content on students' meeting criteria (e.g., reaching or surpassing a specific grade level for a quiz), this is *achievement-based*. Conditional release can be differentiated from *controlled release*, in which the opening of course material is controlled entirely by the teacher with no conditions based on student actions or achievements.

When used properly, conditional release of material allows teachers to build flexibility into the delivery of their course content, better control or manage the pace of their students through the course, and implement scaffolding to support students as they progress through the course. In this paper, we (1) provide an overview of the conditional release concept and how it relates to other pedagogical approaches; (2) describe several case examples from online teachers who have used conditional release in their courses; and (3) generate a set of best practice recommendations based on these online pedagogy and case experience considerations.

Existing Guidelines for the use of Conditional Release

Course management system developers and some universities have provided general guidelines for the use of conditional release tools. For example, Desire2Learn (n.d.), a course management system that markets itself as offering personalized learning with enhanced learner engagement and collaboration, provides the following description of its conditional release tools:

> *Instructors can determine when learners (or other roles) can access specific content, discussions, assessments, drop box assignments, news postings, checklists, surveys, and other learning tools. Release of resources can be based upon results/usage of: time/date, checklists, discussions, quizzing, self-assessment, content, drop boxes, group membership, content progress, learning style preference, and more.*

In a Teaching Guide for using Desire2Learn (Desire2Learn, 2006), teachers using conditional release were advised to avoid circular references, unnecessary conditions, and impossible and contradictory conditions, and to establish conditions before students access the course.

Another course management system, Blackboard (n.d.) boasts flexibility in managing content, engaging learners, and assessing outcomes, and describes its tools as "adaptive release" options. In one of its press releases, it notes that "through the use of Adaptive Release, instructors will be able to control, monitor and create assignments according to their evolving student assessment and criteria."

Deakin University (2011) in Australia has provided a list of several reasons why a teacher might use conditional release. These reasons include ensuring that students read specific course content before they move on to more content, attempt to complete a quiz, or submit an assignment to the drop box. Conditional release also can be used for specific tasks such as requiring students to post to a discussion forum before being able to access more content, having students complete a checklist before submitting an assignment to the drop box, or releasing news items only after students have met certain conditions. The authors of these guidelines also suggest that a teacher "reflect on whether you are overusing release conditions, using them punitively or for valid learning reasons, using them so they confuse students, using them so that they counter each other making it impossible for students to move, overusing them to the extent that students disengage."

In summary, some general suggestions and recommendations are available for the use of conditional release tools. However, these guidelines do not appear to be tied to specific pedagogical practices or linked to the actual practices of teachers. In the next section of this paper, we discuss issues pertaining to the pedagogy behind the use of conditional release. As we discuss these issues, we will highlight a number of potential advantages and disadvantages of conditional release.

How can Conditional Release Enhance One's Pedagogy?

One excellent reason for using conditional release is to provide *scaffolding* to bolster student success. Scaffolding, by definition, consists of providing direct support at the right level of current skill while a student is carrying out the task and then gradually fading out the assistance (Jarvela, 1995). According to Geert and Steenbeek (2005) this definition has several implications. The first is that there is some identifiable level of a student's skill. Second, there exists a support in the form of help, assistance, instruction and so forth, and third, that this support is close to the student's skill level. Additionally, giving this support should result in the increase in the student's skills and, once this increase occurs, the support can gradually disappear. Finally, Geert and Steenbeek propose support must be "at the right level of the current skill" (p. 117). Therefore, as the level of the current skill increases, so must the level of the scaffolding support. In disciplines where content builds on itself, conditional release is ideally suited for use as a scaffolding tool.

According to Brinthaupt Fisher, Gardner, Raffo, and Woodard (2011), the amount of scaffolding and flexibility needed may differ greatly depending on the characteristics of the students in the course. However, teachers in an online course have an obligation to make an effort to determine those needs. For example, achievement-based conditional release can be used when the teacher wants students to reach a designated mastery criterion (e.g., scoring 70% or better on a quiz) before proceeding to the next unit of content. It might also be used to ensure that students demonstrate a particular competency before moving on to the next level in the course. Many

teachers in traditional (i.e., face-to-face) classes already employ some kinds of controlled release, such as not making course materials available until a particular date has passed or posting lecture notes or supplemental materials after the class that discusses the topic. Some teachers will provide reviews for tests prior to the exam and post correct answers following a quiz. However, it appears that release of such content is typically guided neither by student actions nor by students reaching specific levels of mastery or competency.

It may go without saying, but conditional release should only be used when specific conditions (either action- or achievement-based) can be applied. The teacher should determine which elements of the course should be conditionally released. Ideally, conditional release can be used to guide students through material helping them to prepare adequately for class discussions, assignments, and assessments. This is accomplished by making the release of content necessary for continued success contingent upon the success students have shown in the preceding levels. Through the use of conditional release tools, the teacher has greater control over content and is able to require relevant material be completed to a certain degree before new content is made available. This prevents students from missing scaffolding that is vital for their success, and it can provide scaffolding where none previously existed.

Another pedagogical concept that is relevant to conditional release is *self-directed learning*. This refers to "an approach where learners are motivated to assume personal responsibility and collaborative control of the cognitive and contextual processes in constructing and confirming meaning" (Garrison, 1997, p. 2). In many ways, it is seen as the ideal form of learning when it is a collaborative process between teacher and student (Garrison, 1992).

Self-direction is a matter of degree. It can range from an unstructured environment where students form their own learning goals and assessments of learning (with teacher input) to a more structured environment where teachers provide the course resources and scaffolding with the students progressing through the course at a flexible pace (with some or no deadlines). However, it can be difficult to determine the degree of autonomy needed to develop personal responsibility combined with success (Garrison, 1992). Ultimately, online learning calls on learners to be self-directed and assume greater control than they may be used to in managing and monitoring the learning process (Song & Hill, 2007).

Most of the emphasis in the research on self-directed learning has been on external control and facilitation of students' self-management of their learning (Garrison, 1997). One of these external control functions is flexible pacing. Such pacing is typically viewed as a hallmark of the online learning environment, to the extent that it aims for a collaborative learning experience at the students' convenience. Self-paced learning implies solitary, on-demand learning at a pace that is managed or controlled by the learner (Singh, 2003). Completely self-paced movement through a course has both advantages and disadvantages. While it allows students to move at their own pace, it sacrifices or makes less likely the development of a sense of community among the course's participants and may inhibit communication among classmates. In cases where the teacher prefers that students move through the course together (e.g., when class discussions are desired), self-paced learning would be more difficult to implement.

Recognizing that students can fall behind in any course, regardless of delivery mode, conditional release can be used to provide a mechanism to help students recover more effectively if they have fallen behind in the course. It can prevent students from taking an assessment for which they have not adequately prepared. Achievement-based conditional release that is coupled with flexibility of due dates allows or requires students to complete content first and then proceed with the assessment. Requiring the student to prepare for the assessment should increase the likelihood of student success.

If a teacher uses it wisely, conditional release can encourage and facilitate self-directed learning in students. Ideally, conditional release can be used to help unprepared students prepare adequately for class discussions, assignments, and evaluations. It can also be used to encourage uninvolved students to become more involved and engaged in the course. On the other hand, conditional release requirements might work against students' self-directed learning efforts. For instance, conditional release may make it more difficult for students to manage their time and schedule their studying sessions compared to if they are progressing through the course at their own pace.

A third instructional approach relevant to the use of conditional release is *differentiated instruction*. This approach, popular in K-12 classrooms, emphasizes individualizing the curriculum to fit student abilities, interests, and knowledge rather than requiring students to adjust to the curriculum (Hall, Strangman, & Meyer, 2003; Huebner, 2010). Once it is clear from where students are starting, teachers can guide them through course content, learning activities, and further assessments that are geared to their levels (Tomlinson, 2008; Tomlinson & Kalbfleisch, 1998). As long as there are some online aspects of the course, conditional release tools are well-suited to differentiated instructional efforts.

Conditional release might be used to conduct differentiated instruction in college courses. For example, in a dual-enrollment course, the teacher could provide release criteria for specific activities and assessments for undergraduate students and a different set for graduate students. Conditional release tools could also be used to guide under-performing students to remedial activities before progressing in the course, while directing stronger students to more challenging activities and assessments. More generally, conditional release could present individual or groups of students with branches that will lead them to different content based on their actions or achievements. Alternatively, courses could be set up so that students' content, activities, and assessments can be individualized at several points in the term. In these examples, the release conditions can be based either on students' achievements or actions.

As reviewers have noted (e.g., Tomlinson, 2008), the implementation of differentiated instruction in the traditional classroom can be a complex process. Creating online conditional release options that are based on this approach are also likely to be complicated and time-consuming for the teacher. Teachers might also need to modify or remove certain aspects of the course (e.g., content discussions that all class members participate in at the same time) if they decide to differentiate their instruction along these lines.

A final area of pedagogy concerns how *online best practice recommendations* relate to the use of conditional release. Bain's (2004) study of outstanding teachers challenges traditional notions of best practices. Rather than creating a "to-do" list, Bain focuses on teacher attitudes, beliefs, and behaviors that influence student outcomes. Brinthaupt *et al.* (2011) review Bain's book in the context of online teaching and learning and identify three important factors: (1) *Fostering student engagement* or creating effective student interactions with faculty, peers, and content; (2) *Stimulating intellectual development* or challenging students to think critically and reevaluate previous knowledge, beliefs and assumptions; (3) *Getting personal with students*, which includes behaviors such as demonstrating and encouraging trust and potential in students, flexibility, self-directed learning, communicating learning and success intentions to students, and conveying realistic goals and expectations.

Conditional release should be designed so that it contributes directly to these three best practice areas. Many course management systems, for example, support online discussions that can be leveraged to achieve those goals. Online messaging boards, discussion forums, chats, and blogs are all tools designed to foster student engagement with peers and course content (e.g., Grandzol & Grandzol, 2006). Faculty should emphasize them as opportunities for students to build a

community where they can learn from each other, help one another in tackling challenging course content, and provide a support system for each other. These systems can be merged with action-based conditional release, requiring students to engage with the course, the students, and the teacher before they can advance to subsequent course content. Achievement-based conditional release should be implemented in ways that will foster student engagement and stimulate their intellectual development.

In summary, scaffolding, self-directed learning, differentiated instruction, and online teaching best practices all are relevant to the strategic use of conditional release. Poorly-planned or -designed conditional release is likely to hurt student learning, require increased time and effort on the part of both students and teachers, and negatively impact student evaluations of teachers.

Case Studies of Online Courses Using Conditional Release

In this section of the paper, we present four case descriptions of online courses where teachers utilized conditional release. These cases, all drawn from our own campus, represent a variety of disciplines and student populations and reflect varying degrees of success in the use of conditional release tools. The cases illustrate why and how the teachers used conditional release, as well as the effects of those efforts on student performance.

Conditional Release in a Transitional Algebra Course.

One course that has successfully used conditional release of content is an online version of a transitional college algebra course. This course fulfills the mathematics general education requirement by covering all of the traditional college algebra material along with supplemental material to help underprepared students be successful in college algebra. The course was originally developed as a traditional face-to-face class and then redesigned as a conditional-release online class. Content is presented through teacher-created video lectures. Students are required to take a proctored, comprehensive pencil-and-paper midterm and final exam. All other exams and all homework are completed online using the MyMathLab (n.d.) course management system. Recognizing that many students who enroll in online classes do so because they have unusual schedules or family situations that prevent them from taking traditional classes, the developer decided that student flexibility and a self-paced course with material released as the student progressed through the course best served this particular at-risk student population.

Since this is a mathematics course, not a time management course, the teacher decided to place more value on mathematics that is done well rather than work that is simply completed on time. Deadlines are provided to guide students through the course so that they finish by the end of the semester. Most students meet the deadlines and have no trouble keeping up with the workload. However, in the event of a missed assignment, material is reopened with no penalty. Many argue that flexibility of deadlines does not prepare students for the real world. While this argument has some validity, one might also argue that in the real world an employee can use a sick day, bereavement time, or personal leave if a life event occurs. We should not assume that our students will never encounter a life event during the course of a semester.

A concern of the course developer was that, without flexible deadlines, these at-risk students might have a life event or procrastinate and then attempt a quiz for which they were not adequately prepared in an effort to meet a deadline. The goal of conditional release is to prevent this from happening. In this class students were required to move through the course material in an orderly fashion and with a level of success that was at least the minimal level to pass the course. Students could access the first homework set when the course opened. They were not allowed to proceed to the next set of homework until they had attained a score of at least 60% on the previous homework set. In this course management system, homework problems are algorithmically generated and can be attempted until the student successfully completes the problem, so there is no reason that a student cannot score at least 60% on the homework and

move on in the course. Students also cannot access the quiz covering a chapter of material until they have completed the homework for that chapter. If a student misses the deadline for a chapter quiz and contacts the teacher to reopen it, the requirement is that the student completes the homework for that chapter first. When that is done, even though it is late, the homework grade is counted and the quiz will be reopened with no penalty. Students are rewarded with the grade that reflects their knowledge of the material. They are also reminded at this time that all material must be completed by the end of the semester or they will receive an F for the course.

This flexibility works very well for some students who would not succeed in the traditional version of the class. Some specific examples of this are described next. Several students in the online conditional-release class have deployed for military service during the semester. For these students, there are usually a few weeks that they are unable to work on the course at all. However, once they are settled in their new location, they can pick up where they left off and complete the course with all the content released as they proceed, while serving their country overseas. In a traditional face-to-face class, they would have generally withdrawn from the course and retaken it when they returned from deployment.

Other students have opted for the online class when pregnancy is involved. A student with a due date that falls mid-semester may work very hard to get ahead in the course. Since material is conditionally released this is not a problem. When the child is born they may take a couple of weeks off and then proceed with the class. Other times if the due date is close to the end of the semester, the student may decide to finish the course early so that it is completed before the baby is born.

One student worked on an oil rig while taking the online class. Homework and testing was very sporadic based on the work schedule of the rig. There would be several days when no work at all would be done on the course, but then would come a gap of time when the student would be able to focus on the course and complete substantial amounts of homework and quizzes and continue the course. The proctored midterm and final exams were given a local university to ensure integrity.

Some students prefer the online course simply because they do not feel rushed. They can view the videos at their own pace and re-watch them if it would help with understanding the material. Homework and quizzes can be completed when students are most rested and able to best concentrate on the material based on their schedules. If an unexpected event occurs, students in courses with conditionally released material may be able to recover in the course and succeed better than students who have simply missed the material in a traditional course.

There are a multitude of reasons that students choose an online class and remain in it when they learn of its conditional release components. Regardless of these reasons, initial research indicates that there is no statistically significant difference between the performance of these students and their counterparts in traditional face-to-face classes.

Conditional Release in an Agricultural Economics Course.

Agricultural Economics is a required course for all students in the School of Agribusiness and Agriscience on our campus. Like many economics courses, this one makes heavy use of mathematics. Assessment is primarily based on online quizzes, which can be repeated, and exams, which cannot. Exams and quizzes draw from the same question database. The quizzes are thus study tools for the exam. During previous offerings of this course, both online and face-to-face, the teacher noticed a strong correlation between exam grades and quiz grades. In previous online classes the teacher noticed a pattern among low performing students. Many would procrastinate, waiting until the section deadline to complete all of the section quizzes and the section exam. Only in rare occasions did this strategy result in success.

When conditional release was first employed, the intent was to guide students toward a successful outcome by reinforcing the importance of continually engaging with the course material and practicing quizzes in order to prepare for exams. Course material was delivered in the form of online video lectures created from narrated PowerPoint slides. After viewing the video lectures, conditional release was used to unlock quizzes. After scoring 70% or higher on a quiz, and viewing the next lecture, the next quiz would be released. After completing five to six quizzes in this manner, the section exam would become available. Each quiz and exam was given a deadline. Students were allowed to drop their lowest exam, so if any students were not able to unlock an exam it would not harm their grade and they would then be granted access to the next course module.

Results were disappointing. The added pressure of performance goals with deadlines served only to maintain a state of panic among high-performing students. Low-performing students were frequently unable to meet the release criteria and procrastination was still a problem. Conditional release served only to increase the severity of the penalty for procrastination or low performance. The teacher's experience was equally frustrating – not only was conditional release not helping students meet learning objectives, it increased his workload. Students who failed to meet deadlines were typically granted an extension, which required entering individual exceptions in the course management system. In addition, after setting up release conditions for quizzes, any modifications to the course content required a revision to the conditional release criteria. The software used to generate the video lectures was unreliable and many of them had to be revised. Each time a lecture was revised, release conditions within the course management system had to be updated.

The following semester, the use of conditional release in this course was modified. Quizzes within each unit no longer had a deadline, but the unit exams did have deadlines. The performance threshold was lowered to 50%. Results were dramatically different. High-performing students could easily reach the 50% threshold and no longer expressed anxiety about course deadlines. Low-performing students, even those who were prone to procrastination, could complete the work and make progress in the class. The pass rate for the course was dramatically higher than the previous offering. Although viewing lectures was no longer required to access quizzes, this did not appear to create problems. Students tended to move through the course in a linear fashion and could match content topics to quizzes without being micromanaged by the course management system.

The original goal of implementing conditional release was to provide additional motivation to low-performing students. This was not an effective use of conditional release in this course. It appeared that the behaviors associated with low performance could not be modified with a computer program and were often the result of factors that are external to the course itself. Conditional release, designed as a motivational tool, served as an additional punishment for students who were struggling to complete the requirements of the course. At least in this course, motivating students may be more effective by using the communication tools imbedded in the course management system, such as discussion boards and chat **rooms.**

Conditional Release in an Integrative Seminar in Leadership Studies.

Integrative Seminar in Leadership Studies is a 1-credit, pass/fail independent study course that provides an opportunity for students to identify their personal leadership strengths, understand how their strengths apply to their leadership experiences, and develop a personal profile that embodies their unique talents, leadership education, and leadership experiences.

Course requirements prompt students to (a) build an awareness of their strengths by identifying times that they are "in the zone" or at their personal best; (b) identify their strengths with the StrengthsFinder assessment (Gallup Inc., 2011) and describe them in their own words; (c)

describe their signature themes and how they currently use them; and (d) identify how they can foster and hone their strengths while in college and beyond in their career. Because this class is designed to be independent study that encourages originality and personal development, students are required to be self-directed learners. Success in this course is not merely a passing grade. Success is a heightened self-awareness in the students as leaders and what they uniquely can contribute in making a difference on campus, in the community, and in our world. These goals make the class an ideal match for the self-directed learning process where students may work ahead of schedule and complete the class as their time permits. However, because each assignment builds on the previous assignment, it is imperative that students progress through the class in a specific sequence.

This sequential approach necessitates that student learning be process-oriented, rather than product-oriented. Each assignment is deliberately designed to lead students through the process of thinking about when they are at their personal best, then identifying their leadership strengths, followed by making connections with experiences, and finally integrating them into a culminating document they can share with others. The teacher used conditional release as a tool to compel students to be process-oriented and complete an assignment before moving on to the next assignment (to prevent students from jumping around, completing assignments randomly, and most importantly, moving ahead without the professor's feedback on the previous assignment).

Conditional release can cultivate a process-oriented emphasis in learning. However, when the progression in the course is obvious and the readings and deadlines are clearly ordered, it would be highly unlikely that students would progress out of sequence. In such as case, conditional release can become a tool that is used just because it is available rather than because it serves a real need or has an essential function. In this case, the teacher incorporated conditional release into the class because it was an available tool that would ensure sequential progress. However, the teacher found that the tool was not essential or even useful for this purpose. At least for this course, using conditional release solely for sequencing purposes was unnecessary.

Conditional Release in a Liberal Studies and Professional Studies Culminating Project.

The capstone experience for Liberal Studies and Professional Studies majors on our campus is a Culminating Project class. The majors are geared toward adult students who are returning to college to complete their degree. Students are able to propose either an argumentative research paper that is related to their chosen course of study or a professional project that must also tie to their previous coursework. At the end of the course, students create a multi-media presentation to summarize their culminating project experience. Students take the Culminating Project in their senior year. Since this is an online degree program, the course is offered in both online and hybrid delivery.

Several sections of this senior-level culminating project online course implemented conditional release to improve the students' performance in the class. After two semesters, the conditional releases were removed due to teacher feedback that it had not improved student performance and had created confusion for some students.

The culminating project class requires that students begin with a proposal that outlines what tangible professional product they will produce related to their area of study. Teachers were interested in implementing conditional release in order to improve the quality of the proposal and ultimately the final student product. In order to ensure that students had a quality proposal before moving forward with any other assignments, a conditional release was placed on the proposal that required students to earn 80% of the points before they could submit their next assignment. Multiple submissions were allowed of the proposal until the student reached 80% of the points. The idea was that students would be forced to refine their proposals until it was above average or received a grade of 80 or higher. Before conditional release was used, the students would submit

the proposal and regardless of the score proceed with the next assignment. In addition, the students could not see the next content module until they earned 80% of the points on the proposal assignment.

Setting the minimum grade at 80% created a situation where some students were not reaching the release criterion but were still capable of completing the final project with a passing grade. Teachers were not sure how to handle these situations and in most cases accepted the proposal with less than 80% of the points, so that the student could proceed to the next assignments. This in effect defeated the purpose of the conditional release. In other cases when the teacher continued to require multiple submissions of the proposal until students received the minimum grade of 80%, the students experienced difficulty finding enough time in the semester to implement the project. Having students in the same course progressing at different paces was also unique, uncomfortable, and created extra work for some teachers.

Since this is an online class, there was also the feeling that a lot of information in the content modules was overwhelming and that students would be able to focus better if modules were released upon completion of the previous module. Although the information was discussed in the syllabus, posted on the home page, and discussed at an optional orientation, several students did not understand that conditional releases were being used for the content modules and this also created confusion and frustration for them. Many did not understand that content was being released at different times based on their progression. Additionally some students would not login regularly enough to see that action or revision was required on their part.

After two semesters of using conditional release for assignments and content modules, the conditional releases were removed from the course. Teachers still require students to revise their proposals as necessary before approving the proposal, but a minimum score of 80% is not required and students are able to see all the content on the first day of class and work on the next assignment regardless of the grade they earn on the proposal.

Recommendations for Conditional Release Best Practices

Based on a review of the relevant literature and experiences of the case examples we collected, we have generated a list of conditional release best practice recommendations (see Table 1). In this section, we provide a rationale and justification for each of these recommendations, consistent with online pedagogical principles and best practices discussed earlier.

Table 1

Best Practice Recommendations for Conditional Release in Online Courses

- Conditions for release should be reasonable and realistic.
- Conditional release is best used with activities or assignments that lead to the mastery of course content.
- Conditional release is best used when course content progresses linearly or builds on itself.
- The reasons for using conditional release and for using specific release criteria must be transparent and clearly communicated to students.
- Teachers who use conditional release need to be flexible.
- Conditional release is best used with caution.

1. *Conditions for release should be reasonable and realistic*. In the real world every student cannot be expected to perform A- or B-level work on every assignment. We recommend allowing students to advance with D-level work. There are a couple of reasons for this

recommendation. First, 60% or better on an assignment or assessment is typically a passing grade, even if minimally so. Preventing students from progressing through the course when they have achieved a passing grade is problematic and likely to generate student challenges or complaints. Second, setting conditions that are too high or difficult can engender anxiety and frustration in students. Students may need to complete the trigger assignment more than once. If this is not related to mastering the material, then it is a wasteful and unnecessary requirement. Speaking metaphorically, teachers might think of conditional release as paper walls instead of brick walls. Picture a football team running on to the field, bursting through a giant banner. Any player can break through that barrier if they will just try. If it was a brick wall, the game would be over before it started.

2. *Conditional release is best used with activities or assignments that lead to the mastery of course content.* That is, conditional release seems to be better suited as a "guidance" tool than an assessment tool. Teachers can use and justify conditional release tools as necessary to ensure that students are adequately prepared for the major assignments and assessments that "really count." This can include individualizing content, activities, and assessments so that they are tailored to the skills and preferences of the student. Implementing release conditions for trivial materials or activities that are not clearly tied to mastery of the course content (such as learning how to navigate the course management system) is likely to generate frustration in students. When implemented properly, conditional release will increase student interaction with the course material, which will improve student learning.
3. *Conditional release is best used when course content progresses linearly or builds on itself.* In particular, conditional release can be optimized when mastery of later course material requires the mastery of earlier content. Our general rule here is that, if the course content (reflected in textbook chapters or course modules) can be moved around or presented in different orders without negatively affecting student learning, then conditional release is probably unnecessary. Requiring release conditions in this case would create unnecessary barriers for students and extra work for the teachers. If, however, there is a specific sequence that is required for student progress through the course (e.g., in terms of the development of core knowledge or skills), then teachers and students can benefit from the effective use of conditional release. There can be more than one sequence, if the course is taught in a differentiated way that allows students to reach the desired outcomes in a variety of ways.
4. *The reasons for using conditional release and for using specific release criteria must be transparent and clearly communicated to students.* Because conditional release is likely to be a new concept for many students, teachers must explain the logic and reasoning behind the use of these tools. Whether the release conditions are based on student achievements or actions or the release criteria are objective or subjective, teachers need to ensure that students understand how they will progress through the course. Particularly with achievement-based conditional release, teachers should clarify to their students why those conditions are necessary. For example, teachers could stress to students that mastery of earlier course material is essential for later course success and that the conditional release tools will actually help students to better navigate the more difficult aspects of the course. In this way, students can use conditional release as a way to better manage their own effort, time, and learning. Additionally, if the purpose of conditional release has been clearly articulated to students, they may be more willing to perform beyond the minimal criteria for release of new content.
5. *Teachers who use conditional release need to be flexible.* The case examples illustrated the need for and advantages of being flexible when using conditional release. Using conditional release inflexibly (i.e., posting the conditions for release and adhering to

those rules without exception) will decrease its effectiveness. Depending on the nature of the course and as well as the characteristic of the students, teachers may need to alter or adjust their conditions or deadlines, as the course progresses. It also may be necessary to add conditions to or remove them from particular aspects of the course or grant individual students deadline extensions. In other words, we recommend that teachers who use conditional release, particularly for the first time, need to approach its usage with the expectation that specific release criteria or actions may need to be adjusted. If the teacher is not flexible, the use of conditional release can create barriers or penalties that are unrelated to student learning.

6. *Conditional release is best used with caution*. Student learning should be the determining factor with the use of conditional release. Until the effects of using the tools on student behavior and learning are clear, it is probably best to begin using conditional release sparingly. We recommend that teachers target the course content that is most critical for ensuring mastery of material or class success and apply conditional release tools to that content. Each teacher should determine the best balance of conditionally-released content in the course. This could range from the entire course being conditionally released to certain activities or topics being released after specific criteria have been met. Using too much or too little conditional release may decrease its effectiveness in the class. Some students may react negatively to the imposition of conditions for progress through the course, feeling that their progress is being "over-managed." They may become frustrated if course material is hidden from them. Some of the case examples reported earlier applied conditional release when it was not necessary or in ways that made student progress through the course more difficult. Had those teachers introduced conditional release more gradually or selectively, they might have experienced better success with the tools.

Implications for Course Design, Delivery, and Research

In this paper, we have attempted to connect the use of conditional release with broader pedagogical principles. Considering when and how to apply conditional release can be a very useful exercise for teachers designing an online course. Depending on the course learning objectives, teachers may identify areas where mastery of content is required before progressing to new material. Such points seem ideally suited to the use of achievement-based conditional release.

Really, we are talking about a different approach to teaching. Through the use of conditional release tools, the teacher can take a more active role in guiding or pacing students through the course. Regardless of the desired nature of progress through a course, conditional release can be used to facilitate that process. This contrasts with the traditional model where students come to class whether they are prepared or not, students are free to devote as much or as little attention to a course as they please, and the teacher has no idea how engaged a student is in the course until the first major assessment.

Conditional release cannot always be used to ensure that students read course content. It might only ensure that students have accessed specific content. This is a significant limitation of using action-based conditional release. We would caution against requiring students to simply access or open material in order for additional content to be released. If a teacher wants to use the reading of material (as opposed to simply its access) as a condition for release, then it would be better to include an assessment of that material and to apply a criterion to be reached before additional content can be accessed.

Our recommendations apply to online course delivery. However, conditional release is clearly useful for courses that are delivered in blended or traditional formats. In fact, some uses of conditional release appear to be better suited to specific delivery modes. For example, a common

complaint among college teachers is that the students arrive for class unprepared, having not read the material. In a face-to-face class, teachers could create a "pre-class" quiz that requires students to reach a passing grade before coming to class. Failure to reach the criterion would prohibit the student from attending class that day. Or, phrased more positively, reaching the criterion could provide students with a "ticket" to attend class that day. A similar criterion could be required before students can access an online class discussion in a blended course.

The accuracy of the best practice recommendations we have generated awaits actual teaching practice and empirical verification. As more teachers make use of the conditional release tools at their disposal, a database of teacher and student experiences can be generated and used to revise our recommendations. Given the absence of research on the use of conditional release in online (as well as blended and traditional) courses, there is a clear need for studies that examine teachers' perceptions and experiences using the tools. Additionally, because the use of conditional release may cause disruptions in the "mindset" of students or require adjustments to how they approach a course, research on student perceptions and experiences in courses utilizing these tools would be quite valuable. Such research would be particularly valuable for determining the best criteria to meet a release criterion, ways that students change their study habits, and whether the use of conditional release improves student learning and performance.

As we noted in the beginning of the paper, course management release tools can also be used for the *controlled release* of materials, in ways that are not dependent upon students meeting a particular condition or reaching a criterion. For example, students might be required to read a "getting started" course module to become familiar with the course structure and organization during the first weeks of the term before moving to the major content. Or, students' access to the entire course can be restricted or segmented so that they are not overwhelmed by a large amount of content. Although we have not addressed best practices for the controlled release of content, it seems ideal for an online teacher to determine a combination of conditional and controlled release of course content that will optimize student learning.

It should be clear from our recommendations, that conditional release is best used when it puts students more in control of their learning. As with any other instructional technology tool, teachers need to evaluate to what extent conditional release can be used to help create the "ideal" student. Such a student is active and self-directed and shows more of a "learning/mastery/process" orientation than a "grade/performance/outcome" (see Bolhuis, 2003; Grant & Dweck, 2003).

Are there unintended consequences of using conditional release? Obviously, conditional release should not be used if inhibits students' future learning. Does conditional release negatively affect students' learning orientations? Does the use of conditional release create anxiety or frustration among students? What do students think of courses that employ conditional release tools? These are some of the interesting questions that await the strategic use and systematic assessment of conditional release in online courses.

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Editor's Note: When we make changes and additions to educational programs, we assume they will improve student learning and performance. Research enables us to verify that expected results occur and how well. The data is also helpful to guide the next stage of program improvement.

The Degree of Teachers' Application of "Intel Teach to the Future" Program in Implementing the School Curricula in Jordan

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Jordan

Abstract

The study aimed at investigating the degree of teachers' application of "Intel Teach to the Future" program in implementing the school curricula as perceived by teachers in Jordan. The sample consisted of 120 male and female teachers from Amman district for the academic year 2008/2009. In order to answer the study questions, the researcher developed an instrument which consisted of 43 items distributed over five scales. Reliability and validity were established. Means, standard deviations, T-test, One-Way ANOVA and Scheffe Test were used to identify the significant differences among the means of the variables. The results showed that the teachers' degree of the application of Intel program was low. The results also showed that there were statistically significant differences at ($\alpha \leq 0.05$) attributed to the academic qualification, experience and school level. In light of the results, the researcher came up with some recommendations for improving the teachers' application of Intel Program in implementing the school curricula.

Keywords: Educational Technology, Intel Education, Professional development and K-12 Teachers.

Introduction

Attention to the role of technology has increased since the beginning of the nineties of the last century as an important component in the educational reform process. In this regard, many scholars of education including Davey (1991), Peterson (2000), Shinkfield, & Stufflebeam (1995) and Barry (1996) agreed upon that it is possible to benefit from technology in the development of educational systems and to increase their efficiency through the integration between the outputs of learning and education technology. The reason behind doing that is to create an educational framework that allows increasing the quality and quantity of direct interaction between students and the various sources of knowledge.

In this direction, the future vision of the political leadership in Jordan crystallized, through setting a new policy for the future of the educational system, to comply with the new trends in the alignment between the outputs of education and knowledge economy whose most prominent feature was the adoption of information and communications technology (ICT) and considering it as a strategic choice for the advancement of national economy and improving the quality of life in Jordan (The National Agenda, 2006).

In response to these orientations, the Ministry of Education carried out many educational projects, initiatives and practical steps starting from introducing computers to schools, amending educational laws and legislations, developing curricula and teaching. Furthermore, the Ministry worked on enhancing professional development for teachers; through adopting the Educational Reform for Knowledge Economy)ERFKE) project in order to convey scientific and technological developments taking place in the information age to be applied in two stages; each taking five years. The first phase was from 2003 - 2008 and the second started in 2008 to 2013 (Ministry of Education, 2006).

According to the ERFKE project, among the most important goals were: improving the performance of teachers through quality training programs; in accordance with advanced needs,

ensuring the mastery of educational technological skills such as courses of International Computer Driving License (ICDL), Capital for Technology (CISCO) which is specialized in management and maintenance of networks, and the Eduwave to use the e-learning system in the administrative and technical work, (A +) to acquire the skills of computer hardware maintenance, and Intel Teach to the Future program to train teachers on using technology in education (The National Agenda, 2006).

Intel Teach to the Future program represents one of the most important initiatives adopted by the Ministry of Education in the implementation of the curriculum in line with ERFKE project. It makes the Jordanian teacher a pioneer in applying technology and teaching higher order thinking skills in the school curricula, which relies primarily on skills gained from the ICDL program (Intel Corporation, 2006).

Intel Teach to the Future program has been implemented in Jordan since 2003 to help teachers apply the pedagogical and content knowledge in learning situations. In cooperation with the Jordanian Ministry of Education, Microsoft and Intel corporations support this program to ensure its successful and efficient implementation in classrooms to improve the quality of students' learning through the focus on the diversity of the sources of knowledge and teaching methods (Intel program, 2003).

Accordingly, this program introduced as a part of the Ministry of Education's initiative in the field of innovation in education, which represents international efforts to help learners perceive the potential of science and technology in the field of education (Ministry of Education, 2004, a)

Components of the Intel Teach to the Future Program

This program consists of the following sections: pedagogy (40 hours), educational packages (80 training hours), and the electronic educational system (Eduwave) (20 hours). It is worth mentioning that Intel corporation has also developed thinking tools program (40) hours of training as part (to complete program) of its educational program to teach thinking through "Intel Teach Thinking with Technology" course, these are: Visual ranking, seeing reason, and showing evidence. The purpose was to enable teachers to acquire knowledge about these tools and skills to help their students develop higher order thinking processes. These tools are free and available on the following Intel's website for education: (Intel Education Website). The following is a review of these tools:

First: **Visual ranking**: an online tool to arrange things in order of priority to put it in a list. By using this tool, students are to deliberately examine things, discuss and determine criteria for arranging things in the lists; they are also required to give an explanation while comparing their lists with each other through visual forms. This tool supports the learning activities where students need to discuss differences among themselves and reach agreement on how to organize things and/or ideas according to the criteria (www.intel.com/education/ visual ranking).

Second: **Seeing reason**: an online tool for mapping relationships between the cause and the effect. By using this tool, students develop their perceptions about the factors and relationships through exploring the cause and the effect. These maps make thinking visible to facilitate students understanding of the causal relationships between ideas, concepts, events or things (www.intel.com/education/seeing reason).

Third: **Showing evidence**: an online tool to put hypotheses and support claims by evidence. By using this tool, students learn how to develop good, explained arguments and prove their case with credible evidence through a visual framework for the process of hypothesizing which is supported by evidence. The interactive features of the showing evidence tool also help students to formulate the claim, identify the evidence, evaluate its quality, and explain how the evidence

supports the claim or weakens it. Then, students come up with a conclusion based on the evidence. This tool supports the learning activities where students need to discuss differences, reach conclusions, and organize ideas logically (www.intel.com/education/showing evidence).

It is worth mentioning that the above tools fit different contexts and is considered to be an important part of higher order thinking processes (Kuhn, 1992). They might be used in many learning situations (Reznitskaya & Anderson, 2002), in various scientific, literature and vocational branches (Passmore and Stewart, 2002), and to provide students with bridges to real life experiences. These tools also help students make decisions about how to assess the quality of what they read or hear (Lizotti, McNeill and Krajack, 2005), to understand the instructional content (Driver, Newton, & Osborne 2000). This requires that students think and get engaged in deep dialogues to provide convincing evidences to reach the correct knowledge (Jiménez-Alexander Rodríguez & Duschl, 2000).

Intel Teach to the Future Goals

The aim of this on-line interactive program is to enable teachers to possess the tools and skills to help him/her integrate technology into the teaching and learning processes as a tool for communication, research and the production of educational materials. This program aims also to develop higher order thinking skills of learners through cooperative learning activities and deliberative thinking to find out facts in the sources whose credibility has been verified.

The tools included in Intel program provide the opportunity for learners to run objective discussion sessions based on the summary of reached knowledge from a variety of sources. Specifically, this program aims to help teachers achieve the following objectives:

- Learning teaching strategies that are appropriate to tackle and assess higher order thinking skills included in the program to develop the skills of effective partnership among students and the skills of interaction between students and teachers to help them realize their potential.
- Designing a sample of projects and assessment strategies that employ online thinking tools based on the criteria of the development of students' higher order thinking skills according to project-based learning approach.
- Understanding the online thinking tools, how to access it and how it works, and how to manage a classroom-based project by using these tools.
- Empowering teachers to effectively implement educational plans using thinking tools to help their students to explore and manage it and make sure of their understanding of the material.

Features of "Intel Teach to the Future" Program's Curriculum

The curriculum and companion CD-ROM are created by the Institute of Computer Technology (ICT), a nonprofit organization that offers non-profit companies and agencies and educational community services of training on curriculum development and on technology for k-12 education. Since its establishment in 1982, the institute became a trustworthy partner to depend on the level of the world in designing competency-based curricula including the curricula of computer science, science, engineering, mathematics, and programs for professional development for educators to use the technology in education (Yost, Culp, Bullock and Kuni, 2004).

The key element in the Institute's mission is to spread knowledge and the application of this technology in all curricula to achieve a quantum leap in teaching and learning for all students around the world (www.ict.org).

This is completed through the training on the three thinking tools and using them to teach higher order thinking skills for students, increase and deepen their learning by using the cognitive methods of teaching and assessment, develop a high skill of dealing with the internet for research and enquiry processes, design standards-based projects and plan student-centered evaluation strategies. To facilitate this process, the ICT provides trainees with a CD containing templates for training on the application of this technology in classroom situations. The program curriculum was translated into Arabic to fit the local community context and its educational philosophy (Intel Corporation, 2006).

As for training material related to this program, it includes the specialized chapters on the development of thinking which help teachers to emphasize the pedagogical knowledge during the implementation of the curriculum using the project-based learning approach, that allows wide range of thinking tools and its processes to be applied (Yost, Culp, Bullock, and Kuni, 2004).

Intel program was constructed based on a set of key ideas including: using technology effectively to implement the curriculum; that is it is designed to intensively train teachers and students on computerized curriculum, referring to multiple sources of information using search engines available on the internet, emphasizing practical learning by designing educational packages and units and implementing them in the classroom, providing the opportunity for teachers to collaborate with their colleagues around the world, to work collectively, to participate in reviewing units which are designed in accordance with this technology, to solve problems to improve the process of curriculum implementation (Yost, Culp, Bullock and Kuni 2004).

Additionally, this program is distinguished from other teacher-training programs and other computer courses by a number of features including: the training process completed through a direct practice benefiting from the advantages of computers, supporting devices and the Internet. It also allows teaching the curriculum inside the classroom. Finally, this program helps teachers use the computer influence to stimulate students' imagination to broaden their creativity horizon beyond the classroom to help them perceive the importance and value of continuous learning, using techniques available in the program (Ministry of Education, 2004, b).

The Importance of the "Intel Teach to the Future" Program

This program focuses on the development of higher order thinking skills among students using a set of thinking tools through the free online website for education; (www.intel.com/education). Moreover, it sheds some light on how to use the Internet by benefiting from new and constructive ways with both teachers and students. This technology has been proven highly effective when used as a tool to develop concepts, thinking skills and to solve problems. Using this technology, teachers and students can work together to create strategies to develop mental representations of the learning material and visually enable students to express their understanding of complicated issues (Intel Corporation, 2006).

With regard to teaching thinking, Cotton (1991) indicated that a clear conclusion has been reached that is education, which focuses on the development of cognitive processes; such as creative, critical, reflective thinking, inquiry, information processing, decision-making and problem solving skills and, meta-cognitive processes; which include planning, monitoring, and evaluation, leads to high levels of meaningful learning.

Coinciding with the changes in human societies, Intel program highlighted the cognitive, technical and psychological advanced skills students need for success in their future lives such as: the ability to adapt to new developments, social interaction, dealing with information and technological media skillfully, participation in group work, self-direction, understanding and identifying learning needs, finding the right and trusted resources, holding social responsibility; consider the concerns of others, and demonstrating ethical behavior in personal, academic,

practical and social situations, possessing research and evaluation skills and the ability to transform the effect of learning to new situations (The National Agenda, 2006).

The importance of this program is also manifested in training teachers on a number of thinking tools available on-line and how to apply them in teaching situations for the implementation of school curricula, and to clarify its role in teaching higher order thinking skills (Yost, Culp, Bullock, and Kuni, 2004).

In this context, Costa, (1991) referred in his book, Developing Minds to that teaching thinking has become a general goal and a right of every human being for the development of his or her mental abilities by integrating it with the content. This demands to reconsider the role of the school and directing it towards teaching thinking for students (Costa and Kallick, 2000-2001). Moreover, research indicated that the improvement of student learning when teaching thinking has become an integral part of the curriculum, especially when the teacher uses teaching methods more appropriate to develop students higher order thinking skills, such as, open-ended questions, enquiry, problem-solving, project-based learning, and the application of qualitative assessment strategies, which are considered to be basics of teaching thinking if it appropriately applied in teaching and learning situations (Salpeter, 2003).

Historically, Intel launched the "Intel Teach to the Future" program in the Arab world in 2002. After the teacher passes the International Computer Driving License (ICDL), this program offers a comprehensive training course based on learning activities of the direct training by competent and specialized trainers. The program offer teachers the opportunity to possess a future vision pertinent to the students' needs and the quantum leap of their learning through the increasing use of varied sources of knowledge and modern technology media to enhance the educational system with all of its components (Ministry of Education, 2004a).

Several researchers, Marzano, Brandt, Hughes, Jones, Presseisen, Rankin, and Suhor (1988); Marzano (1992); Wiggins McTighe, J. (1998) and McNeill, Lizotti, Krajcik and Marx (2004); emphasized that this requires the teacher possesses professional competencies to be able to perform his/her role efficiently and to help students achieve the intended learning outcomes in the school curricula. The Ministry's vision of the educational system in Jordan highlighted the ability to implement the required competencies included in Intel program which was the focus of this study including: skills of determining criteria and asking questions, project-based learning, student-centered assessment, thinking tools and meta-cognitive skills (Intel program, 2003).

Statement of the Problem

Between 2002-2008, the Ministry of Education designed and implemented several training programs to improve the professional competence of the administrative and technical staff at all levels in the Ministry, its directorates and schools. More than (65 000) teachers and administrative have been trained on (ICDL), (42000) teachers and the administrative have been trained on the Intel Program, and (2570) teachers have been trained on World Links program, and on many of the advanced programs for the integration of technology in teaching-learning processes.

Within the educational development program to improve the infrastructure, the Ministry of Education, established approximately (87) school buildings according to the specifications and standards, most of the school curricula were re-composed, linked (3300) public schools by an e-learning system (Eduwave) for directly viewing curricula on-line, distributing (82722) a computer among (4961) laboratory in schools, enrolled 70,000 teachers in computers-specialized training courses, linking (130) exploratory schools to the network of e-learning in preparation for the generalization of this experience to other schools in Jordan (Ministry of Education, Training Plan 2002-2008).

Obviously, the amount of the financial investment in education and training is very huge. Also the continuation of providing more opportunities of high quality education and training requires increasing expenses, wisdom in the use of sources and resources, and a partnership between the public and private sectors in financing investment in education and training according to a flexible agenda (World Bank, Education, 2003). Considering this strategy, Robertson (2004) indicated in her evaluative study that "most of the teachers who were interviewed and observed do not practice what they learn, they also show negative feelings toward teaching and training" (p. 17). Therefore, this study was one of a series of field evaluative studies to assess the status-quo of teachers' application of the competencies contained in the Intel Program to provide an empirical database for those who are concerned about this program by answering the following questions:

1. To what degree do teachers apply "Intel Teach to the Future" program in the implementation of school curricula?
2. Are there any statistically significant differences ($\alpha \leq 0.05$) in the degree of teachers' application of "Intel Teach to the Future" program in the implementation of school curricula which can be attributed to teachers' qualification?
3. Are there any statistically significant differences ($\alpha \leq 0.05$) in the degree of teachers' application of "Intel Teach to the Future" program in the implementation of school curricula which can be attributed to teachers' experience?
4. Are there any statistically significant differences ($\alpha \leq 0.05$) in the degree of teachers' application of "Intel Teach to the Future" program in the implementation of school curricula which can be attributed to school's level?

Significance of the Study

This study is one of the initial studies conducted on the degree of teachers' application of Intel program in the implementation of the school curricula. Therefore, this study has a high significance related to Intel program applications in education, administration and research, either in Jordan or at the international level. this study is important for policy makers at the Ministry of Education, teacher educators, researchers, supervisors, school principals, teachers and students as it may provide with information about factors may enhance quality of application or aspects that need for development in teacher training.

For officials at the Ministry of Education and teacher educators, this study considered as a formative evaluation that provides a feedback, which may contribute to improve the program implementation, develop and increase its efficiency, especially that this study conducted at the second phase of evaluating the project of ERFKE; 2008-2013. Furthermore, the study provides indicators that enable officials to search for solutions to problems that may impede the achievement of the desired goals of the program.

This study is also important for researchers who are interested in the competencies contained in Intel Program to benefit from the instrument of the study or in conducting other studies on different samples and areas to assess the degree of teachers' application of the skills contained in the Intel program in their teaching practice.

Moreover, it is important for supervisors since they are responsible for training, assessing and monitoring the performance of teachers at schools. The study is also important for evaluating the effectiveness of the teachers' ability to apply these skills and determine the level of their performance and to identify their training needs.

As for school principals, they may also benefit from the study instrument to evaluate teachers' performance at their schools. Through informing the teachers about the results of this study, they may benefit from in self-evaluation and work to improve performance. Ultimately, it is assumed that the students' learning will be affected by the teachers' practices, which will be reflected in developing their reasoning and their abilities to achieve the intended learning outcomes in school curricula. Finally, this study may contribute in developing a list of competencies included in the program to provide guidance for evaluating and updating teacher education programs.

Literature Review

The researcher reviewed the literature and summarized the relevant research related to the teachers' application for the "Intel Teach to the Future" program in relation to some teachers' demographic variables such as qualification, experience, the school level, gender and major. Research studies were retrieved from internet databases by searching the specialized educational sites, such as EBSCO, ERIC, Wiley production and Sage databases. Several key words were used; Educational Technology, Intel Education, Professional development and K-12 teachers. Most relevant studies were found to be between 1988 and 2010. However, literature still very few as compared to the importance of Intel program application in the educational field. It was possible to categorize these studies into three themes: the first; evaluation the impact of Intel program on teachers' practices, the second; focusing on the teachers' attitudes and satisfaction about the program and its effectiveness in learning the content of the school curricula, the third theme focused on the development of Information and Communications Technology in schools and the factors affecting its application in classrooms and schools to implement school curricula.

Concerning evaluation the impact of Intel training program on teachers' practices, Martin, McMillan, Gresick and Nudell (2001 & 2002) conducted two studies aiming to evaluate the success of Intel program in the integration of technology in education, with a focus on the responses of teachers for training, and gathering preliminary evidence of the impact of implementing the program at multiple levels in the participating schools included: grade, school and the school area in an attempt to understand how to accelerate, expand and increase the program's effectiveness in influencing the practices of classroom teachers.

The results showed that teachers who participated in the program changed their teaching practices in the workplace, and that the ideas and skills learned through the program had helped them to successfully integrate technology through their application to the unit plan they developed during their training on the program in achieving the intended learning goals. The results also showed that the school's environment, culture and the nature of local community play an important role in determining the transfer of the effect of learning when this environment supports change and school self-renewal.

As for teachers' attitudes and the degree of satisfaction about the program and its effectiveness in learning the school curricula, Al shaqran (2005); Al-Tarawneh (2006); Bani Awwad (2006); Daradkah, (2006) and Abdelrahim (2008) conducted a series of local studies on Intel program in Jordan aimed to identify the teachers' degree of satisfaction and attitudes, who participated in the Intel program, about the program in terms of its goals, training material, instructor, time and place of training, the conditions for joining the program and the obstacles that impede the application of skills gained from the training program. These studies also focused on the degree of use of technology in the application of pedagogical knowledge, including planning, implementation of learning activities, classroom management, and evaluation strategies. Results of these studies indicated that teachers were satisfied with the Intel program and its effectiveness, however, the degree of the application of skills gained from the program is still weak despite the improvement in teachers' access to Information and Communications Technology at schools.

To identify the effect of some independent variables in the degree of teachers' application of Intel program, the results of those studies indicated that there are statistically significant differences of the teachers' qualification, experience and school level (basic/secondary) in favor of teachers who have graduate degrees, with experience less than 15 years, and for secondary schools respectively, whereas results showed that there are no statistically significant differences due to gender and major. To find out about the effectiveness of the program in the implementation of the school curricula, Bani Awwad (2006)'s study aimed at measuring the impact of teaching science through an electronic Packages based on Intel program on the eighth grade students' attainment of scientific concepts. The results indicated that there were statistically significant differences in the scientific concepts attainment attributed to teaching method and in favor of the experimental group.

The third theme focused on the development of Information and Communications Technology at schools and the factors affecting its use in the classroom and schools. Results of the studies conducted by the Chanlin, (2007); Peneuel, Boscardin, Masyn and Crawford (2007); Wing, (2007); Gulbhar and Guven (2008) and Morrison, and Lowther, (2010) indicated that there is a positive correlation between information communications and technology, and teaching effectiveness, the improvement in teachers' access to ICT and their ability to use it in the in classrooms and schools. The results also showed that teachers use the applied software in administrative work and in the search for knowledge sources as a supportive tool to help him or her in the teaching and learning processes.

Among these sorts of software are: words processes, power point, the search engines, e-mail, discussion forums, electronic encyclopedias, films, databases, and electronic tables. However, the use of the above software in implementation of school curricula was the lowest or maybe not used effectively. Several researchers of the above studies attributed this to a number of obstacles that teachers encounter in using technology such as the lack of technical knowledge and skills among large number of teachers and students, technological equipments, availability of internet services, sufficient time for teachers to plan due to teaching burdens, and complexity of school curriculum, class size teachers' uncertainty to use technology.

To summarize, Chanlin (2007) mentioned that the most important factors affecting the integration of computer technology in the classroom are the following: the school curriculum; teaching load, and the nature of subject matter, and teacher's ability to use technology, environmental factors; the availability of facilities, appropriate software, and time for computer labs in the school, personal and social factors; teacher's attitudes, training and experience to create meaningful application of computer technology.

Salpeter (2003) indicated that the process of transition to e-learning system may contribute in the achievement of the desired educational goals; providing the appropriate educational environment for this system, explaining why and how to apply it, and the availability of required devices, equipment, software and skills, and the will to resolve problems that impede the effective application of this system.

According to Zajda & Gibbs (2009), the appropriate environment demands four important factors for the success of the e-learning system at schools. These are: providing the adequate infrastructure, selecting technologies for the instructional content, providing support system for monitoring and evaluating the learning process and providing training system for teachers, which enable them to deal with the various programs and sources of learning.

In the case of this environment availability, Oliver, Disborne, and Brady (2009) expected that teachers' ability to communicate with learners will be improved through, designing varied and quality teaching strategies and learning tasks and activities for student toال الاستماعقراءة صوتية للكلمات interact with the content meaningfully, and providing them with feedback about their learning,

encouraging students to ask knowledge base questions and managing constructive dialogues to develop knowledge, skills, and values.

Furthermore, Zajda & Gibbs (2009) pointed that despite the current wide spread of e-learning significantly in the educational process, there are many schools that have not realized the importance of its application or at least try to activate it. In this regard, Kay (2006) believes that teachers' attitudes and their beliefs play an important role in the decisions taken by the teachers to use technology in their teaching in the classroom. Accordingly, Martin & Shulman (2006) indicated in their study that teachers, who have strong and positive beliefs, use technology in teaching practices more than those who have moderate or weak beliefs. The study proved that the availability of the educational environment for the e-learning system affects teachers' practices of technology.

Therefore, Koivisto, Kumar & Turner (2006) stressed that the continuous training is one of the key requirements of the successful application of e-learning in the school and to increase the effectiveness of Intel program in implementation of school curricula, in addition to the need for providing more administrative, technical and financial support to facilitate the integration of technology in teaching-learning processes at schools to be more efficient and productive for both teachers and students.

Also Harris, Mishra and Koehler (2009) recommended the need to support e-learning initiatives at schools, conducting feasibility studies of e-learning system, providing comprehensive training for teachers on educational technology and how to apply it in the classroom situations to help them develop and implement pedagogical knowledge to integrate technology in educational system.

Methodology

The population and sample of the study

The study population consists of all public schools in the Rusaifa Directorate of Education, which covers (81) schools; (31) boys' schools, and (50) girls' schools. The number of teachers who have been trained in these schools on "Intel Teach to the Future" program was (680) teachers according to the statistics of the Directorate Education by the end of 2009 year. The sample consisted of (120) teachers, who were randomly selected using Cluster Random Sampling to participate in this study, accounting for 18% of the study population.

Study instrument

The researcher developed an instrument consisted of (67) items in its initial form. These items were distributed over five dimensions reflecting the components of Intel program. The process of developing the instrument passed through the following steps; a comprehensive survey of the previous literature pertinent to Intel Teach to the Future program, identifying the dimensions that will be measured, allocating an appropriate number of indicators, which seemed most appropriate for each dimension. The indicators were then grouped into dimensions and developed into an initial instrument for the validation process. The criterion for inclusion as an indicator was whether the indicator was specific and limited in its application for each dimension.

Validity and reliability of the instrument

To validate the instrument, a panel of judges was asked to evaluate each dimension and its items in the instrument based on the following criteria: items clarity, accuracy of the language, appropriateness and inclusiveness of items for each dimension, the suitability of the instrument for the purpose of the study and to propose any amendments to improve it. Based on their observations, some modifications have been made by adding and deleting some of the items according to the percentage of agreement of 80% of the reviewers. The final version included

(43) items distributed over the following dimensions: Skills of determining criteria and asking questions (8), project-based learning (6), using of student-centered evaluation (7), thinking tools (13), meta-cognitive thinking skills (9).

The reliability of internal consistency was calculated by using Cronbach's Alpha Coefficient. The overall reliability coefficient was 0.93. The Five-Likert Scale has been adopted to determine the degree of teacher's application of each item as follows: strongly agree 5, Agree 4, neutral 3, disagree, 2, strongly disagree 1.

Procedures:

After verifying the validity and reliability of the instrument, the researcher did the necessary procedures for receiving the Ethics Approval from The University of Jordan and the Ministry of Education to collect data for the study. After that, the researcher contacted the Directorate of Education for getting a list of the names of all who have been trained on Intel program. They were 680 teachers in 81 schools; 31for males and 50 for females. Then, a random cluster sampling of schools and staff was selected.

After that, principals of selected school were contacted and a visit was arranged to discuss the idea of the study. In the case of agreement, a meeting with teachers who participated in the training on Intel program was arranged for and at the end of the meeting, they were voluntarily invited to participate in this study through responding to the items of the questionnaire, which in fact, does not identify the school or the participant. A sufficient number of questionnaires were left for those who wish to participate. Then, the completed questionnaires were to place in a special box in the reception area at school. As a result of this process, 137 questionnaires were retrieved in the same way of distribution, among which only 120 were completed correctly, and 17 were excluded. After that, data were entered to the computer and appropriate statistical analyses were conducted for the subjects' responses using the Statistical Package for Social Sciences (SPSS).

Results and Discussion

The following criteria were used to assess the degree of teachers' application of Intel program: low (1-2.33), medium (2.34-3.67), and high (3.68 - 5).

Q.1. To what degree do teachers apply the "Intel Teach to the Future" program in implementing the school curricula? To answer this question, means and standard deviations were calculated. Table 1 shows the results

Table 1 shows that those teachers' degrees of application on each of the five dimensions, and their overall combined were low at all dimensions compared to the standards that were set for this study. This finding is consistent with the result of Robertson (2004); Kay (2006), and Martin and Shulman (2006) studies, which asserted that teachers' attitudes and beliefs play an important role in their taken decisions to use technology in their classrooms. Besides, it was mentioned by several researchers; Gulbhar and Guven, (2008) Zajda and Gibbs (2009) Wing (2007) and Chanlin (2007), that there is a need to reconsider the organizational aspects to integrate technology in education. Martin, McMillan, Gresick and Nudell, (2001 & 2002) also drew the attention to consider the importance of teaching environment and school culture to learn with technology at schools.

Table 1
Means and standard deviations for implementing Intel program

Dimensions	Means	SD	Degree of Application
Skills of determining criteria and asking questions	1.94	0.48	low
Projects-based learning	2	0.47	low
Student-centered assessment	2.02	0.44	low
Thinking tools	2.04	0.45	low
Meta-cognitive thinking skills	2.04	0.5	low
Overall	2.01	0.43	low

Q.2. Are there any statistically significant differences ($\alpha \leq 0.05$) in the degree of teachers' application of "Intel Teach to the Future" program in the implementation of school curricula which can be attributed to teachers' qualification? To answer this question, means and standard deviations were calculated. Table 2 shows the results.

Table 2
Means and standard deviations for implementing Intel program according to qualification

Dimension	Qualification	Means	SD	T Value	Sig.
Skills of determining criteria and asking questions	**Graduate** **Undergraduate**	2.00 1.9	0.50 0.42	**1.28**	**0.2**
Projects-based learning	**Graduate** **Undergraduate**	2.04 1.91	0.48 0.44	**1.3**	**0.2**
Student-centered assessment	**Graduate** **Undergraduate**	2.06 1.93	0.46 0.40	**1.44**	**0.15**
Thinking tools	**Graduate** **Undergraduate**	2.10 1.90	0.45 0.41	**2.25**	**0.03***
Meta-cognitive thinking skills	**Graduate** **Undergraduate**	2.07 1.97	0.49 0.54	**1.04**	**0.3**
Overall	**Graduate** **Undergraduate**	2.06 1.91	0.43 0.40	**1.8**	**0.07**

* sig. $\alpha \leq 0.05$

Table 2 indicates that the mean of teachers' estimations of Intel program application on each dimension and on the overall means of estimations at all dimensions were higher for teachers who hold graduate degrees. To examine the statistical significance differences between Graduate and Undergraduate teachers' estimations of Intel program application, T-test was conducted, and results showed that there were statistically significant differences in the degree of teachers'

application of thinking tools that can be attributed to teachers' qualifications in favor of teachers who hold graduate degrees, where the T value was (2.25) for this dimension. This finding was consistent with the results of studies carried out by McMillan, Gresick and Nudell, (2001and 2002); Al-Tarawneh (2006); Bani Awwad. (2006); Daradkah (2006); Martin & Shulman (2006) and Attal (2010) Martin, which, indicate that teachers who participated in the Intel program, and who have graduate qualifications were more likely to implement the ideas and skills learned through the training program. Koivisto, Kumar & Turner, (2006) added that the continuing education and training are among the important requirements for successful implementation of e-learning.

Q.3. Are there any statistically significant differences ($\alpha \leq 0.05$) in the degree of teachers' application of "Intel Teach to the Future" program in the implementation of school curricula which can be attributed to teachers' experience? To answer this question, means and standard deviations were calculated. Table 3 shows the results.

Table 3

Means and standard deviations for implementing Intel program according to experience

Dimension	5<		5-10		10>	
	Means	SD	Means	SD	Means	SD
Skills of determining criteria and asking questions	1.94	0.54	2.02	0.44	1.82	0.43
Projects-based learning	2.05	0.52	2.08	0.46	1.84	0.38
Student-centered assessment	2.02	0.45	2.15	0.46	1.87	0.37
Thinking tools	2.02	0.47	2.14	0.42	1.94	0.45
Meta-cognitive thinking skills	2	0.55	2.1	0.46	2	0.5
Overall	2.01	0.46	2.11	0.41	2	0.43

Table 3 indicates that the mean of teachers' estimations of Intel program application on each dimension and on the overall means were higher for those teachers whose experience ranges between (5-10) years compared to other categories of experience. To examine the statistical significance differences in the mean estimates of teachers with respect to their experience, Analysis of variance (ANOVA) was applied, and Table 4 shows the results

Table 4 reveals that there were statistically significant differences ($\alpha \leq 0.05$) in the degree of teachers' application of Intel program on dimensions of Projects-based learning and student-centered assessment that can be attributed to teachers' experience, where F values were (3.02 and 4.09) respectively. To find out between which of the categories these differences were found, Scheffė test was conducted for post-hoc comparisons, and Table 5 shows the results.

Table 4
ANOVA results for the differences in the degree of teachers' application of Intel program according to Experience

Dimension	Source of variance	Total of squares	Mean of squares	F Value	Sig.
Skills of determining criteria and asking questions	Between	0.81	0.41	1.79	0.17
	Within	26.46	0.22		
	Total	27.27			
Projects-based learning	Between	1.29	0.64	3.02	0.05*
	Within	24.97	0.21		
	Total	26.26			
Student-centered assessment	Between	1.53	0.77	4.09	0.02*
	Within	21.89	0.19		
	Total	23.42			
Thinking tools	Between	0.73	0.37	1.85	0.16
	Within	23.26	0.2		
	Total	23.99			
Meta-cognitive thinking skills	Between	0.24	0.12	0.46	0.63
	Within	29.99	0.26		
	Total	30.22			
Overall	Between	0.85	0.42	2.4	0.9
	Within	20.65	0.18		
	Total	21.5			

* sig. $\alpha \leq 0.05$

Table 5
Results of Scheffe test for post-hoc comparisons between categories of experience

Comparisons	5<	10 - 5	10>	Sig.
5<	-	0.132	0.149	0.328
10 - 5	-	-	0.282	0.02

* sig. $\alpha \leq 0.05$

Table 5 shows that there are statistically significant differences ($\alpha \leq 0.05$) in the degree of implementation of Intel program that can be attributed to teachers' experience between the category (5-10) years and category (10>) years and in favor of teachers with (5-10) years of experience. This result is consistent with the results of the studies conducted by Al shaqran. (2005); Al-Tarawneh (2006) and Al Attal, (2010), which indicated that teachers with this range of

experience were more inclined in the application of what they have learned from Intel program compared to other categories of experience. In this context, Chanlin (2007) indicated that experience is a product of the training process and represents one of the key factors for the success of e-learning in schools. Zajda & Gibbs (2009) believed that the experience is to enjoy teaching the topic and the ability to deal with the various programs and sources of learning, to create applications by the means of computer technology, whereas Harris, Mishra and Koehler (2009) believed that the experience is the ability of how to apply pedagogical knowledge in the classroom situations to integrate technology into school curricula. Through this, teachers' ability to engage students in the learning process will be increased (Oliver, Osborne and Brady. 2009).

Q.4. Are there any statistically significant differences ($\alpha \leq 0.05$) in the degree of teachers' application of "Intel Teach to the Future" program in the implementation of school curricula which can be attributed to school's level? To answer this question, means and standard deviations were calculated, and Table 6 shows the results.

Table 6
Means and standard deviations for implementing Intel program according to school level

Dimension	Elementary		Secondary		T Value	Sig.
	Means	SD	Means	SD		
Skills of determining criteria and asking questions	1.79	0.39	2.01	0.5	2.34	0.02*
Projects-based learning	1.86	0.41	2.06	0.48	2.22	0.03*
Student-centered assessment	1.88	0.35	2.08	0.47	2.31	0.02*
Thinking tools	1.93	0.41	2.09	0.46	1.77	0.08
Meta-cognitive thinking skills	1.92	0.54	2,09	0.48	1.78	0.08
Overall	1.88	0.36	2.07	0.44	2.24	0.03*

* sig. $\alpha \leq 0.05$

Table 6 shows that there were statistical significant differences in the means of teachers' estimations at all dimensions and overall estimations for the degree of teachers' application of Intel program. To examine the significant differences in the means of their estimations, T-test was conducted, and the results showed that there were statistically significant differences ($\alpha \leq 0.05$) in the degree of teachers' application of the first three dimensions that can be attributed to the school level, where the T values for these dimensions were (2.34), (2.22), and (2.31) respectively. The overall of T value was (2.24). These differences were in favor of secondary schools. To explain this result, teachers' written comments indicated that there is a prevailing belief among teachers that the dimensions included in this program focus on developing higher thinking skills and that fit, from their point of view, high school students more than students in the basic stage. Additionally, the focus on the application of Intel program is in high schools more than basic for its importance for students to pass the general secondary examination, having Information and communications Technology major. This result is consisted with results of the studies conducted by Culp, Shankar, Gersick, and Pederson (2001); Harris, Mishra and Koehler (2009) and Morrison, and Lowther (2010), which confirm the need to support teachers through offering both technical and instructional assistance to integrate Intel Teach to the Future program into their curricula.

Recommendations

In conclusion, the findings of the previous studies conducted on Intel program in the fields of education and educational management indicate the improvement of teachers' ability to apply the program with a high degree of efficiency provided that educational policy decision-makers take these findings into account and that the suitable educational environment for the e-learning system is available. In the light of study findings, it is possible to recommend the following:

1. The results of the first question indicate that the degree of teachers' application for Intel program was low compared to the standards set in this study. This result draws attention to the importance of verifying the level of training, adequacy and mechanism to achieve the objectives of this program, and emphasizes the importance of conviction of teachers and modifying their attitudes towards the implementation of the program in students' learning at all levels and curriculum. In addition to that, it shows the need to review the infrastructure and technical capabilities and management available to improve Intel application program in the schools.
2. The results of the second and third questions indicate that there are significant differences in the degree of teachers' implementation of Intel program due to academic qualifications and experience variables in favor of teachers who have high qualifications and with an intermediate experience; 5-10 years. Given the importance of these variables in promoting the ability of teachers to deal with the various programs and learning resources to create meaningful applications in computer technology, the researcher recommends providing more technical and teaching assistance to other teachers who want to be able to apply the program in the implementation of the curriculum they teach in their classrooms in collaboration with colleagues who participated in the program or through designing professional development programs that focus on computer technology to help students achieve the intended learning objectives and the development of higher-order thinking skills among students and thus improve the quality of their learning.
3. The results of the fourth question indicate that there are significant differences in the degree of teachers' implementation of Intel program due to school level variable in favor of secondary schools. It appears from this result that there is a need to educate teachers and modify their beliefs about the impact of teaching thinking programs in the development of higher-order thinking skills of elementary students through the application of the skills included in Intel program in the implementation of the school curricula.
4. Being guided by the tool of study and its results, educational policy makers might work on the review of the development of Intel training program. The outlook for the analytical results of this study seems exciting. There are many questions that need further research, such as: Can teachers apply the skills included in Intel program as the product of the training process? Are teachers effectively convinced this program in student learning? Does the program effective in developing higher-order thinking skills among students? Does Intel's software help teachers to bridge their educational theories into practice? Does teaching strategies included in the program enable students to learn the skills included in the training program? Does this program contribute to enable students to acquire the conceptual structure of the school curricula (concepts, higher order thinking processes and methods of enquiry)? Does Intel program contribute along with other electronic programs in access to integrate school curricula? Finally, does Intel program help in the development of leaders in the field of teacher training to integrate technology in their schools?

Answering these questions can have positive effects contributions in guiding the future of educational policy in Jordan, but this requires a shift in the educational process to become more democratic so as to increase the margin of freedom for teaching thinking strategies; intuitive,

creative and reflective thinking, decision-making and problem-solving. It also requires the restructuring the educational process to focus more on the quality than social reproduction, in addition to provide an appropriate learning environment for e-learning system for successful integration of technology in the educational process.

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Editor's Note: Proliferation and widespread adoption of mobile communication devices opens opportunities to learn anywhere and at any time. There are many kinds of devices, mobile phones, i-phones, droids, tablets and pads, with different technical constraints. However, technology allows all of these devices to share and interact with text, pictures and sound so that e-learning, for the most part, becomes device independent. Since the number of mobile devices in daily use is of the same order or greater than the number of PCs, the results in a tremendous expansion of distance learning options for today's students. Also, many applications of value to students, such as Google and email, have long since graduated to mobile devices.

Mobile Learning Technology

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Abstract

The objective of the current study was to develop a cognitive system, in which the characteristics of mobile learning technology, its nature, context and benefits are presented. The majority of previous literature is in agreement that mobile learning is one form of teaching-learning process that possesses similarities and differences with e-learning. It is based mainly on the concept of wire and wireless communication technologies where the individual learner can access the learning material, lectures and seminars whenever he desires and wherever he is, whether inside the classroom or outside it. This creates a new learning environment in the context of the different learning settings. Such settings are based on interactive cooperative learning, the facility to share information among individual learners and between learners and the lecturer or teacher.

The technologies of mobile earning consist of IPod, MP3 Player, Personal Digital Assistant, USB Drive, E-book Reader, Smart Phone, Cellular Phone, ultra Mobile PSs, General Packet Radio Services (GPRS), Communication, Bluetooth, Wi-Fi, Laptop, Scan Pens, Storage Media and learning Mobile Author.

It was found that the main challenges hindering the implementation of mobile learning in education range between access and protection technologies for the learning content, the availability of devices adequate to perform tasks targeted for mobile learning, their storage capacity, time-to-load, and other educational challenges concerned with the design of educational programs to meet the requirements of mobile learning and differences between individual learners.

Finally, obstacles such as lack of computer literacy among both the teacher and student populations, their underestimation of the value and opportunities of such learning technology, the high cost for inputs of such learning technology, lack of appropriate integrated educational strategies to ensure the adoption of such learning technology. These were some of the main obstacles hindering implementation of such technology in the different educational domains.

The study concluded with the need to reconsider the inputs of the teaching process and the methods used to be better able to absorb the technological and cognitive revolution in communities, and thus be able to address the different needs of student populations and keep abreast with the modern communities we all live in nowadays.

Keywords: learning technology, Mobile learning, e-learning.

Background

The process of communication and the exchange of information between people have always relied since the beginning of man history on the use of different senses, the surrounding environmental and the community the individual lives in. to achieve the objective of communication, man since the beginning of history have used different methods to communicate

with others. To meet he different demands of life, to communicate with others, to express his feelings, ideas and opinions, man used body language, statues, symbols and scripts, and were his main mans to communicate or talk with others.

The use of learning technologies have evolved over several stages, and each use of these were a reflection of the role played by education in the historical stage. They are also related with the most dominating learning theories within a specific historical period. Finally, it is related with the teaching methods dominating in a given time period. They are considered an integral part of an integral learning and teaching system. The focus began on the selection of the different learning material, equipment, tools and how to effectively using them in the context of the teaching learning process, which contains many spatial, temporal, material and human elements, taking into consideration in the same context the learners' individual differences to achieve the desired goals in this environment, the meaning of learning technologies has exceeded only using educational learning and teaching, but the focus was on the inputs, operations and outputs of the educational process, or what is termed systems pattern. This pattern emphasizes on the integrated perspective of the learning technologies role in the learning teaching process and its relations with other elements in the educational process, as the use of learning technologies is designated to achieve the required goals consistent with the used curricula, tools, educational goals, teaching methods, human and material available resources, and the dominating educational administration, in addition to other factors (Brown and others, 1995).

The term learning technologies is one of the elastic terms subjected to many interpretations, and this made it hard to define the main elements of such term. This is due to the rapid changes which appear every day in the different domains. As known, any beginning starts simple; it is well defined, and easy to define. Then, this thing becomes more complex overtime, thus it difficult to define the elements of such thing. This applies to learning technology, which begins in most cases with simple applications, and these applications start to be more complex. Technology in general can be traced back to the beginning of the human history, and can be seen in the different domains of the life we live nowadays. Technology plays a vital role in defining the present and the future for the quality the individual lives. Technology is one of the most changing factors in the life of individuals, and the change captures the quality of the technological applications and in all levels. In the simplest definition, technology is a thinking approach, a style to function, tools to be used to achieve a certain goal, and is one of the cognitive domains to ground the bases of technological applications. Furthermore, technology is one of the acquired experiences and is also a problem solving method (Kloube, 1995).

Hawkins and Collins (1995) pointed out that the use of technology in education promotes the different educational communication. In their opinions, this increases the opportunities to participate, engage, think and interpretation to provoke some kind of balanced development in the skills, emotions and cognition. They are also a method the instructor can use in providing the individual learners with analytical skills via the use of open discussion, research and assessment to achieve the desired goals.

The relation between technology and education appears in behavioral, cultural, educational and social effects resulting from the use of any technological applications for a long time period in the life of nations. The importance of technology emerges from the ongoing relationships between means and ends, and the nature of such relation implies what are the societies which can be describes as technological ones. For example, one cannot teach how to learn unless he teaches first what to learn.

However, the educational industry has entered the fourth stage of its development that is the use of Communication and Information Technology (ICT). This revolution in the educational

industry was preceded by three previous ones. Carnegie Foundation summarized these three revolutions as follows:

1. The invention of writing.
2. The use of textbooks in schools after the invention of printing.
3. The appearance of mainstream education.

The fourth revolution can contribute in the achievement of the mainstream education by using and employing e-learning technologies, communication and networking technologies to facilitate the access of different learners to the learning material. Such technologies are also capable of promoting learners' individual skills, meeting their desires and needs. Modern educational trends emphasize the need to find the most effective educational methods to provide learners with the optimal interactive learning environment to capture the attention of individual learners, to provoke their interests, to motivate them to learn, to share information and different ideas with other learners. In this context, the student is not a passive learner; he is an active participant in the learning experience. He always searches for the right information with all available tools. In doing so, the learner employs different practical and scientific procedures such as observation, synthesis, comprehension, analysis, inference, and data interpretation. These activities are conducted under teacher' supervision, guidance and assessment in the classroom. The prevalence of modern technologies such as the use of mobile phones, computers, Internet, and all related applications such as the use of multimedia and other computer software among schools students and university students. These applications are one of the most effective means to create rich learning environments and other forms of educational systems rich of learning resources, training, rehearsal, development, and self-development opportunities able to meet the needs and desires of students, motivate them from one hand, and to serve the educational process and promote educational outcomes from the other (Al - Ali, 2004).

In his study, Luecy (2004) argues that the increasing use of learning technologies, communication tools and educational media in the different activities has become one of the prevalent characteristics of the world today. It is also based on deeper understanding for the role cognition and human capital play in the development of educational system and the overall progress in societies. Nowadays information technology is the basic element in the economic development. The rapid advances and the ongoing changes in economic technologies not only effect in the size and momentum of development, but also in most life domains. With this vast development in information technology and the processing methods used in information technology comment, production resources, production tools and technology distribution channels information technology has become a basic element in economic development. It is estimated that the information technology industry has exceeded an economic value of more than one trillion U.S dollars in the new millennium. It also estimated that the users of mobile phones will total more than 1.5 billion people in 2010 (Hamami, 2006). This has a great effect in the entry of modern societies to post industrial revolution era. The new revolution is an electronic one, a revolution appearing in the second half of the 20th century which emerged with the use of computers, software, CDs, multimedia, satellites. These all electronic tools resulted in the development of communication systems, computer networks and information technologies which have taken various forms. All these information systems seek to acquire process, store, retrieve, distribute and use different forms of information. All these factors in addition to other factors have contributed in the emergence of what is now termed as e-learning. e-Learning is one of the tools to make distant geographical areas closer. At the end of the 20th century and the beginning of 21st century, mobile phones increased in use and prevalence rates, announcing the birth of telecommunication era and the significant role such telecommunication tools play in the different life domains (Al- Faqeeh, 2010).

These developments and advances had direct and significant effect on learning and teaching process. The traditional models of learning and teaching are no longer most effective tools for teaching. Teachers are no longer the center of educational process and textbooks and schools are not the sole source of "information" with the access to technology, information technology era, more focus was on the integration of telecommunication technologies, mobile and portable phones in education, leading to the appearance of new forms of learning, that is mobile learning as one domain of distant learning applications. Mobiles' learning is now considered a complementary e-learning model to complement the current practices in education. Mobile learning calls educators to use modern mobile technological tools and devices in learning to provide a new form of teaching. Such new form of learning and teaching is compatible with current modern trends resulting from globalization, is consistent with individual characteristics of learners and textbook used in school subjects. Mobile learning is cheap, enables the transfer of educational process out of schools and traditional classrooms, thus provides spatial and temporal freedom for both teachers and students (Al- Mahdi, 2008).

The concept of mobile learning is traced back to the beginnings of 1950s of the 20th century as in appeared in the use of mail in education. This concept evolved in the 1980s and took different forms and several terms were adopted to describe such form of education such as movable learning, to mobile learning and were termed in the last few years as "portable learning". In the last few years, networking learning of third generation learning were terms used to describe such learning. But, and with the advances in communication systems, information networks, internet and the wide use of computers, and with more focus of knowledge, how to acquire it and the transfer of knowledge via the use of rail able tools in doing so, and with the different advancements that exceeded expectations different forms of education such as virtual learning, virtual classrooms, on –line learning, internet based learning, digital learning, e-mentor, blended learning emerged. The use of different terms must not contribute in the appearance of different kinds of confusion in the educational process, but it must be seen as one opportunity to capture the various technological advances in the interest of education in general (Haddad, 2008).

Significance of the Study

Significance of the current study emerges from the fact it attempts to identify the uses of advanced technologies in the educational field, such as the use of telecommunication tools, especially mobile technologies in a new form of education termed mobile of portable learning. Mobile learning is one form of distant learning and an extension of e-learning applications which has invaded the world with the use audio, visual, cognitive, cooperative and interactive means via the use of smart and digital electronic devices in an attempt to create a direct, dynamic, ongoing learning environment, an environment that is not constrained by spatial and temporal boundaries, leading to the elimination of traditional classrooms, routines and imitation. Such form of learning enables the individual learner to move freely in the learning material, able at the same time to access to knowledge sources whenever and whenever the learner desires. The current study will cover a wide range of topics relating the context of mobile learning, its elements, characteristics, advantages, and benefits. The study will identify the role played by technology in supporting education, solving educational problems, promoting educational outcomes, linking it with real life situations, and addressing the similarities and differences between e-;earning and mobile learning.

Problem of the Study

The current scientific advances and the technological development has been the main factor in the appearance of mobile are, as technological tools are transferred between individuals and mostly available for different learners, even put in the pocket of all interested in mobile technologies. The use of small technological tools is available anytime and anywhere the individual wishes to

use such technologies. Mobile phones are the major tool used in life nowadays as it is one of the most prevalent technological tools. Some studies have indicated that most learners have access to mobile phone regardless of their age, gender and socioeconomic background

Some authors have indicated that the number of mobile phone exceeded the total number of people living in a certain country (Al- Shawbaki, 2005). This fact has motivated some governments, both in developed and developing countries, to use all new innovations in the teaching- learning process. Such innovations have been used to develop national educational systems, to use the educational inputs in the best methods available to better serve individuals and communities in general. Mobile learning technology is one of the most interesting topics in daily discussions, and is one of the most addressed issues in modern educational field, especially in light of the technological advances we live nowadays. Furthermore, mobile learning is one of the most effective means to renewing the different school subjects as it is based on the integration of modern technology in different learning setting, ones that are based on cooperation and interaction between all learners designated to create enriched learning environment able to meet the individual needs of learners, increase their achievement productivity reaching to high quality learning outcomes able to meet the vital demands of current stage (Al-Harethi, 2008).

Thus, the current study will shed light on the concept of mobile learning, or what is termed by third generation of online learning in light of the rapid changes and rapid cognitive developments and scientific and technological advances. Such changes have dictated the new trends in the educational field, the new responsibilities and tasks to be assumed by education, which have motivated both students and teachers to think about the significant stage education experiencing to be more qualified and competent to deal with technological advances.

Objectives of the Study

The current study sought to achieve the following objectives:

To shed light on the concept of e-learning including mobile learning.

To define the elements of learning technology and mobile learning.

To focus on the elements and characteristics of mobile learning environment.

To identify the similarities and differences between mobile learning and e-learning.

Questions of the Study

The study addressed the following questions:

What is the nature of mobile learning technology?

What are the elements of mobile learning technology?

What are the benefits and advantages of mobile learning technology?

What are the main challenges hindering the implementation of mobile learning technology?

Study Design

The researcher will adopt the analytical descriptive approach in collecting data, information, facts concepts and opinion related with dimensions of the current study. The main objective is developing an integrated cognitive system in which the problem, background, objectives and significance of the study become more apparent in the context of the current study. In doing so, the researcher will review previous literature addressing the concept of mobile learning. In

addition, the researcher will review some international experiences in the implementation of e-learning to make use of such experiences in identifying the concept of mobile learning contexts, justifications, elements and its use in the educational process.

Procedural Definitions

e-Learning: teaching method in which modern communication tools, computer technologies are used in the context an interactive process between all involved in the educational process to achieve specific objectives serving both individuals and societies at present and in future.

Mobile Learning: A new linguistic term used to indicate the use of wireless cell devices mobile and portable, and all related technologies in the context of a cooperative learning teaching context. Mobile learning is an extension for e-learning and is considered one form of distant learning.

Learning Technologies: A systematic process to plan assesses and implements different domains of the learning teaching process. Learning technologies is are designated to achieve specifics, well defined and clear special and general objectives based on the results reported in educational research via employing a set of human resources and various learning resources to achieve an different learning.

Study Plan

After discussing the study background, significance problem, questions, the study will adopt five main dimensions:

First dimension: The concept of learning technology and mobile learning.

Second dimension: The context and technologies used in mobile learning.

Third dimension: Mobile learning characteristics, advantages and benefits.

Fourth dimension: Similarities and different between e-learning and mobile learning.

Fifth dimension: Challenges and difficulties hindering the use of mobile learning in education.

First dimension: Learning technologies, e-learning and mobile learning

Learning Technologies:

Some people believe that learning technology is only limited to the use of computers, internet, multimedia and learning material in the teaching learning process. This belief is also supported by the nation that the main domain for technology is related to electronic minds, but the fact is for a way from this belief. Technology is concerned with planning, designing, implementing, and assessment of different domains in the learning teaching process based on results reported in the educational research and human resources and various educational resources according to predetermined general and special educational goals in an attempt to achieve high quality education (Kemp, 1995). In light of this nation, the concept of technology goes beyond the use of devices and educational tools. It also exceeded the concept of traditional learning and teaching and technology has become more with how to use modern educational systems and methods employing all modern potentials computer networks (internet, intranet) and all related software to provide best educational products with low cost and high speed, without complexity, away from spatial and temporal constraints. The most significant factor in humanitarian science is not the use of different equipment and devices, but is more concerned with the adoption of a systematic cognitive approach which is the basic element in the functions of such equipments and devices and how to use them to achieve effective, high quality predetermined objectives (Press, 2003).In

his study, Al- Ghazaw (2003) emphasized the role of educational systems in their quest to re – innovate themselves and their ability to make a radical change in providing various educational products and services with high quality, which may reflect the integrated through perspective toward the inputs of educational systems and their reciprocal relations with other systems.

e-Learning:

Some teachers and students think that their use of personal computers or data show projectors in the classroom, or to go to computer labs and to sit in front of computer and using the internet is basically the use of e-learning technology. Others think that e-leaning is achieved through distributing computers and multimedia on schools, universities and offices. The prevent belief is that the main use of e-learning is smart and electronic minds which are the fundamental characteristic of scientific and technological progress. On other hand, the use of e-learning technology has become one of the main aspects in education in the last few years, several definitions have been proposed to define the concept of e-learning, several conferences were organized and many studies have been conducted addressing the concept of e-leaning. Mass media channels have dedicated many programs discussing the use of e-learning, to identify its objectives and role in the educational process (Salim, 2004). But, the reality of e-learning is far away from these beliefs, as it is in fact an integrated educational system (inputs, operations, and outputs) that include the following elements:

1. **Material components**: These include infrastructure, computers and high speed internet networks.
2. **Software**: These include information management systems, which are internet based systems providing management, and follow- up for the individual learner concerning the access to computers, how to use them, enabling the learner to use the educational services, managing educational content. Information management systems assume the following functions:

   Recording learner's data.

   Scheduling courses and educational plans.

   Learners access to learning material.

   Assessment and test.

   Communication between learners via the use of e-mails or other forms of communication tools.

   Follow-up learners performance - content management systems. Learning Management Systems are advanced systems controlling the learning content and may be open of closed.

3. **Human resources**: These include system manager, educational designer; these include system manager, educational designer, and some specialists in different forms of graphic, programming, quality control and support technicians.

Regulations and rules:

These include assessment methods student's attendance publication and quotation rights individuals and information privacy, credentials (Abdel Majed, 2009).

Thus, e-learning is systematic method of learning using modern communication technologies such as computers network, software and audio- visual multimedia, graphics, search engines, e-libraries, e-gates, whether they are provided via distant learning technologies of provided in the classroom. The most significant aspect here is that the use of e- leaning is far beyond the use of machines, learning tools, and random traditional methods, it is in fact a complete revolution based

primarily on the revolution in computer technology, software and communication. This integration is no a mere arithmetic issue, it is more concerned with doubling the technological and scientific production in the least time, with the least cost and the most effective means possible. Such approach emphasizes the integrated perspective of e-learning system and its mutual relations with other forms of systems. e-learning plays a vital role in transforming traditional education to the modern world, a world relying on modernization innovation, promotion of educational outcomes to keep abreast with economic development plans, work force market, and consistent at the same time with student's needs, modern developments and societies aspirations in general (Moussa, 2009).

Mobile learning

The term mobile indicates mobility in language dictionaries The concept of mobile or distributed learning can be traced back to the 1980s when mike wiser used the term "distributed computerization " indicating the increasing use of computers in the various domains. People engaging in a computerized electronic environment means that everything is computerized, and digital processing has entered life domains. The use of computerization is no longer limited to computers conventional uses, which consist of CPV, Keyboard and screen, most computers are operating using microchips, and this includes devices used in education, starting from conventional personal computers to digital cameras, and e-book reading devices, which in future (Khamis, 2010).

Mobile learning is a form of combinational learning which consists of a combination of e-learning and teacher's instruction. In this form of leaning, student's gets the available learning material and multimedia on the Internet and the teacher directs him to related information and required tasks. Mobile learning is based on the constructive approach in learning via the use of discussion, constructive learning activities and listening to lectures thought the available communication channels. Therefore, both teachers and students need to understand the complex relationships, cognitive tasks and learner's social – emotional attributes to be able to create social educational environment that have positive effects on individual students (Attewell, 2005). Mobile learning is an electronic educational system based on wire and wireless communication channels, and it enables the learner to access to the learning material, lectures and seminar anywhere and whenever he desires, and without the need to be in classroom. Vavaula and Shaples (cited in Dahshan, 2010) - proposed three methods to enhance the effectiveness of mobile learning:

To use time as effectively as possible.

To liberate learners from spatial constraints.

To address other life domains.

Such contexts create in turn new educational environments in the context of settings based mainly on cooperative learning, facilitating information exchange and transfer between learners from one side and lecturers or the others. It was argued that mobile learning is the use of mobile devices in teaching learning, training, learning task management, homework and assignments management and other educational domains. Mobile learning is accessible to the majority of students, it is easy to use and can be used in any mobile electronic device. In sum, mobile learning is not just an extension of e-learning. (Behia, 2010).

The added value provided mobile learning to the learning teaching process includes two domains:

1. Cognitive, represented by mastering reading, writing mathematic and research skills.

2. Educational, represented by changing behavior, and the acquisition of life skills and learning motivation.

Thus, it can be said that mobile learning is a true feasible interpretation for distant learning philosophy based on expanding learning opportunities for all individuals seeking to learn, reducing the economic cost for learning compared to traditional forms of education, as distant learning philosophy emphasizes the rights of all individuals to capture all available learning opportunities without any form of spatial or temporal Constraints. In distant learning environments, the learner is able to continue his learning at his own pace, and based on his previous experiences and skills.

Distant learning has been very successful in providing an educational service compatible with the needs of all students needing such an educational opportunity, and it enhanced the notion of self–learning, which all contributes on deeding the concept of educational democracy (Al-Oraini, 2003).

Second Dimension: Mobile Learning Context and Technologies

Mobile Learning Context:

Designing mobile learning context is not limited on using devices and cell phones, but mobile learning must be an open dynamic system, in which software and technology are fully integrated with tools, devices and development means so using and re- using all these elements on objective, logical and accepted standards to promote the flexibility and efficiency of distant learning in general (Desmond, 2010). Thus, mobile learning context include the following:

Applicable services, which contain teachers' and students' service such as information services, library, cards and language translation…etc.

Integration through web services between content and content applications, within an applicable frame as it is possible to transfer data, sound, video, graphs, and files and to dissimilate content using safe management tools.

Delivery services, which are used to deliver learning content and learning material via internet using wireless devices such as mobile phones, e-mail, wireless personal computers and digital assistant device.

Individual services and these contain teacher's learners and administrator services and the interaction between these stake holders.

Mobile learning context is similar to learning setting as the individual learner can engage in the learning environment whenever and wherever he desires. Mobile learning implies the existence of learning opportunities everywhere and at all times. One cannot see mobile learning, but it is easy to access learning opportunities using it through mobile or portable devices. Mobile learning context contain educational entities, various portable devices connected using wireless networks with each other in an open space, a space that provides the learner the opportunity to interact with such connected entities (Al- Dahshan, 2007). Such entities can be defined as follows:

Laptop, pocket computers, mobile phones, e- book readers and digital aids.

Wireless technologies such as Bluetooth and Wi-Fi.

Doctors used to verify students attendance in different courses.

Mobile learning context sever, learning strategies and database, as the server manages network resources while strategies support students' understanding through interaction, feedback and analyzing students' responses to questions posed, analyzing their responses in group discussion

and providing them with needed information. As for the database, it stores all data concerning electronic devices, user and interaction between both of them.

Mobile Learning Technologies

1. **I Pod Touch**: Portable media player which enables users to upload music, e-books, images and videos, I pod contains address book, calendar, storage, devices, e-books reader, information and files exchange, projects collaboration between learners and lectures recording, high cost of such technology is the main reason hindering the accessibility by all students for such technology. Furthermore, it only provides one –way communication, thus no interaction is possible using it. Finally, I Pod has a limited screen.
2. **MP3 Player**: To download music, audio files, and to listen to audio lectures. MP3 contains movable parts as opposed to CD's. it provides high quality sounds, but cannot be used in interactive settings between teachers and students or between individual students.
3. **Personal Digital Assistant**: A devices carried in hand or can be put in pocket. It combines between computerization and internet access, and it contains in one system networks, reminder, address book, productive tools Bluetooth and W- phone technology. It is equipped with a special pen, and uses sounds, videos and flash films as players. It is able to show documents, and provides users the opportunity to access internet, web contents and text message. It can be used for complete storage application, and contains a clear, easy to read screen. It combines computerization applications and Communication tools in one device. Data can be entered using keyboard, or other technologies. The main disadvantage of such technology is that it is bigger than other mobile devices, and has limited capacity to enter e-mail without the use of other entry technologies.
4. **USB Drive**: A complete device for data storage. It is a small portable engine compatible with all modern computers. It can store huge numbers of lectures, seminars, courses, projects, audio files and videos. It can be used to transfer files from home to school, and vice versa. One of its main disadvantages is that it is used only for storage purposes.
5. **E-Book Reader**: It is used to read texts, and can be used to read hundreds of e- books, newspaper and journals. It searches complete texts, easy to find students can use it to download textual learning material, e-materials, and textbook and to conduct research. It contains a clear, big screen to facilitate reading, even in dark places. In contains phosphoric digital signals, allowing users to read texts showed on screen. The main disadvantage is that its uses are limited to reading e-books and has a limited computer capacity.
6. **Smart Phone**: A devices that combines between cell phones applications, a camera, personal digital assistant, MP3 player, and access to internet. Students use smart phone to download sounds, video clips, and audio lectures. Students can switch on sounds, video clips, movies, flash, while showing and editing text documents and access to e-mails, sending textual and immediate messages. Smart phones can also be used for complete storage applications, interactive learning, and international cooperation. Smart phones combine the applications of communication, and computerization within one integrated system. Nineties, the major disadvantage in smart phones is that it contains a small screen, making surfing the internet and reading texts hard. Furthermore, the keyboard of smart phones is small and difficult to use, text entry is hard task and is expensive compared to other computer applications (Salim, 2006).
7. **Cellular Phone**: Cellular phones are used in SMS and MMS messages to send and receive visual, audio, cartoons, colored, normal, short text and WAP messages. Wireless application protocol is an international standard containing specific communication rules and measures. Such rules and measures were agreed upon by a group of companies, and

it helps users in accessing internet using wireless channels via the use of portable micro wireless devices such as mobile phones, and personal digital assistants. Such technological applications can be used in e-mails, pocket computers, and smart phones. It can also provide radio packages services, a new technology allowing mobile phones access to the internet with hyper speed, while users can also receive data, and files, store, retrieve and exchange them using wireless channels.

8. **Ultra Mobiles**: Students use ultra mobile to download sounds, videos, audio lectures, surfing internet, sending e-mails, text message, entering web and other communication channels and networks applications.
9. **General Packet Radio Services** (GPRS): A modern technology allowing mobile phones to access the internet with hyper velocity and the possibility to receive data, files, store and retrieve them using wireless channels.
10. **Communication, Bluetooth and Wi-Fi**: such application is used to do scientific experiences, research, interactive learning and international cooperation. The main disadvantage of such application is high compared to other computers.
11. **Laptop Table**: Laptop table is a functional device containing Bluetooth, Wi- Fi and internet application. The main advantage of such application is the ability to transfer sound effects, identifying line, surfing the internet, and transferring video clips and audio lectures, sending e-mails, and immediate and text message, entry registration to websites at home and school. This facilities interactive learning conducting scientific studies and research international experiments and international cooperation. As for the disadvantage of laptop table, it can be summarized in high cast, difficult to carry while moving from one location to other and cannot be used while traveling.
12. **Learning Mobile Author**: A program that helps teachers and supervisors in uploading their learning material without referring to programmers. Such application contains a simple approach to upload interactive content combined with sounds, videos and text in different languages.
13. There are other computer devices, such as scanners and storage media via USB, digital video players, digital goggles that present information from wireless computers.

Third Dimension: Mobile Learning Characteristics, Advantages & Benefits

Mobile Learning Characteristics

Communication technology is one of the leading scientific fields nowadays. Most technological applications such as using the internet computer software, internet and mobile phones include most activities and domains individuals and organizations engage in, as they have the potentials to achieve two major functions

Expanding the possibility to access any piece of information.

Computer applications are active tools to develop individuals' mental cognitive, performance and attitudinal abilities (Arafat, 2010).

The use of e-learning technology has increased widely in education, and these uses have taken many forms such as mobile learning, which is an extension of distant learning. As this form of learning is fairly modern, and due to its significance, several studies addressed it, including

Mobile teaching: The future of learning in your hand.

Mobile learning: The next generation of learning.

Technologies: Transforming the future of learning.

Literature Review in Mobile Learning.

Several international scientific conference have been organized (Awad, 2007) addressing the concept of mobile learning. These conferences identified the following characteristics for mobile learning:

Mobility: The transformability of learning away from a fixed point, without any spatial and temporal limitations, away from traditional classroom environment.

Adaptability: The individual learners is given adequate freedom and his abilities and desires are respected when interacting with all educational community members and without the need to site in front of computers screen is specific time in predetermined locations.

Freedom: The individual learner is given adequate freedom in and out educational organizations.

Interaction and Collaboration: Students interact and collaboration with each other and with teachers.

Access: The students can access learning material whenever and wherever they are. Easy to travel with educational devices due to their small size.

Advantage of Mobile Learning (Dahshan and Yunis, 2009)

One form of e-learning based mailing on the notion of assimilating learning, the mobility of it beyond spatial and temporal limitations.

Providing a deeper concept of what is described as achieving the best results anyplace and in anytime.

Transforming from learning based on specific time and location to a concept of learning accessed anyplace and at anytime.

The ability to deliver audio, visual and text material in distant learning forms.

Controlling learner's conscious response and information flow.

Providing the opportunity of social, interactive, and networking learning.

Saving time and cost for learners.

Velocity of storage and operating efficiency.

Cleaners of audio, visual presentations, and scientific designs, figures and charts.

Benefits of Mobile Learning:

In addition to the characteristics provided previously, Corbel and Valdes (2009) proposed the following benefits for mobile learning:

More focus on learners and the ability to meet their needs.

Supporting students with high competence in using technological devices.

Supporting student's special needs.

Learning material can be accessed anywhere and at anytime.

Facilitating cooperation between learners.

Reducing cultural constraints between students and teachers via the use of different communication channels.

Depending on more numbers of laptop compared to PC's.

Using styles pen in writing in educational devices makes learning easier compared to using keyboard.

Texts cut and paste applications via the use of e-mails, personal digital assistant and infra-red are more effective procedure to do such applications.

Engaging youth learners in different learning opportunities via the use of games and other interesting learning activities.

Bridging the digital gap as mobile devices are cheaper than PC's.

Mobile learning is one approach that depends on the use of various integrated learning activities.

Mobile learning can supplement and support learning process.

Mobile learning provides some learning activities such as games and stimulation.

Maps and schemes can be drawn directly on microcomputers screen using software.

Mobile learning helps students built their own video clips libraries in specific school subject.

Actual learning environment is what mobile learning uses in providing learning opportunities.

Fourth Dimension: Similarities and Difference between Mobile Learning and e-learning

The different between reading books paper and surfing the internet is in the way to access information, and the difference between mobile learning and e-learning lies in the way learners access the learning information. But, the technological development, the current status, and the transformation from using wire communication channels to wireless communication channels have resulted in the emergence of similarities and difference between e-learning and mobile learning.

Similarities:

Each of them needs an infrastructure and a wide community base in dealing with wire and wireless electronic computer technologies.

Each of them needs a high cast technological system.

Both provide students with digital literacy focusing on information processing.

Students are focus of learning process in both models (Self- Learning).

Students in both learning models can access and surf the internet.

Both learning models allow communication between individual students and between students and teachers anywhere and at any time from one hand, and communication with local and international on the other via the use of e-mails and text message.

The learning content in both learning models is delivered in the form of texts, images and video clips.

Both learning models depend on developing problem solving and creative thinking skills among students.

Both learning models are capable of providing learning opportunities to many students.

Learning material can be updated continuously in both learning models.

Differences:

E-learning use fixed, wire devices such as PC's, but mobile learning uses wireless communication devices such as cell and smart phones, microcomputers and personal digital assistants.

In e-learning, access to the internet is achieved the available telephone service, while mobile learning uses IR when accessing the internet anywhere at any time.

In e-learning, messages are exchanged via the internet while MMS and SMS messages are used to exchange information between users.

In e-learning, it is difficult to transfer books and files between individual learners, while in mobile learning, Bluetooth and IR technologies are used to exchange books and files among learners.

Storage applications used in e-learning are more effective than ones used in mobile learning.

Communication channels used in e-learning have low protection levels as learners use more than one device, while mobile learning provides users with more protection as learners use their own devices to connect with others.

It is hard to pass devices through learners in e-learning while these devices are easy to pass between learners in mobile learning.

Fifth Dimension: Challenges Hindering Implementation of Mobile Learning

The benefits and advantages of mobile learning are countless, but some challenges hinder the implementation of such learning model. (Salem, 2006; Abdullah, 2009) list some of them:

Technological Challenges:

Printing and distribution rights for learning materials.

The available of required devices and potential to meet the rapid flow of information.

Battery short virtual age, small screen and keyboards used in mobile learning applications.

Low storage capacity.

Continuous advances in mobile learning applications. Thus, keeping abreast with them is a hard task.

Educational challenges:

Learning process assessment in and out of traditional classroom.

Cheating in learning process.

Digital gap between different students using mobile learning applications.

How to support learning process by using various courses containing different learning contents.

Designing and preparing educational curricula.

Mobile learning position towards learning and teaching theories.

Academic and personal disorders among some students.

Technological gap between individual students.

Some students may develop an isolative attitude.

Cartoons are hard to use in mobile learning.

Both teachers and students need adequate training on the use of mobile learning applications.

General Challenges:

High cost for some mobile learning devices.

Needs a well-defined strategy.

Differences between e-learning and mobile learning conceptualizations.

Geographical boundaries.

Some learning materials may need editing using various forms.

Some students may use mobile learning applications out of context.

Easy to breach.

More vulnerable and less endurance compared to PC's.

Needs an infrastructure, wireless networks and modern devices.

Some security breaches for wire and wireless networks.

Conclusions

Education is a social philosophy immortal messages a way of life. Religious and heavenly messages have called all people to learn, and education is one of national demands, and is a basic element in human rights legislation, the equality between all humans, a call for all democratic systems, as education plays a vital role in human development, led by educational policy makers, and as education is the most effective way to achieve more development, it is a must to connect education and integrate it with the electronic evolution to be more capable of observing future sciences, and to be able to adapt with current technologies, education ability to innovate, creativity and production.

Recommendations

Based on this literature review, the researcher recommends the following:

Reconsidering educational programs and curricula to be more able to absorb the concepts of technological and electronic revolution, integrate them in classroom.

e-learning is one of the demands for all educational communities world wild, but high cost and complexity are one of the obstacles hindering the implementation of e-learning and mobile learning in educational setting.

More emphasize must be put on the importance of mobile learning and its uses in education, as it serves many community populations with any spatial and temporal limitations.

Stressing the significance of using learning technology in teaching side-by-side with information technology.

Entering information and communication technology era require adequate infrastructure and full understanding of all technological concepts.

Good teaching provided at the right time by an effective teacher results in a quality educational outcome.

Persuading all people in community that change and development are a must.

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- There are several researches to be published in Kuwait, Palestine, and Europe.

- Wrote several books in Education Technology and instructional aides (author and co-author).

Editor's Note: A variety of factors need to be considered for planned changes to be effective. This study determines the impact of positive and negative influences that impact the adoption of online learning.

A case study to understand the influences of motivation, resistance to change, and computer self-efficacy on faculty intention to use online technology

Rui-Ting Huang and M. Khata Jabor
Malaysia

Abstract

In online education, although there are numerous online learning studies, relatively little attention has been paid to faculty intention to use online technology. It is shown that an instructor can play an important role in the effectiveness and efficiency of online learning. The primary purpose of this study is to understand the influences of motivation, resistance to change, and computer self-efficacy on faculty intention to use online technology and further improve the quality of online education.

Keywords: computer self-efficacy, motivation, online education, resistance to change

Introduction

Due to the growing trend in online learning, many colleges have spent a lot of money and time in developing new online learning system in order to provide learners with a convenient and flexible learning channel (Hogan & McKnight, 2007). Nevertheless, the implementation of new online learning technology, just like the organizational change, is not easy to most institutions and organizations (Gibson, Harris & Colaric, 2008). The sequential barriers in change are often inevitable and difficult (Davidson, 1999; Long & Spurlock, 2008), mainly because it is highly associated with people's attitude toward changes (Schneider, Brief & Guzzo, 1996; Van Dijk & Van Dick, 2009).

Although there are numerous online learning studies, little attention has been paid to faculty usage of online technologies (Park, Lee& Cheong, 2007; Wang & Wang, 2009). A recent study by Allen and Seaman (2009) revealed that "Chief academic officers report a slight decrease in faculty acceptance of online instruction, a surprise given the increase in student demand for courses and programs" (p.12). Moreover, Oncu, Delialioglu, and Brown (2008) have indicated that "while there is more technology in classrooms, there is little evidence that these technologies are integrated into instructions" (p.20). In additional to issues related to motivation, computer self-efficacy, training and technical supports, it is indicated that one of the main reasons that directly influence faculty intention to use online technology could be closely connected with faculty resistance to change (Huang & Hsia, 2009). It has been shown that an instructor could be closely linked to the effectiveness and efficiency of online learning. In order to minimize faculty resistance to change and maximize learning effectiveness and efficiency, it is necessary that professionals and practitioners in online education field should pay more attention to instructors' acceptance and usage of online technology. Consequently, the primary purpose of this study is to understand the influences of motivation, resistance to change, and computer self-efficacy on faculty intention to use online technology.

Literature Review and Hypothesis Development

Perceived Usefulness

It is found that users' perceived usefulness, which is viewed as an extrinsic motivation in information technology (IT) studies (Davis, Bagozzi, & Warshaw, 1992), could play a key role in new technology usage (Bhattacherjee, 2001a; Bhattacherjee, 2001b; Davis, 1989; Davis, Bagozzi, & Warshaw, 1989). According to Technology Acceptance Model (TAM), the perceived usefulness is defined as "the degree to which a person believes that using a particular system would enhance his or her job performance" (Davis 1989, p.320). It is suggested that users' perceived usefulness toward an IT system should be one of the influential components that affect IT usage (Davis, 1989; Davis et al., 1989). Several studies have revealed that users' perceived usefulness toward an IT system could have a positive effect on IT acceptance and usage (Bhattacherjee, 2001a; Bhattacherjee, 2001b; Davis, 1989). In online learning domains, a college instructor's perceived usefulness toward the online learning technology is defined as the degree to which a teacher believes that using online learning technology would enhance his or her teaching performance (Davis, 1989). Recent e-learning studies by Gibson et al., (2008) and Park et al., (2007) have indicated that the perceived usefulness could have a positive influence on instructors' intent to use online learning technology. Walker and Johnson (2008) have signified that the perceived usefulness could be positively related to college instructors' intention to use web-enhanced instruction. However, Yuen and Ma (2008) indicated that the perceived usefulness didn't exert influence on instructors' intent to use online learning technology. In the online education environment, it is likely that teachers with higher level of perceived usefulness could have better intention to use online technology. Based on previous study suggestions, thus, this study proposes the following hypothesis.

H1: The perceived usefulness has a positive influence on faculty intention to use online technology.

Resistance to Change

It is indicated that users' resistance to change could be one of the possible hindrances in implementing the new information technology in institutions and organizations (Cooper & Zmud, 1990; Gong, Xu, & Yu, 2004; Joshi, 1991; Kwahk & Lee, 2008). An e-commerce study by Al-Somali, Gholami and Clegg (2009) has indicated that customers' resistance to change could have a negative influence on their attitude towards using online banking. Several IT studies have also indicated that users' resistance to change could be linked not only to the users' acceptance and usage of new information technology, but also to the successful implementation of new information technology (Kim & Kankanhalli, 2009; Manzoni & Angehrn, 1997; Nov & Ye, 2008). In addition, another recent study by Huang and Hsia (2009) has shown that faculty resistance to change could be one of the key hindrances to implement the web-based instruction. In online education domains, it is possible that faculty with higher level of resistance to change could have less intention to use online technology. Accordingly, it is critical that users' resistance to change should be worthy of further discussion in this study, and the following hypothesis is proposed by this study.

H2: The resistance to change has a negative influence on faculty intention to use online technology.

Computer Self-Efficacy

The computer self-efficacy, which refers to "a judgment of one's capability to use a computer" (Compeau & Higgins, 1995, p. 192), is derived from the definition of self-efficacy from Bandura (1986). According to Bandura (1986), the self-efficacy is defined as "people's judgements of their capabilities to organize and execute courses of action required to attain designated types of performances. It is concerned not with the skills one has but with the judgements of what one can

do with whatever skills one possesses'' (p. 391). The computer self-efficacy, one of the influential variables in the IT studies, has been found to be positively associated with instructors' intent to use online learning technology (Gong et al., 2004; Ball & Levy, 2008), and users' system usage (Compeau & Higgins, 1995; Igbaria & Ivari, 1995). Moreover, several studies have signified that the computer self-efficacy could play a key role in minimizing users' resistance to technology adoption (Coffin & MacIntyre, 1999; Ellen, Bearden & Sharma, 1991; Hasan, 2003; Hasan, 2006). Based on previous study suggestions, accordingly, this study proposes the following hypotheses.

H3: The computer self-efficacy has a positive influence on faculty intention to use online technology.

H4: The computer self-efficacy has a negative influence on faculty resistance to change. That is, faculty with better computer self-efficacy is very likely to have less resistance to change.

Technical and Training Supports

The organizational supports such as technical and training supports have received intensive attention in previous IT studies, not only because organizational supports could be highly associated with users' adoption of new technology (Amoako-Gyampah & Salam 2004), but also because sufficient organizational supports could help organizations successfully implement a new IT system (Igbaria, Guimaraes, & Davis, 1995). An early study by Amoako-Gyampah and Salam (2004) has revealed that training supports could be positively related to users' perceived usefulness and acceptance of an IT system. Another recent study by Magni and Pennarola (2008) has shown that the organizational supports exerted a positive effect on users' perceived usefulness. Moreover, with particular respect to the connection between organizational support and computer self-efficacy, mixed results have been found in previous IT studies. In more detail, some studies indicated a positive association between organizational support and computer self-efficacy (Scott & Walczak, 2009; Igbaria & Ivari, 1995), whereas others revealed the negative relationship between organizational support and computer self-efficacy (Compeau & Higgins, 1995; McFarland & Hamilton, 2006). Based on previous studies, it is likely that technical supports, which refer to "availability of specialized personnel to answer user questions regarding IT usage, troubleshoot emergent problems during actual usage, and provide instructional and/or hand-on support to users before and during usage" (Bhattacherjee & Hikmet, 2008, p.71), could have a positive influence on faculty computer self-efficacy, and training supports could have a positive influence on faculty perceived usefulness. Accordingly, this study proposes the following hypotheses.

H5: The technical support has a positive influence on faculty computer self-efficacy.

H6: The training support has a positive influence on faculty perceived usefulness.

To summarize, it has been shown that faculty perceived usefulness, resistance to change, computer self-efficacy and organizational supports could be closely connected with faculty intention to use online technology. Therefore, based on previous study suggestions, this study proposes the following theoretical framework (see Figure 1).

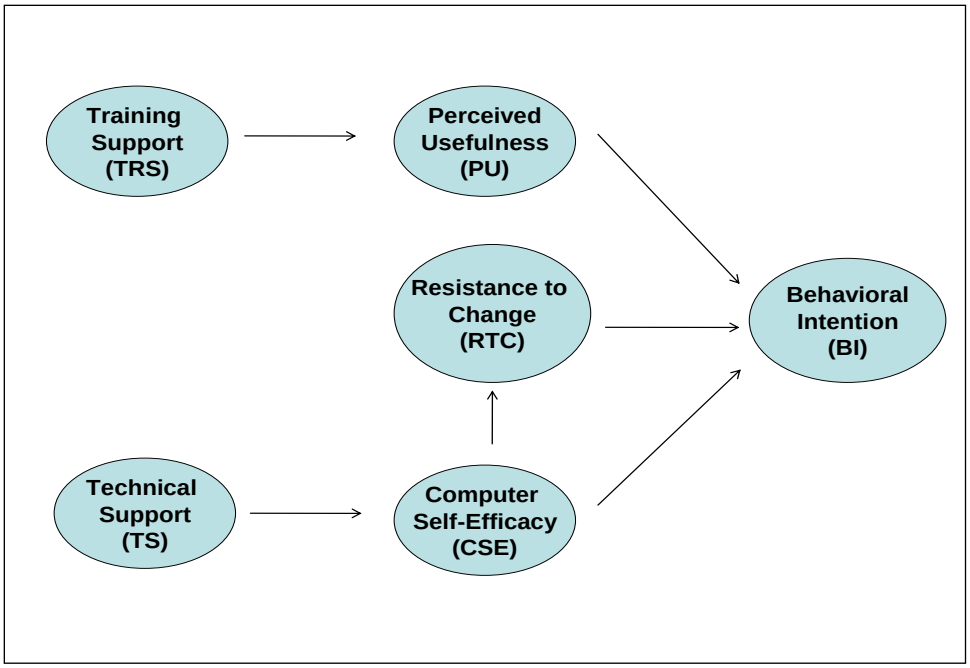

Figure 1. Research Framework of This Study

Research Methodology

Data Collection

Faculty members from two colleges in Taiwan took part in this study, and the participation of this study was voluntary. The survey was delivered to full-time instructors via the Teaching Evaluation Center at both colleges. Instructors could choose either to complete the paper survey or finish the questionnaire vie online survey website of Teaching Evaluation Center. The participants were asked to finish the online survey or to return the paper survey to Teaching Evaluation Center at both colleges within two weeks. The total number of usable and complete surveys was 169.

Instrumentation

With regard to the measurement of the instructors' perceived usefulness and faculty intention to use online technology, seven items were adopted from studies by Davis (1989) and Roca, Chiu and Martínez (2006). Furthermore, with respect to the measurement of faculty resistance to change, computer self-efficacy beliefs, and technical supports, four items of measuring faculty resistance to change were adopted from the study by Al-Somali et al. (2009), four items of measuring faculty computer self-efficacy beliefs were adopted from the study by Roca et al. (2006), and three items of measuring technical supports were adopted from the study by Bhattacherjee and Hikmet (2008). Finally, this study used self-designed items to measure training supports and demographic variables.

Data Analysis and Results

Examination of measurement scale

Due to the limitation of small sample size, it is suggested that the Partial Least Squares (PLS) analysis should be more suitable for this study in order to conduct a confirmatory factor analysis (CFA) (Fornell & Bookstein, 1982).

Table 1
Factor Loadings, Average Variance Extracted, Cronbach Alpha and Composite Reliability of Each Construct

Item	PU	RTC	CSE	IT	TS	TRS
PU1 Using online learning technology provided by my university could improve my teaching performance	.94					
PU2 Using online learning technology provided by my university could enhance my teaching effectiveness	.95					
PU3 Using online learning technology provided by my university could make teaching easier	.92					
PU4 I found the online learning technology to be useful to me in my teaching	.90					
RTC1 I am not interested in new online learning technological developments		.82				
RTC2 I feel uncomfortable in changing my current teaching methods and using online learning technology for my teaching works		.90				
RTC3 I am not interested to use online learning technology for my teaching works		.91				
RTC4 I am not used to using online learning technology for my teaching works		.89				
CSE1 I could complete my teaching works using the online learning technology if I had never used a system like it before			.67			
CSE2 I could complete my teaching works using the online learning technology if I had only the technology manuals for reference			.86			
CSE3 I could complete my teaching works using the online learning technology if I had seen someone else using it before trying it myself			.81			
CSE4 I could complete my teaching works using the online learning technology if I had just the built-in-help facility for assistance			.82			
IT1 I will use online learning technology for my teaching works in the future				.95		
IT2 I intend to regularly use online learning technology in my teaching works				.96		
IT3 I would recommend to other teachers to use online learning technology in teaching works				.91		
TS1 IT support staff is responsive to my teaching needs					.93	
TS2 IT support staff is competent in providing their services					.94	
TS3 I find it easy to interact effectively with the IT support staff concerning my problems					.93	
TRS1 My college provides teachers with sufficient training supports for the usage of online learning technology						.89
TRS2 The trainings provided by my college are beneficial for my teaching works						.89
TRS3 The training contents are satisfactory						.94
TRS4 Overall, my college provides teachers with adequate and sufficient trainings for using online learning technology.						.94
Average Variance Extracted (AVE)	.87	.78	.63	.88	.88	.84
Composite Reliability (CR)	.96	.93	.87	.95	.95	.95
Cronbach Alpha	.95	.90	.80	.93	.93	.93

As shown in Table 1, except the factor loading of CSE1=.67, factor loadings of the other items, Cronbach alpha and composite reliability (CR) of each construct all indicated satisfactory internal consistency. Moreover, it was found that convergent validity was satisfactory because the average variance extracted (AVE) of each latent variable was over 0.5 (Fornell & Larcker, 1981). Finally, as shown in the Table 2, correlations of each latent variable further indicated adequate discriminant validity because the square root of AVE values on the diagonal were all higher than correlation value of the latent variable with the other latent variables (Fornell & Larcker, 1981).

Table 2

The Correlations of Each Latent Variable

PU = perceived usefulness; RTC = Resistance to Change; CSE = Computer Self-efficacy;
IT = Intention to Use Online Technology; TS = Technical Support; TRS = Training Support;

	PU	RTC	CSE	IT	TS	TRS
Perceived Usefulness (PU)	**.933**					
Resistance to Change (RTC)	-.252	**.883**				
Computer Self-efficacy (CSE)	.303	-.264	**.793**			
Intention to Use Online Technology (IT)	.672	-.477	.499	**.938**		
Technical Support (TS)	.457	-.171	.404	.425	**.938**	
Training Support (TRS)	.516	-.186	.404	.501	0.815	**.916**

Note: Diagonal elements are the square root of Average Variance Extracted.

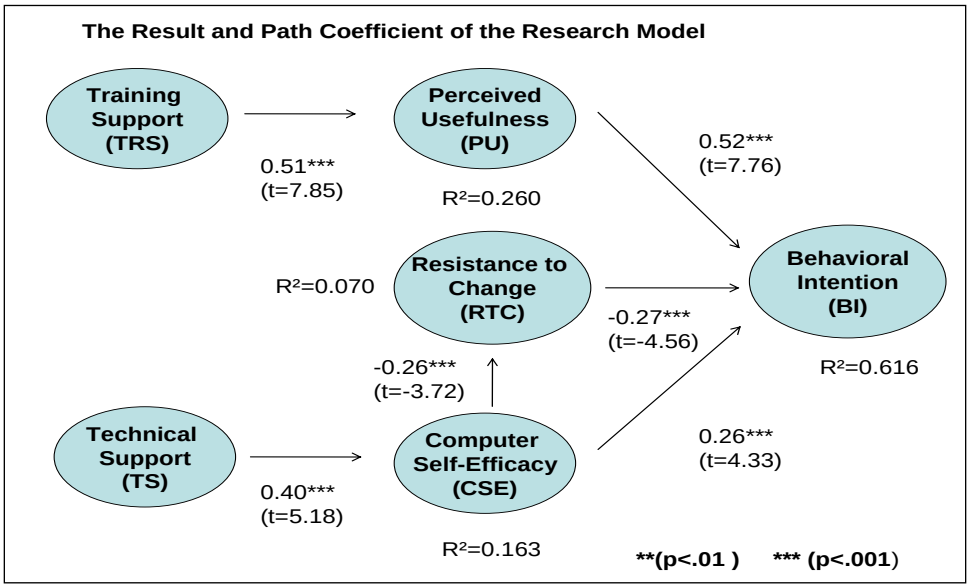

Figure 2. The result and path coefficient of the research model

Examination of structural model and hypotheses

As shown in Figure2, path coefficients and t values of the structural model indicated that all hypotheses in this study were supported. It was found that the perceived usefulness, resistance to change, and computer self-efficacy together explained 61.6 % of variance in faculty intention to use online technology. In addition, it was demonstrated that the computer self-efficacy only accounted for 7 % of variance in resistance to change. Last but not least, it was shown that the training support explained 26.6 % of variance in faculty perceived usefulness, and the technical support accounted for 16.3 % of variance in faculty computer self-efficacy.

Discussions

The primary purpose of this study was to understand the influences of motivation, resistance to change, and computer self-efficacy on faculty intention to use online technology. According to the data analysis and results, it has been demonstrated that all hypotheses are supported in this study. It is found that the perceived usefulness has a positive influence on faculty intention to use online technology. The study result, consistent with previous study suggestions (Bhattacherjee, 2001a; Bhattacherjee, 2001b; Davis, 1989; Davis et al., 1989), has indicated that faculty perceived usefulness could be one of the key determinants of intention to use online technology. That is, it is revealed that faculty perceived usefulness, an extrinsic motivation, could be the most important factor that directly affects faculty online technology acceptance, mainly because the t value= 7.76 appears to be the highest one among variables related to faculty intention to use online technology (see figure 2).

In addition, it is shown that faculty resistance to change has a negative influence on their intention to use online technology. The study finding is congruous with previous studies (Kim & Kankanhalli, 2009; Manzoni & Angehrn, 1997; Nov & Ye, 2008), and has signified that faculty resistance to change could be closely associated with the faculty intention to use online technology. Specifically speaking, it is possible that faculty members with higher level of resistance to change could have lower level of online technology usage. More noteworthy, it is demonstrated that the computer self-efficacy has critical influences on faculty intention to use online technology and resistance to change. In more detail, the study results are coherent to previous researching works (Ball & Levy, 2008; Gong et al., 2004), and have revealed that faculty with higher level of computer self-efficacy could have a higher level of online technology usage and lower level of resistance to change.

Last but not least, with particular respect to the technical and training supports, the study findings are consistent with previous study suggestions, and it is indicated that technical support has a positive influence on faculty computer self-efficacy, and the training support has a positive effect on faculty perceived usefulness. In other words, it is likely that faculty members with better technical supports could have more preferable perceived usefulness (Bhattacherjee & Hikmet, 2008; Magni & Pennarola, 2008), and faculty members with higher level of technical supports could have a higher level of computer self-efficacy beliefs (Scott & Walczak, 2009; Igbaria & Ivari, 1995).

Implications

First, with respect to the extrinsic motivation, it has been demonstrated that the perceived usefulness could play the most important role in determining faculty intention to use online technology, and training supports could be closely and directly linked to faculty perceived usefulness. The study findings have implied that if facilitating faculty members to use online technology is one of the main goals, educational institutions and organizations could utilize training supports to facilitate faculty members to further improve their online technology acceptance. Additionally, with regard to the faculty computer self-efficacy, it has been shown that faculty computer self-efficacy could be closely connected with faculty resistance to change, online technology usage, and technical supports. More specifically, it is likely that faculty members with higher level of technical supports could have higher level of computer self-efficacy beliefs, which intern not only could lead to lower level of resistance to change, but also could cause higher level of faculty online technology usage. The study results have revealed that sufficient and satisfactory technical supports could be closely associated with improving faculty online technology acceptance and minimizing resistance to change. Finally, with particular respect to faculty resistance to change, it has been found that faculty resistance to change could be one of the key factors that negatively affect faculty online technology acceptance. The study

finding has suggested that people's attitude toward change should be one of the focal points (Schneider, Brief & Guzzo, 1996; Van Dijk & Van Dick, 2009), mainly because resistance to change and sequential barriers in change are often inevitable and difficult (Davidson, 1999; Long & Spurlock, 2008). Although it is shown that improving faculty computer self-efficacy beliefs could lessen resistance to change, it only has little explanatory power in faculty resistance to change. Hence, it is meaningful and considerable that future online education should further investigate factors that affect faculty resistance to change in order to further improve online learning effectiveness and efficiency.

Limitations and Conclusions

There are several limitations in this study. First, mainly due to limitations of time and financial resources, this study only gathered data from two colleges. It is suggested that future studies should gather the data from the other countries to further verify the generalizablity of the study findings. In addition, this study only probed into the role of extrinsic motivation in faculty intention to use online technology. In order to further clarify the influences of extrinsic and intrinsic motivations on faculty online technology acceptance, it is recommended that professionals and practitioners in the online education field should incorporate factors of intrinsic motivation into future studies. Finally, with particular respect to study finding of faculty resistance to change, it is shown that although faculty computer self-efficacy could have a positive and significant influence on faculty resistance to change, it only explains 7% of variance in faculty resistance to change. Consequently, in order to minimize faculty resistance to change, it is meaningful that future studies should further probe into factors affecting faculty resistance to change.

In conclusion, the findings have not only offered professionals and practitioners in the online education field incremental understandings, but also verified key influences of perceived usefulness, resistance to change, and computer self-efficacy on college faculty intention to use online technology. More importantly, the study results have further contributed to body of knowledge in teacher education field by confirming key roles of technical and training supports in affecting faculty perceived usefulness and computer self-efficacy beliefs.

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Editor's Note: Computer technologies provide significant enhancements to presentation of knowledge and provide interactive simulations of laboratory experiences. Simulations not only save time and cost, they can identify errors, provide feedback at each step, tutor the student at crucial points in the learning process, and provide a record of learning events for the instructor.

Exploring Electronics Laboratory Experiments Using Computer Software

Y.B. Gandole
India

Abstract:

The roles of teachers and students are changing, and there are undoubtedly ways of learning not yet discovered. However, computer and software technologies may play a significant role in identifying problems and presenting solutions and supporting life-long learning. It is clear that computer-based educational technology has reached the point where many major improvements can be made, and significant cost reductions can be achieved, in Science education. In science, full-course lecture-laboratory components may replace existing lecture-based courses, and virtual instruments may provide a highly interactive user interface and advanced analysis facilities that were not deliverable in the conventional methods.

The user-friendly GUI may provide a better scientific picture of the system under test. Moreover, using distance learning may attract new students and add value to education. Equipping the laboratories with effective education tools can empower both the disciplines and the students. Hence, the role of the laboratory course in imparting knowledge increases effectiveness and it enables the students to absorb individual science disciplines and addresses real problems. It is clear that change is necessary because many of the things that we are doing can be done better with the help of technology.

Although the initial cost may be high, if the right technology is selected continuous improvement can be achieved with minimal cost. The cost of the development may be reduced further if the portion of the existing hardware is utilized and integrated with the existing system. If the size and the complexity of the system increase, organizations and universities may undertake laboratory developments in partnership with other universities and/or commercial partners

Keywords: Laboratory practical's, Computer Software, Simulation, Virtual Instrumentation

Introduction

In recent years, electronics the world over has made unprecedented growth in terms of new technologies, new ideas and principles. The rate of obsolescence of technologies also has been extremely high. Researchers, academicians, industries and the society at large have to work in unison to meet the challenges of the rapidly growing discipline. The research organizations and industries that work in this frontier area are in need of highly skilled and scientifically oriented manpower. This manpower can be available only with flexible, adaptive and progressive training programs and a cohesive interaction among the research organizations, academicians and industries.

Laboratory activities must be designed to engage students' minds, so that students may acquire skill and confidence in their:

- Measurement of physical quantities with appropriate accuracy.
- Recognition of factors that could affect the reliability of their measurements.

- Manipulations of materials, apparatus, tools, and measuring instruments.
- Clear descriptions of their observations and measurements
- Representation of information in appropriate verbal, pictorial, graphical, and mathematical terms
- Inference and reasoning from their observations
- Ability to rationally defend their conclusions and predictions
- Effective and valued participation with their peers and their teacher in a cooperative intellectual enterprise
- Articulate reporting of observations, conclusions, and predictions in formats ranging from
- Informal discussion to a formal laboratory report
- Ability to recognize those questions that can be investigated through experiment and to plan carries out, evaluate, and report on such experiments.

Laboratory work is essential in the study of electronics. Electronics is a laboratory-based course designed to expose students to basic analog and digital devices and circuits. Students are encouraged to discover concepts through laboratory experiences and apply their knowledge to problems and projects.

Laboratory work should aim to encourage students to gain

- Manipulative skills
- Observational skills
- The ability to interpret experimental data
- The ability to plan experiments
- Interest in the subject
- Enjoyment of the subject
- A feeling of reality for the phenomena talked about in theory

The laboratory experiments should help students master basic electronics concepts, should help students understand the role of direct observation in electronics and to distinguish between inferences based on theory and the outcomes of experiments.

Theory and research suggest that meaningful learning is possible in laboratory activities if all students are provided with opportunities to manipulate equipment and materials while working cooperatively with peers in an environment in which they are free to pursue solutions to problems that interest them. Effective and appropriate experimentation is often seen as a highly significant component of an undergraduate science based curriculum. Third level institutions are under pressure to keep up to date with commercial advances and technology; so that students graduating from their courses have the necessary skills to operate in a competitive business environment [1]. However indications are that due to the high cost involved in upgrade and maintenance of equipment, that there has been a decline in the emphasis placed on experimentation in engineering courses in recent decades [2]. Institutions attract new students to their courses by making them interesting, comprehensive and relevant to industrial applications and the majority of graduates either continue within academia or take up employment in their chosen discipline. In both, research and industrial applications, it is commonplace to use a computer for data acquisition. Students that have not gained experience in automated systems during their course work are disadvantaged both in acquiring and performing the duties required. Virtual instrumentation can help not only the students but the faculties themselves by recreating the equivalent of very expensive conventional laboratory equipment quite cheaply [3]. Through the

use of a Data Acquisition (DAQ) tools, students can record relevant data from the experiments in real time. This allows students to concentrate on the concepts and details of experiment itself and not get distracted by the process of data recording. Animations, images and video clips can also be embedded within the virtual instrument which engage students and give them real world examples that relate to their coursework. Students can thereby gain not only a better understanding of what they are doing but why they are doing it [3].

One of the recurring advantages attributed to using computers in the classroom is that of more positive student attitudes [6]- [7]. Using computers in a classroom is believed to lead to more positive attitudes in students, because computers can do so many new things so quickly, so carefully, and because many students prefer using computers. There is little research, however, to support such claims. The limited research available suggests that computers can lead to more positive attitudes in some groups of students (males, younger students). Although the importance of hands-on labs to the science curriculum cannot be denied, [19], cites several advantages of computer simulations compared to laboratory activities. First, there appear to be important pedagogical advantages of using computer simulations in the classroom. Second, the purchase, maintenance, and update of lab equipment is often more expensive than computer hardware and software. Also, there is no concern for students' physical safety in this learning environment. [36], discuss the instructional use and sequencing of computer simulation and its effect on students' cognitive processes. The sequence in which learning occurs influences the stability of cognitive structures [4]. New knowledge is made meaningful by relating it to prior knowledge and optimization of prior knowledge is done through sequencing. According to [20], simulations used prior to formal instruction build intuition and alert the student to the overall nature of the process. When used after formal instruction, the program offers the student an opportunity to apply the learned material.

There is evidence that simulations enhance students' problem solving skills by giving them an opportunity to practice and refine their higher-order thinking strategies [29]. Computer simulations were found to be very effective in stimulating environmental problem solving by community college students [18]. In particular, computer simulation exercises based on the guided discovery learning theory can be designed to provide motivation, expose misconceptions and areas of knowledge deficiency, integrate information, and enhance transfer of learning [27]. In three studies, students using the guided version of computer simulation surpassed unguided students on tests of scientific thinking and a test of critical thinking [35]. As a result of implementing properly designed simulation activities, the role of the teacher changes from a mere transmitter of information to a facilitator of higher-order thinking skills [38]. According to [27], simulations are seen as a powerful tool to teach not only the content but also thinking or reasoning skills that are necessary to solve problems in the real world.

The Experimental Design

At first the investigator has diagnose the learner’s difficulty in performing the experiments with the help of diagnostic test. An achievement test was developed (covering theoretical aspects of these experiments) for examining change in the level of knowledge in Electronics (theory concepts).

The competency of performing the experiment was examined with the help of competency test on spot observation of student (Checklist), while performing the experiment. Their change in attitude was reflected with the help of an attitude scale to be given before and after learning with the help of proposed Computer software support.

Learner's opinion about Computer software support was assessed with the help of opinion scale, developed by the investigator.

In the conventional laboratory, the students were given a lab manual which they had to read prior to starting the laboratory. From survey results, students often found it difficult with this method to understand what they had to do or how to find the result. The introduction of a virtual instrument for the laboratory experiments allowed the possibility of guiding the student through the operation of the experimental apparatus and the collection of the required data. The first ten experiments for which computer software were developed were used to aid the learning process.

The investigator developed the software using "mixed" design methodology. The programme modules were developed using Visual Basic 6.0, Visual C++, Multisim-8 , LAB-VIEW-9 and SPICE programming language in Window 2007 environment. It provides multimedia presentation platform to attract the sense of learner for easy and happy learning. The investigator had seen that the frames were unambiguous, brief, simple and straightforward. The detail frame design is given in the Fig 1(a-g). An associated instrumentation, have been piloted with over 150 undergraduate Electronics science students affiliated to Sant Gadge Baba Amravati University, Amravati. The design of the Computer Software for each of these experiments was divided along pedagogical lines into three sections which are presented consecutively to the students:

1. Introduction

   In this section, the students were given an overview of the experiment to be undertaken, an animation showing how it worked, what was being measured and how it related to real applications.

2. Procedure and Data logging

In this part of the experiment students perform the experiment and see the data logged and graphed on the PC as they progress though the experiment.

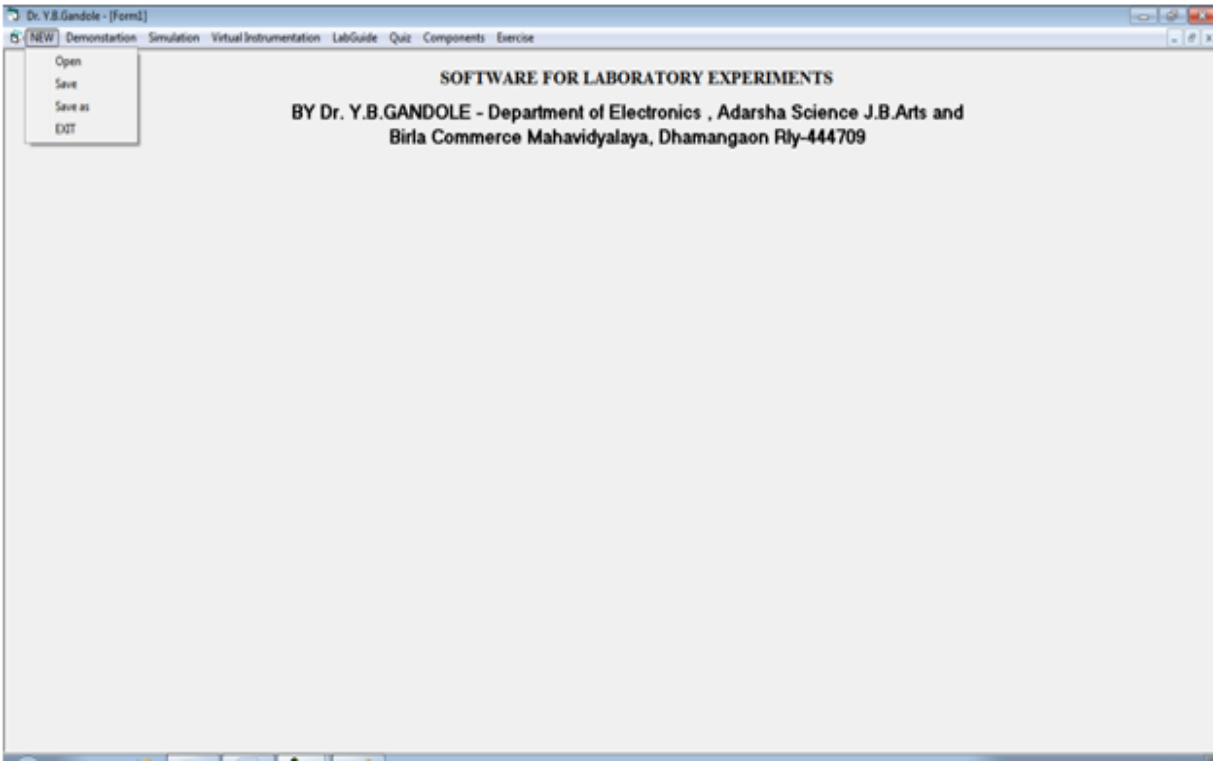
3. Theory and Calculations

   In this section, the students work through their calculations manually and calculate the result being sought from the experiment. They then enter their own values into the computer and receive immediate feedback of how these compare to the automatically calculated values from the Virtual Instrumentation and simulation techniques.

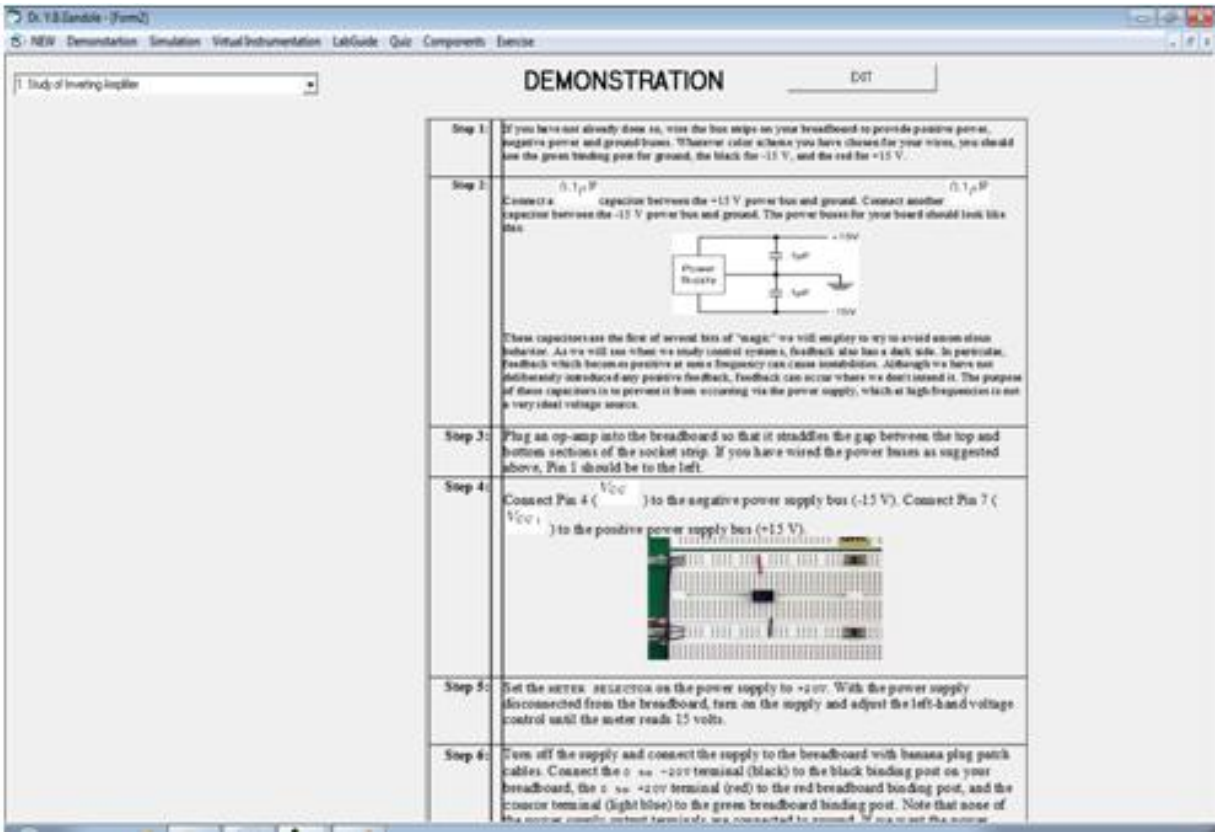
Result and discussion

Software Tryout

The questionnaire has been designed by investigator to evaluate the quality of computer software program. This questionnaire contains 13 statements refer to the technical aspects of the software. Their aim was to evaluate its technical adequacy to the learning objectives of the program. They deal mainly with questions related to the general structure of the product navigation, interactivity, design and other aspects that can favour or hinder the learning process. Overall 27 statements refer to curricular design aspects, usefulness and intend to evaluate the integration capacity of the program in the learning process of an electronics practical.

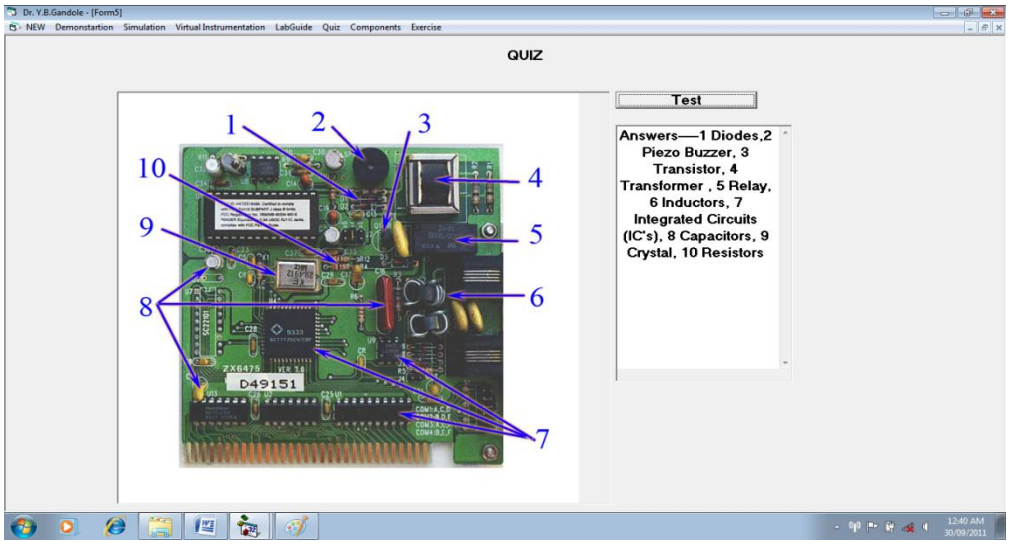


(a) Front panel of screen

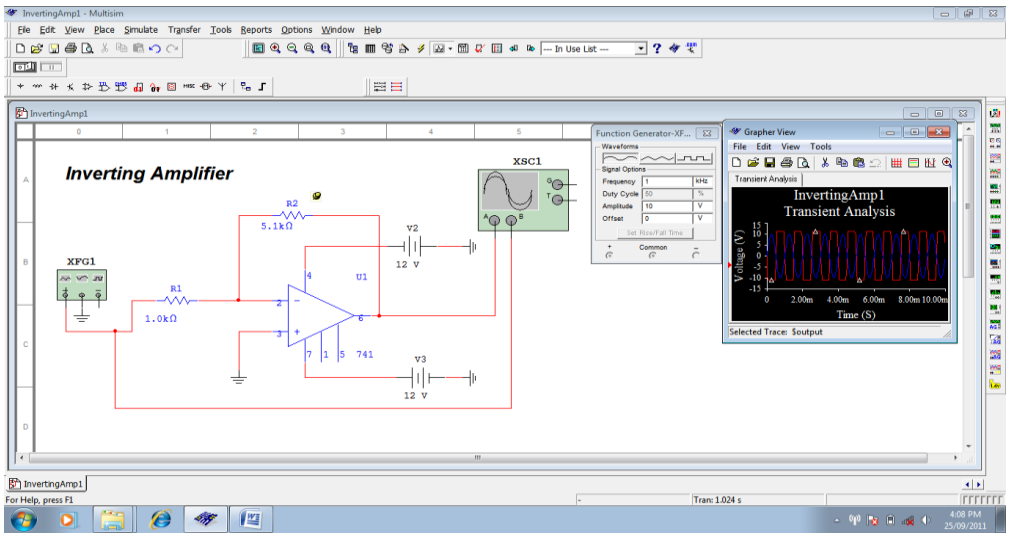


(b) Demonstation module

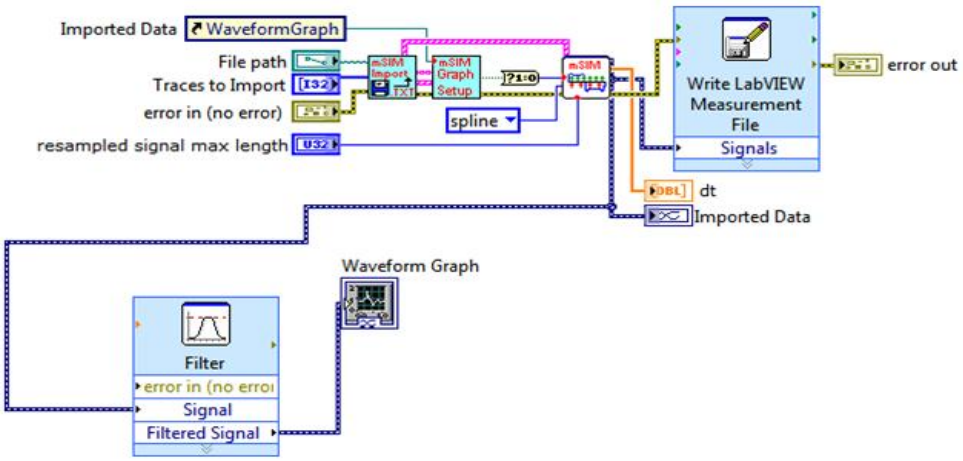
(c) Electronics Components and Instrumentation module



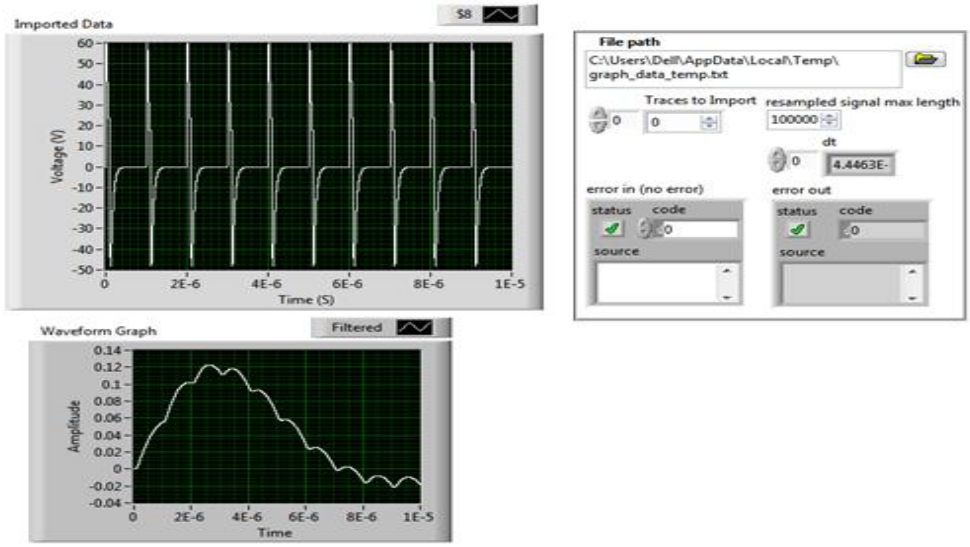
(d) Quiz Module



(e) Simulation Module



(f) Virtual Instrumentation module



(g) Virtual Instrumentation GUI.

Fig 1. GUI for Software

Responses of students were in five-point scale. The 45 students, offering electronics subject at B.Sc. level were selected randomly for this piloting. The students were divided into three batches. Initially the investigator demonstrated the each module of the software using LAN for each batch and they asked to operate the each module of the software freely. Finally the questionnaire was given to every student and they asked to write '1' for very bad or NO, '2' for bad or sometimes, '3' for acceptable or average, '4' for good or almost always and '5' for very good or Yes. The students who respond either 4 or 5 were grouped together which indicated the good quality of computer software. On the other hand the students who responded either 3, 2 or 1 are grouped together which indicated the poor quality of software and requires modifications. It was later on converted into percentage. The consolidated list of percentages for every statement was given in Table 1.

Table 1
Analysis of computer software tryout

Item no	Statement	% of positive response	% of negative response
A	***Technical-Instructive Adaptation :Interface Design*** *(Screen design)*		
1	The quantity of colour on screen is adequate for the sort of information contained	84.44 %	15.56 %
2	The quantity of the images is adequate for the sort of information contained	77.78 %	22.22 %
3	The sound quality level is adequate for the sort of information transmitted	71.11 %	28.89 %
4	The quantity of graphics and images is adequate for the sort of information transmitted	82.22 %	17.78 %
5	The resolution of graphic and images is adequate for the sort of information transmitted	82.22 %	17.78 %
6	The text presentation on screen is adequate for the information transmitted, Access and control of the information	97.78 %	2.22 %
7	The student has control over different parameters of presentation (colour, sound level, etc.)	82.22 %	17.78 %
8	The program facilitates the paper printing of selected information by the student	95.56 %	4.44 %
9	The program facilitates the navigation through the contents	88.89 %	11.11 %
10	The program gives the student the possibility of modifying the information contained.	84.44 %	15.56 %
11	The interaction tools (buttons, menu, commands) facilitate the learning process	86.67 %	13.33 %
12	The program, in general, is easy to use	88.89 %	11.11 %
13	It is easy for the student to learn how to use the program	88.89 %	11.11 %
14	The running of the program is adequate (there are no bugs which block it)	86.67 %	8.89 %
B	***2.- Didactic or Curricular Adaptation***		
B1	*Learning contents*		
15	Are clearly presented	93.33 %	6.67 %
16	Emphasize the most important things	77.78 %	22.22 %
17	Are sequenced	93.33 %	6.67 %
18	The information is updated	88.89 %	11.11 %
19	Are enough to achieve the objectives	80.00 %	20.00 %
20	Are beneficial to the improvement of attitudes	91.11 %	8.89 %
21	Are extra-laboratory activities	91.11 %	8.89 %
22	Are free of grammar or spelling errors	95.56 %	4.44 %
B2	*Learning activities*		
23	Require different levels of mastery	8.89 %	91.11 %
24	Follow a logical sequence in relation to the objectives	84.44 %	15.56 %
25	The number of different activities is enough	80.00 %	20.00 %
26	Allow different tries for answering	91.11 %	8.89 %

Item no	Statement	%of positive response	%of negative response
27	Examples of the activities to be done are shown	93.33 %	6.67 %
28	Examples are clear and adequate	93.33 %	6.67 %
B3	*Evaluation*		
29	The program is constantly evaluating the student's output	84.44 %	15.56 %
30	Shows the student the errors he/she has made	82.22 %	17.78 %
31	Provides specific help for the student's errors	91.11 %	8.89 %
32	The feed-back is immediate	88.89 %	11.11 %
33	The feed-back is motivating for the student	86.67 %	13.33 %
34	The feed-back provides clear and significant information	88.89 %	11.11 %
35	Facilitates self-correction	86.67 %	13.33 %
36	Constantly informs the student about his/her output	82.22 %	17.78 %
B4	*Motivation*		
37	The program increases the active involvement of the student on the laboratory task	91.11 %	8.89 %
38	Students show a better interest in learning practical	93.33 %	6.67 %
C	***Usefulness***		
39	Use it as self-instruction material	88.89 %	11.11 %
40	Use it as complementary laboratory material	68.89 %	31.11 %
41	The program makes it possible for the students to work in groups of two or three	71.11 %	28.89 %

From the analysis of piloting it was found that the development of computer software programme for laboratory communication was very good.

Finally, acceptance testing was performed to demonstrate to the students, teachers and experts in electronics and computer field, on the real life data of the practical.

Opinion Scale

The investigator used opinionnaire to collect learner's opinion regarding Computer software support. This opinionnaire was containing 39 items related to various educational aspects. The overall analysis of data collected with the help of opinionnaire is given below.

1. The experimental group students were of opinion that the computer software support for laboratory work was relevant to the objectives of laboratory experiment. According to 78 % of students of FY B.Sc., 70 % of students of SY B.Sc and 74 % of students of TY B.Sc., the Computer Software support was relevant to the objectives of Electronics experiments.
2. About the implementation of software, According to 88 % of the students of FY B.Sc, 80 % of students of SY B.Sc and 90 % of students of TY B.Sc., the experiments were presented in an interesting manner. According to 100 % of the students of FY B.Sc., SY B.Sc and TY B.Sc., what is required in the write-up of an experiment was clear. the theory behind the experiments was clearly presented. According to 96 % of the students of FY B.Sc., 90 % of the students of SY B.Sc and TY B.Sc, The laboratory demonstration, experimental techniques and write-up were all interlinked. According to

80 % of the students of FY B.Sc and TY B.Sc, 82 % of the students of SY B.Sc, The instructions provided with the software were adequate. According to 20 % of the students of FY B.Sc, SY B.Sc & TY B.Sc, the content of the software assume too much prior knowledge about computer. According to 80 % of the students, the instructions provided with the software were adequate.

3. According to 88 % of the students of FY B.Sc., 80% of the students of SY B.Sc., and 90 % of the students of TY B.Sc. The software was interested in their progress in Electronics.
4. According to 94 % of the students of FY B.Sc., 84 % of the students of SY B.Sc., and 90 % of the students of TY B.Sc, the laboratory demonstration contained instructions that were easy to follow.
5. According to 90 % of the students of FY B.Sc., 92 % of the students of SY B.Sc., and 90 % of the students of TY B.Sc, the simulation module made them feel, to have ability to continue in Electronics science.
6. According to 90 % of the students of FY B.Sc., 80 % of the students of SY B.Sc., and 90 % of the students of TY B.Sc, time in practical was spent effectively.
7. According to 92 % of the students of FY B.Sc., 92 % of the students of SY B.Sc., and 96 % of the students of TY B.Sc, the software stimulated their interest in the subject area.
8. According to 96 % of the students of FY B.Sc., 90 % of the students of SY B.Sc., and 90 % of the students of TY B.Sc, the software did his share in helping them to learn electronics experiment.
9. According to 84 % of the students of FY B.Sc., 90 % of the students of SY B.Sc., and 90 % of the students of TY B.Sc, the software was user friendly.
10. According to 80 % of the students of FY B.Sc., 90 % of the students of SY B.Sc., and 90 % of the students of TY B.Sc, the software is fully self-instructional.
11. According to 94 % of the students of FY B.Sc., 94 % of the students of SY B.Sc., and 90 % of the students of TY B.Sc, the interactive nature of the software made the experiment more interesting.
12. According to 96 % of the students of FY B.Sc., 98 % of the students of SY B.Sc., and 90 % of the students of TY B.Sc, the software enhanced their enjoyment of learning about electronics subject.
13. According to 80 % of the students of FY B.Sc., 80 % of the students of SY B.Sc., and 80 % of the students of TY B.Sc, the software helped make the experiment concepts easy to understand.
14. According to 96 % of the students of FY B.Sc., SY B.Sc., and TY B.Sc, when needed, they found the written instructions & simulation to be helpful
15. According to 84 % of the students of FY B.Sc., 80 % of the students of SY B.Sc., and 80 % of the students of TY B.Sc, the software help electronics practical learning.
16. According to 96 % of the students of FY B.Sc., 98 % of the students of SY B.Sc., and 90 % of the students of TY B.Sc, the software add value over conventional practical methods.
17. According to 80 % of the students of FY B.Sc., 78 % of the students of SY B.Sc., and 80 % of the students of TY B.Sc, the software meet the needs for their electronics practical.
18. According to 82 % of the students of FY B.Sc., 90 % of the students of SY B.Sc., and 90 % of the students of TY B.Sc, the software make the student think about subject matter.
19. According to 90 % of the students of FY B.Sc., 96 % of the students of SY B.Sc., and 96 % of the students of TY B.Sc, the software support activities that is otherwise difficult to learn.
20. According to 90 % of the students of FY B.Sc., 94 % of the students of SY B.Sc., and 96 % of the students of TY B.Sc, the software have the potential to add anything new to the students learning experience that traditional practical method would not provide.

21. According to 76 % of the students of FY B.Sc., 70 % of the students of SY B.Sc., and 70 % of the students of TY B.Sc, students will learn by using software.
22. According to 88 % of the students of FY B.Sc., 90 % of the students of SY B.Sc., and 90 % of the students of TY B.Sc, the software would be recommended for teaching students about electronics practical.
23. According to 92 % of the students of FY B.Sc., 96 % of the students of SY B.Sc., and 96 % of the students of TY B.Sc, the tasks in the software engage the students.
24. According to 92 % of the students of FY B.Sc., 92 % of the students of SY B.Sc., and 90 % of the students of TY B.Sc, the software can test out their ideas and receive feedback-using software.
25. According to FY B.Sc. Students, The Overall rating of the software:
    30 % rated, outstanding (Among the top10%), 50 % rated, excellent (Among the top 30 %), 20 % rated About Average (Middle 40 %).
26. According to SY B.Sc Students The Overall rating of the software:
    40 % rated, Outstanding (Among the top10%), 40 % rated, excellent (Among the top 30 %), 20 % rated About Average (Middle 40 %).
27. According to TY B.Sc Students The Overall rating of the software:
    36 % rated, Outstanding (Among the top10%), 44 % rated, excellent (Among the top 30 %), 20 % rated About Average (Middle 40 %).

Conclusion

In a lesson without simulations or *VI*s, the learner deals with the lesson and the real world in two separate moments and the lesson can just present a picture of the real world. On the opposite, according to the *VI* model, the learner can deal directly with the real world. The main goals of the lesson become to guide the execution of the experiment, to give on-line instructions and information about the involved subjects and to stimulate the participation of the student. The execution of virtual experiments requires the creation of interfaces which, in the case of Science applications, consist of multimedia simulation for the communication between the learners' commands and the target system

The Computer software support was found very effective in communicating laboratory activities than the traditional method. However, there were not much difference in the achievement and competency of student in experimental and control group. Computer software support activities can be used as an educational alternative to help motivate students into self-discovery and develop their practical skills. The laboratory activity can then be focus on the actual transfer of knowledge. This strategy helps improve the effectiveness and efficiency of teaching-learning process. While communication science subject through distance education mode, it is necessary to arrange contact programme or a laboratory workshop where the demonstration of an experiments will be given by teacher and then only students can perform the experiments.

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Editor's Note: This provides technical information about the LabVIEW system.

LabVIEW-Based Virtual Model for Building Electronics Experiments

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Abstract

This article describes the LabVIEW-Experimental System using Analog Electronic Technology for Design and Implementation of a virtual model. This system has the advantage of parameter adjustment; convenient, easy implementation; and high reliability. In higher education, use of the virtual laboratory can be the answer for the serious funding shortage for experimental equipment and practical problem solving. As a complement, it supports conventional electronic technology experiments so that students who master the initial simulation software technology can conduct experiments in textbooks in a comprehensive manner and demonstrate knowledge learned in the classroom in a concrete manner.

Keywords: LABVIEW, Virtual Instrumentation, Electronics, Experiments.

Introduction

Virtual instruments is a computer hardware platform as the core of its functions and definition by the user, with a virtual panel, its test function implemented by the testing software, a computer test system. The essence of virtual instruments using computer monitors display function to simulate the traditional instruments of the control panel in order to express the output results in various forms: the use of computer software function to achieve a strong signal data computing, analysis and processing. The use of industrial Input/output interface device signals the completion of the acquisition, measurement and signal conditioning in order to establish one set of testing capabilities for the computer equipment systems. Virtual instrument completely broken the traditional instruments can only be defined by the manufacturer, the user cannot change the situation, allowing any one user can be convenient and flexible way to use the mouse or the buttons on a computer display screen virtual instrument soft front panel to operate a variety of 'knob' test work, and according to different testing requirements through the window, switch to a different virtual instruments, or by modifying the software to change, increase or decrease in the virtual instrument function of the system and scale.

The virtual instrument has such a 'can be development-oriented' and 'scalability' and other superior features to make the virtual instrument have strong vitality and competitiveness. Virtual instrumentation can help not only the students but the faculties themselves by recreating the equivalent of very expensive conventional laboratory equipment quite cheaply, Brabazon (2003). Through the use of a Data Acquisition (DAQ) tools, students can record relevant data from the experiments in real time. This allows students to concentrate on the concepts and details of experiment itself and not get distracted by the process of data recording. Animations, images and video clips can also be embedded within the virtual instrument which engage students and give them real world examples that relate to their coursework. Students can thereby gain not only a better understanding of what they are doing but why they are doing it ,Brabazon (2003).

By taking advantage of both LabVIEW and Multisim, designers can improve and quicken the circuit design process. Using both programs allows users to perform:

- Data acquisition using National Instruments DAQ boards and LabVIEW
- Simulation with Electronics Workbench Multisim
- Driving simulations with sampled analog signals (Analog buses)
- Driving simulations with digital signals including data and address buses
- Driving simulations with microprocessor signals from an emulator board
- Driving HDL test benches with real world values
- Comparing simulation waveforms to real world values
- Tightening the accuracy of the simulations
- Debugging by comparing simulation waveforms to actual ones
- Driving external circuitry with simulation results

The composition and classification of virtual instruments

Virtual Instrument from general instrument hardware platform and application software of two major sections.

(1) Virtual instrument hardware platform

Virtual instrument hardware platform consists of two parts:

(a) a computer, generally a PC, or workstation, which is the core hardware platform.

(b) Input/output interface device primarily to complete the measured input signal acquisition, amplification, and Analog to Digital conversion. Different bus have their corresponding Input/Output interface to hardware devices, such as the use of PC-bus data acquisition boards, GPIB bus, VXI bus, equipment modules, PXI bus, equipment modules, serial bus instruments.

The compositions of the main mode of virtual instruments are as follows:

- **PC-DAQ System**: PC-DAQ system is based on data acquisition card, signal conditioning circuits and computer hardware platform for the apparatus composed of plug-in virtual instrument system. This system uses the computer's PCI or industrial SA bus, the data acquisition card directly into the computer, the appropriate bus slot on the bottom.
- **GPIB system**: GPB system is based on standard bus PB instruments and computer-instrument platform consisting of virtual instrument test systems.
- **VXI System**: VX 6 is based on VXI standard bus module with the computer as the instrument platform consisting of virtual instrument test systems.
- **PXI Systems**: PX system is based on Industry standard bus Instruments PXI modules and computer-instrument platform consisting of virtual instrument test systems.
- **Serial System**: Serial system is based on standard bus instruments and computer-instrument platform consisting of virtual instrument test system

(2) Virtual instrument software

Virtual instrument software development tools have the following two categories:

- **Text-based development platform**: If the VisualC, VisualBasic, LabWindows/CVI, etc.
- **Graphical development platform**: such as LabVIEW, HPV E and so on

Virtual instrument software consists of two parts, namely, the application and Input / output interface, instrument drivers. The application also includes virtual panel features of the software program and definition of test function flowchart software programs. Input / Output interface, instrument drivers to complete the expansion of a specific external hardware devices, drivers, and communication.

LabVIEW development platform and Graphical programming Language

LabVIEW is a complete, open the virtual instrument development system application software, use it to set up instrument test systems and data acquisition system can greatly simplify the process design. LabVIEW and Visual C, Visual Basic, Lab Windows / CVI and other programming languages, which will use text-based language program code (Code), while the LabVIEW was to use graphical programming language, with the block diagram instead of the traditional program code. The use of Lab VIEW device icon and the scientists, engineers have used most of the icons are basically the same, which makes the programming process and the thinking process is very similar. LabVIEW contains dedicated to design data collection procedures and procedures for instrument control libraries and development tools for libraries. LabVIEW programming is the design one by one in essence a 'virtual instrument', i.e. 'VIs'. The use of a computer display screen on the library and development tools to generate a previous version of libraries (Front Panel); in the background is to use the graphical programming language used to control the preparation of a block diagram of the front panel program. Programs have the front panel interface similar to traditional instruments, acceptable user's mouse and keyboard commands. Generally speaking, each one VI can be called by other VI, its function is similar to the text language subroutine nesting; while the nested hierarchy, in theory, is not subject to any restrictions. LabVIEW is a library with a scalable and general-purpose programming subroutine library system. It provides for control of GPIB devices, VXI bus control, and serial device control, and data analysis, display and store the application program modules.

LabVIEW can easily call to Windows dynamic link libraries and user-defined functions in the dynamic link library; LabVIEW also provides a CIN (C Interface Node) node allows users to use by the C or C language, such as ANSI C, compiled program modules making LabVIEW as an open development platform. LabVIEW also directly supports dynamic data exchange (DDE), Structured Query Language (SQL), TCP and UDP network protocols. In addition, LabVIEW also provides a special toolbox for program development, enabling users to easily set breakpoints, dynamic implementation of the program to a very visual observation of the image data transmission process, as well as to facilitate debugging. LabVIEW operating mechanism of macro sense is no longer a traditional von Neumann computer architecture modalities for the implementation of the. Traditional computer languages (such as C) in the order of implementation of the Structure in LabVIEW was replaced by a parallel mechanism; from essence, it is a control-flow structure with a graphical data flow models (Data Flow Mode), this approach to ensure that the program functions in the node (Function Node) only with all the data before it can be executed. In other words, in which the concept of data flow program, the program execution is data-driven, it is not the operating system, computer and other factors.

Since the LabVIEW program is data flow-driven, data flow program design requirements, a goal only if it is valid only when all input can be implemented; against a target of the output only when its function is complete when valid. This, Lab VIEW was to connect the function nodes control the data flow between the program execution sequence, rather than the text-line procedure has been bound by the order of execution. Thus, we can function nodes connected to each other rapidly developing simple applications can even have multiple data channels operating simultaneously in the so-called multi-threaded (Multithreading).LabVIEW is the core of VI. VI has a man-machine dialogue user interface - Front Panel (Front Panel) and the equivalent function

block diagram of the source code program (Diagram). Front panel to accept instructions from the block diagram program. In the VI front panel controls (Controls) to simulate instrument input devices and the data available to the VI block diagram of the procedure; and Indicators (Indicators) is a simulation of the instrument's output device and display or generated by the block diagram of the procedure for obtaining the data. When a control or indicator when placed on the front panel, LabVIEW block diagram will be in the process produced a corresponding terminal (Terminals), it is subordinate to the control or indicator terminals cannot be deleted arbitrarily, and only remove it corresponds to the control or indicator when it will collapse with them removed.

LabVIEW block diagram using the preparation procedure, not subject to the details of the syntax of conventional programming restrictions. First of all, from the function panel (Function Palette) select the required function of the node (Function Node), their inclusion in the block diagram on the appropriate location; then use to connect (Wires) connecting all nodes in the function block diagram program port (Port) is used to transmit data between nodes in the function. Nodes of these functions include a simple calculation functions, advanced acquisition and analysis VI, as well as used to store and retrieve data files input and output functions and network function. The system level Integrated design flow diagram is shown in Fig. 1.

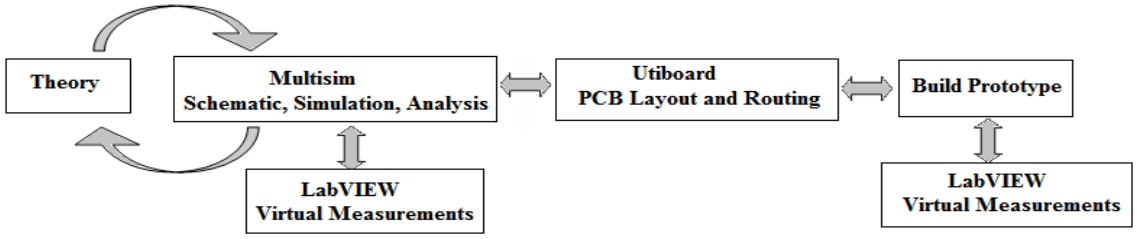


Fig 1 System level Integrated Design flow

Many books on LabVIEW programming are available [1-9], ranging from introductory [1-3] to advanced [4-7] and specialized [8-9].

Experimental model

There will be several occasions during the course of the electronics lab when you will need to save voltage versus time data generated at the proto-board. The data will need to be analyzed to determine various things such as: RC circuit time constants, lamp and light transducer response times, lamp pulse sequences, and A/D board noise levels and resolution. Most of these things can be determined from the oscilloscope display as well, but data displayed on our oscilloscopes cannot be saved for later analysis. When you want to save pulsed data, use the LabView 'Oscilloscope' program that is located on the front panel on the Graphical User Interface.

Before starting the program, be sure to connect the wiring correctly. The Electronics Laboratory are equipped with National Instruments 12-bit data acquisition (DAQ) boards and LabView software that can be used to manipulate the data that is collected through the DAQ board (and send data out through the DAQ board). The interface between the DAQ board (which is located inside the computer) and the outside environment is the green terminal board that should be attached to each computer via a thick data cable. A red and a black wire should be attached to two of the screw terminals on this board. The terminal connected to the red wire corresponds to an analog input for the DAQ board. The black wire is connected to a ground terminal. An analog voltage signal coming from your experiment can be transmitted through these wires to the DAQ board where it is converted to a digital signal that can be read by the computer. Therefore the

other end of the red wire should be connected to the signal that you wish to observe and save. The black wire should be connected to ground. This type of data conversion (analog to digital or A/D) is universal in modern instrumentation that takes advantage of microprocessors.

Start the software by double clicking on the 'Oscilloscope' program icon. To begin observing data click on the white arrow icon located in the upper left hand portion of the screen. When the program is running, the arrow icon should appear black. The program is designed to work much like an oscilloscope. The two virtual knobs located to the left can be used to adjust the x axis of the graph, which corresponds to time (units of seconds) and the y axis, which corresponds to voltage (units of volts). The setting on the knobs corresponds to the delimitations between grid lines on the graph. To turn the knobs place the pointed finger mouse cursor over the knob, hold down the left mouse button and drag the knob in a circular manner, just as if you were turning it.

The actual value of the knob displays in the box below each knob (you cannot enter a specific value in this box, you must turn the knob). Once you make an adjustment to a knob, wait a few seconds for the data displayed in the graph to adjust before making any further adjustments. Depending on the time axis setting (x-axis) a prefix may appear after each number on the axis scale. No prefix corresponds to seconds, an 'm' prefix corresponds to milliseconds, and a 'u' prefix corresponds to microseconds. If the average value of the signal you are trying to observe is not zero, you may have to adjust the trigger. Adjust the trigger by clicking on, and dragging the control located below the data display. Drag the control slowly until you observe a signal. Adjust the control knobs until the data is displayed to your liking; when you save the data, you will save exactly what you observe on the graph.

If you wish to stop the program without saving data make sure that the switch located to the lower left is in the 'off' or down position. The text, 'Don't save data on stop' should be visible. Placing the pointed finger cursor over the switch and left clicking the mouse will operate the switch. Then left click on the 'Stop and save data' button. The program will stop collecting new data from the DAQ board and no data will be saved. The start button should turn white, and to begin the program again, simply press the start button with the mouse cursor.

To save data you must make sure that the switch in the lower left is in the 'on' or up position. The text, 'Save data on stop' should be visible. Before pressing the 'Stop and save data' button a file path and file name should be entered into the text box located along the bottom of the screen. A specific path and file can be chosen by clicking on the file icon to the far right of this text box. If no path and filename is given, a standard Windows dialog box will open when the stop button is pressed that will prompt you for a file path and name.

Next you will want to work with the data in Microsoft Excel. To open a data file in Excel, first start Excel with no specific file opened. Choose 'File/Open…' from the drop down menu at the top left. Go to the directory where your data file is located. Since the data file is not Excel formatted it probably will not show up in the dialog box. To make it appear, under 'Files of type:' in the Excel dialog box, you must choose 'All Files'. Double click on your file and a second dialog box should open. In the first screen you must tell Excel if your data file is delimited or fixed width. Data saved using the 'Oscilloscope' program is delimited, so make sure this radio button is chosen and click on 'Next' at the bottom of the dialog box. Specifically, the data is comma delimited, so make sure the 'comma' box is chosen and then you can click 'Finish' at the bottom of the dialog box. You should now have a spreadsheet with two columns and approximately 1000 rows. Column A is time in seconds. Column B is voltage in volts. When plotted (voltage versus time) the data in the spreadsheet should be the same data that was displayed in the 'Oscilloscope' program when you pressed the 'Stop' button. The additional Sample Experimental screens are shown in fig. 2 (a-f).

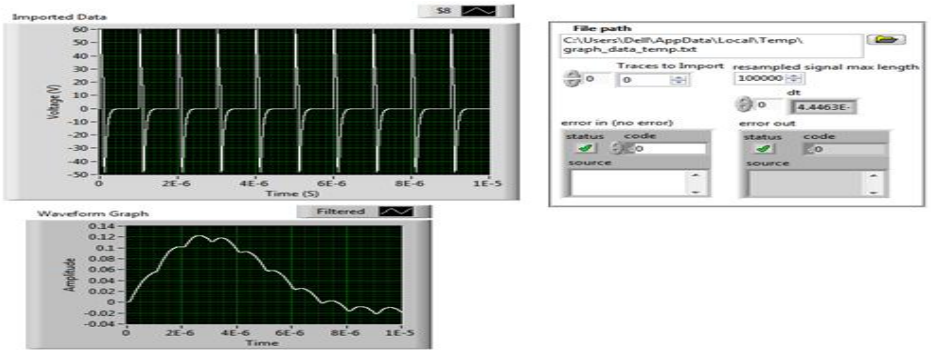


Fig 2 (a) Output of piezoelectric Transducer.

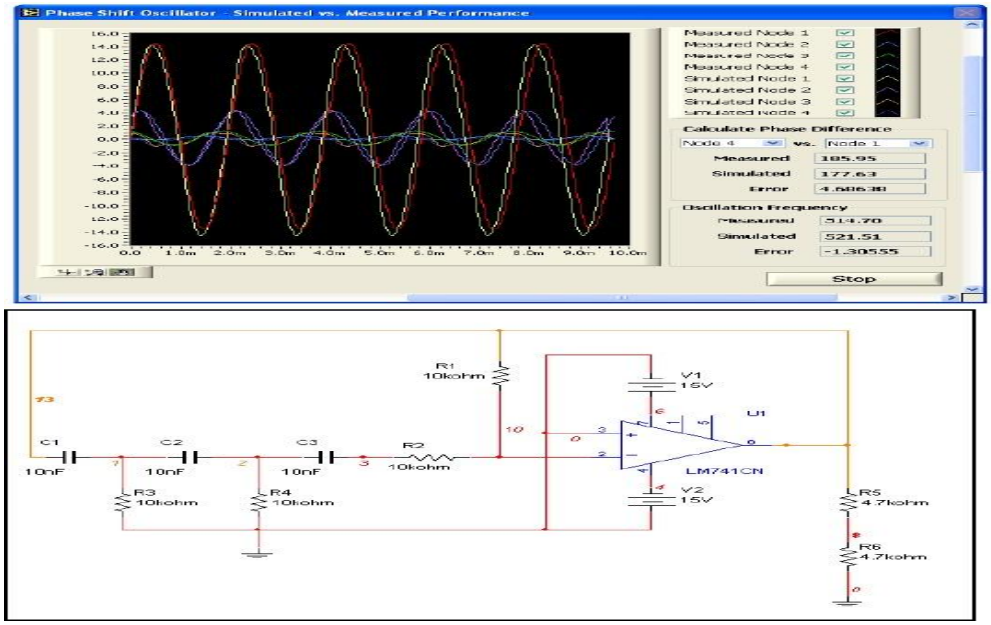


Fig. 2 (b) Simulation of phase-shift oscillator.

Fig. 2 (c) ECG Signal Generation

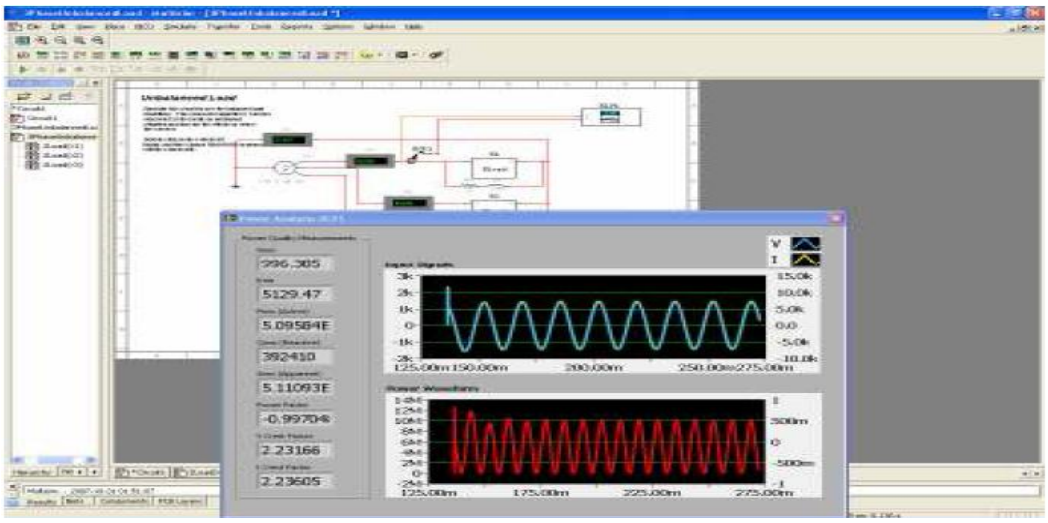
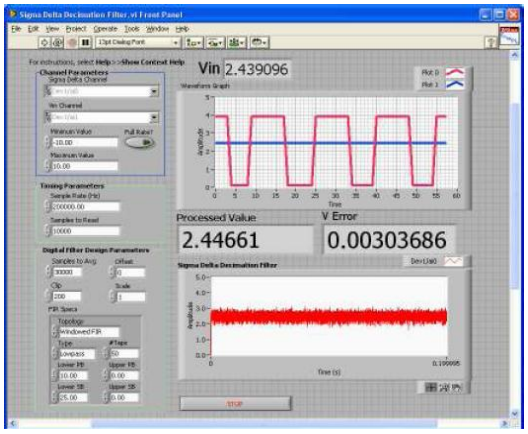


Fig. 2 (d) Power Quality Analysis Measurements



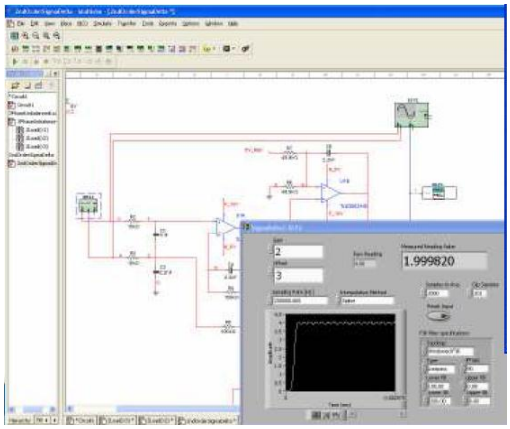


Fig 2 (e) Sigma Delta ADC / Circuit running in Multisim / LabVIEW used to design and implement DSP Filter. Test VI (right) shows implementation of ADC and good agreement between input and processed values.

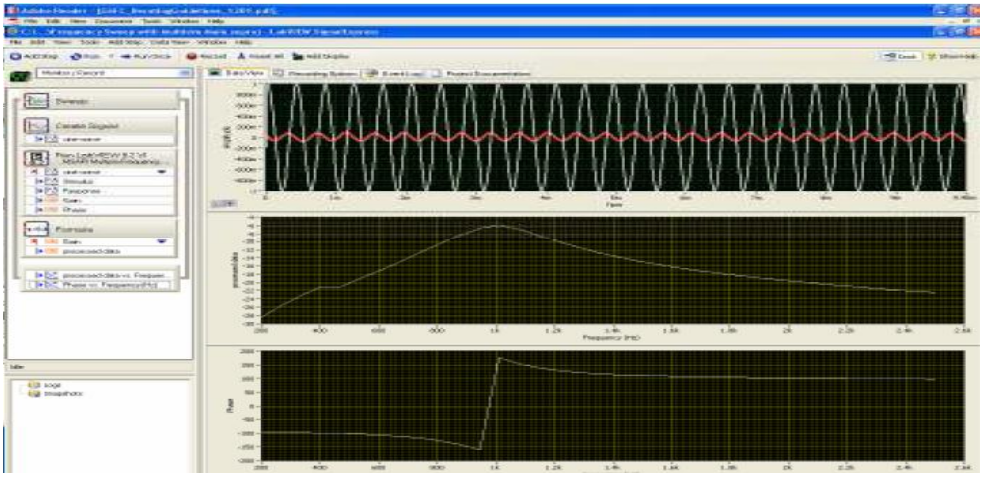


Fig 2 (f) Signal Express Test Script – Running 'Virtual Device' simulation in Multisim to compare and correlate simulation with real test data.

Results

We have made a case for the pedagogical and practical advantages of LabVIEW-based computer-controlled experiments in Electronics laboratory. The range of feasible and affordable experiments is increased, allowing for greater correspondence between lectures and the student's laboratory experience. As computers and data-acquisition interfaces become more versatile and less expensive, as they inevitably will, the trend towards computer-controlled experiments in Electronics instruction will accelerate. Students who are science majors will benefit from experiences more closely related to their future real-world work. All students will benefit from the experience of data acquisition and analysis by computer. This individual learning experience was a multi-faceted educational opportunity. First, the design student independently developed a new skill by learning to program with LabVIEW. In so doing, he added a powerful problem solving technique to his skills. By developing a lab experiment for other undergraduates, the design student also gained valuable insight to the demands of teaching, particularly the need to clearly communicate procedures and objectives. This new perspective allows the student to obtain a more complete outlook on the learning process. In addition, students gain familiarity with LabVIEW as a programming alternative to traditional text based languages which are sometimes difficult for more visually oriented learners. It is hoped that the students will continue to learn more about the capabilities of LabVIEW as a result of performing the experiment.

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Editor's Note: Economic woes put additional pressures on students. This creates an unusual challenge for educators to motivate students and make learning a positive experience.

Helping Students to Cope with Current International Economic Conditions

Thomas Schaefer and Robert Fiermonte
USA

Abstract

The purpose of this paper is to highlight and identify how negative economic conditions impact the motivation of online students. During periods of economic downturn many students are negatively impacted as they lose their jobs; see cutbacks in hours worked and/or salary, forced to retrain or learn new skills, take on additional responsibilities within the workplace, and/or lose or reduce economic security as expected savings or retirement investments are impacted. Surviving the consequences of an economic downturn can result in de-motivation in the workplace and in the classroom as well. The paper seeks to provide guidance on how to identify the student survivor in the online classroom, review key factors necessary to create or enhance individual and class motivation, and discuss possible techniques or methods faculty and administrative staff can implement and utilize to reduce the impact of economic de-motivational factors.

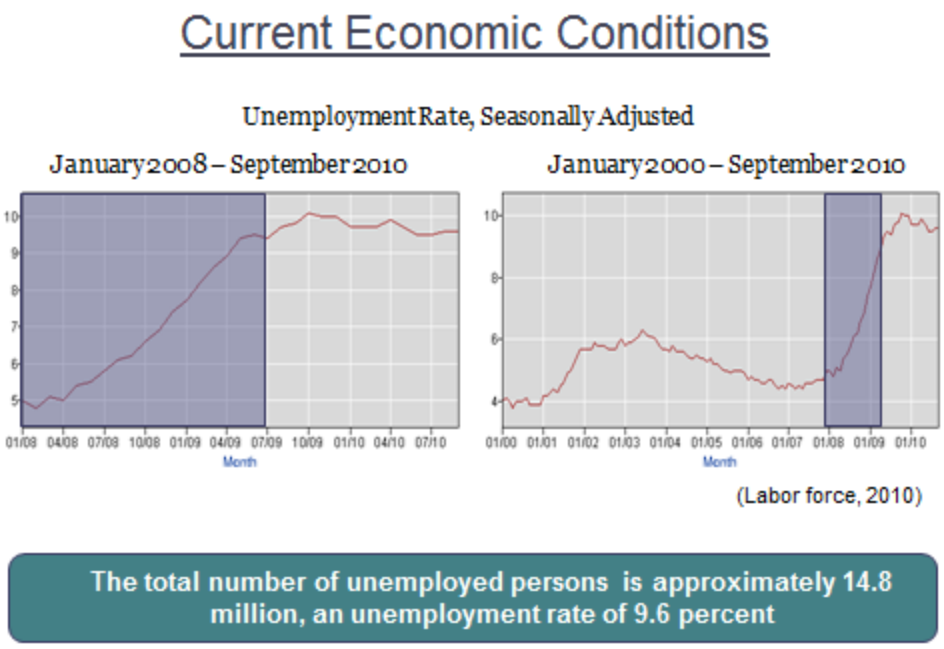
Keywords: distance learning, e-learning, economic downturn, recession, on-line learning, student motivation

Introduction

Since 2008 the global economy has and continues to fall. There appears to be a general assumption among faculty in higher education that the consequences of recession do not follow the student into the classroom. However, the evidence and statistics reveal the opposite to be true. Administrators and faculty need to be aware of the impact that an economic downturn has upon their students and to act accordingly when appropriate.

At the end of 2010, economic conditions in the United States resulted in a national unemployment rate just below 10% (Labor force, 2010). In the chart below (exhibit 1), two seasonally adjusted unemployment charts are presented. Between January of 2008 and September of 2010 the national unemployment rate rose drastically as the United States economy went into the recession in 2008. The 10 year chart (January of 2000 to September 2010) clearly indicates the unemployment rate at a low of 4% in 2000 contrasted to a rate just under 10% in 2009. In 2010, the number of unemployed persons in the United States was estimated to be approximately 14.8 million and excludes those individuals that are classified as chronically unemployed (Labor force, 2010).

Statistics at the end of 2010 indicated economic conditions wherein 42% of unemployed persons within the United States had been jobless for 27 weeks or more. This number does not include US citizens with involuntary part time employment status. Involuntary part time employment has risen since 2008 to 8.9 million as of the end of 2010 (The employment, 2010). Many of those individuals classified as involuntary part-time employed desire to be employed full-time, but the US economy in its current state has not been able to provide such opportunities.



(Exhibit 1)

Couple these factors with information identifying that within the United States the percentage of employed individuals reporting they are doing worse in 2010 (than in 2009) has increased substantially. During the U.S. recession of the 1980's the percentage of employed individuals indicating they were doing worse rose from 20% to 30%. Contrast this with polling results in 2010 that indicate, for the same question, that the number of employed individuals feeling they were worse off year-to-year rose from 20% to 60%. This is a threefold increase in the number of individuals who today believe they are doing worse now than they did in the past (Shapiro, 2009). These numbers run in stark contrast to polling of general consumers where only 50% indicated they expected things to be harder in the coming year. This number remained steady during polling regardless of economic conditions even though a significant portion of the United States working age population has been directly or indirectly impacted by the current economic situation (Shapiro, 2009).

The State of the Economy Increases Depression and Anxiety

The economic fear of what's going to happen is having a huge effect on whether employees seek assistance for anxiety, marital strife, or substance abuse. In fact, the American Psychological Association (APA) conducted a poll in 2008 which identified that 80% of respondents from the United States reported that the economy was causing them stress in comparison to only 6% of American respondents indicating the economy causing stress in 2007 (Belluck, 2009).

For the purpose of this paper, we will be addressing the traditional or continuing education student in higher education. When a student is impacted by economic conditions they tend to fall under one or more of the following six categories:

- Lost their job.
- Underemployed.
- Survivor's guilt.
- Never been employed and cannot find a job.

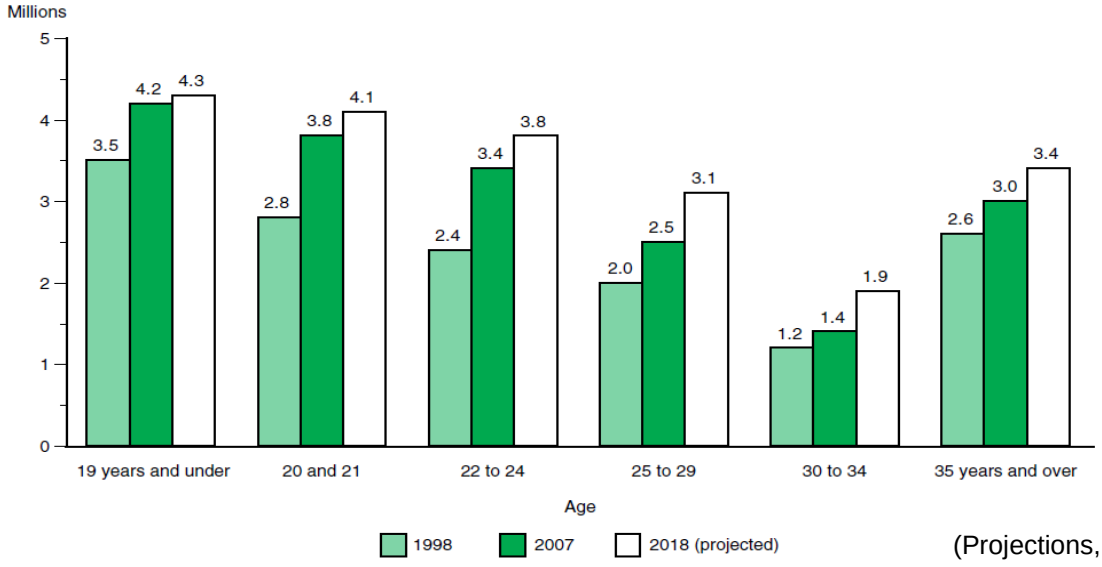
- Indirectly impacted.
- Those not impacted.

Statistics reflect that in 2008 the jobless rate among college graduates was 4.3%, or 2 million unemployed graduates. The National Association of Colleges and Employers predicted that companies will hire 22% fewer graduating seniors in future years than they did in 2008 (David, 2009). This factor, as borne out by the recent fluctuations in the global marketplace, has created anxiety among those getting ready to graduate.

College Students the Economy and Depression

According to the United States government, the US recession officially began in 2007 and officially ended in 2008. Yet many students have seen no signs of recovery and continue to be greatly affected as a consequence of the recession. John Gutman at Hofstra University co-authored a study comparing the records of 3,256 traditional college students. He discovered that when college students sought counseling at a midsized private university; those with moderate to severe depression had risen from 34% in the general college population to 41% (Ortega & Huffer, 2010). This is bolstered by the fact that the overall rate of depression among traditional college students was found to have risen from 10% to 16% between 2000 and 2005 (Dusen, 2008). A subsequent study in 2007 identified that 36% of students surveyed identified they were so depressed they had difficulty functioning within the classroom (David, 2009).

Consider that the bar chart below (exhibit 2) indicates the number of college students is expected to rise from current levels by more than 20% before 2018. Clearly we cannot overlook the impact of the economy on the student's ability to learn and function correctly within the classroom. Correlate these facts and consider that as the number of students increase, the potential for having students suffering from the effects of the economy, in multiple ways, should increase exponentially as well.



(Projections, 2009, p.29)

(Exhibit 2)
Employment and the College Student

Many college students depend on staying employed while they attend school. This is not a fact exclusive to adult learners as many younger students find their parents can no longer pay 100% of

the college tuition, room, and board costs. Add to this mix a growing college population and a decrease in available jobs due to an economic downturn and the impact is clearly substantial.

For example in a 2009 poll conducted across 40 US colleges and universities involving 2,240 undergraduates aged 18 to 24 found that:

- nearly 1/5 of respondents indicated at least one parent had lost a job in the previous year.
- 11% chose not to go to graduate school because their parents could not afford it.
- 27% of those surveyed consider dropping out of college altogether.
- 22% of those surveyed worry about having enough money to get through a typical week at school, let alone an entire semester.
- 30% are concerned about the finances of their parents. (Edison Media, 2010)

Increasing Demand for Financial Aid

The impact of the economic downturn has led to an increase dependence among students on government supported and privately financed student loans and aid. The college aid contribution by parents and family decreases during difficult economic times and this means students need to borrow ever increasing sums of money (Chitty, 2009). The end result, of course, is a large student debt load that contributes to emotional and psychological issues ("How I repay these loans"). Both students and administrators are predicting that there will be an increasing demand for financial aid assistance as a result of the downturn in the economy and cuts in government assistance, while simultaneously experiencing a decrease of student dollars and financial aid at all levels federal, state, municipal institutional and private (Chitty 2009).

Such competition for a decreasing pot of available funding adds greatly to negative student psychology and depression. Add to this the fact that any further downturn in the economy and the potential for a double-dip recession means that students are making less money. Additionally, parents of students are making less money overall as well and, as such; this makes more students become eligible for student loans. The pot of aid continues to reduce while the number of eligible students increases. A good example is that in 2009 there were 786,000 more applicants receiving Pell grants than in 2008. This resulted in a $6 billion shortfall in the Pell grant program (Chitty 2009).

The impact of reduced opportunities for employment directly affects students, particularly if they need to be employed to attend school, or one or more parents are no longer employed. Studies indicate that the unemployed and their families suffer from:

- Lower levels of well-being and life satisfaction.
- Increase stress, psychological distress and depression.
- Increased concerns due to familial and financial obligations.
- Temporary unemployment or multiple part-time jobs provide positive and negative perspectives endorsed by both workers and employers.
- Continued downsizing and job reductions can create an environment of instability and fear.
- Feelings of anxiety and guilt can result in a lack of motivation and decreased productivity. (Campbell, 2010 and Economic, 2010)

This information is important because unemployed students or students whose parents have lost their job(s) can exhibit one or more of these behaviors. These behaviors are manifested through their classroom approach as well as how they complete or approach their assignments.

Survivors Guilt

The loss of nearly 2.5 million jobs from the economy has dramatically impacted not only those who've lost their jobs, but those who kept their jobs after layoffs and reorganizations. Studies

have found that there is a tendency for employees to experience empathy for those who are laid off. Such feelings of despair are called emotional contagion. Survivors guilt occurs when those who kept their jobs experience a feeling or belief of " why me and not them". Survivors envy is different than survivor's guilt but has the same damaging psychological impact. Survivor's envy occurs when those who kept their jobs believe they would have been better off had they to lost their jobs (Kiviat, 2009).

Ramifications of emotional contagion, survivor's guilt, and survivors envy include: reduced commitment, diminished productivity, lessening creativity (job responsibilities increase but the time to do them does not) and distraction from the organizational mission by worry and fear that they are next. People who lose their jobs tend to feel ostracized by those who are still employed and a conflict occurs (even among friends). The divide between those who kept their jobs and those who lost their jobs increases. This then in turn increases their stress level (Kiviat, 2009).

Survivor's guilt is a major issue for those who remain employed. This includes students who are continuing their education while working. Harold Kaufman, professor of management and the director of organizational behavior at the Polytechnic Institute of New York University, notes that those individuals who don't lose their jobs are also victims (Alleccia 2008 para 8). In effect those individuals who don't lose their jobs during periods of economic downturn are both survivors and victims'. Interestingly, studies are finding that survivor's guilt is greater during the current economic recession than in all previous recessions (Reisner, 2009). It appears that entire job types are being eliminated whereas in previous recessions survivors could simply find work in a similar type job position. When survivors guilt does occur, those who remain employed believe that they are, in some way, responsible for the other individuals losing their jobs. Anxiety continues as the remaining employees worry that they may be next in line for possible termination (Alleccia, 2008). Surviving employees (those who keep their jobs) feel sympathy and concern towards those who lose their jobs while worrying about their own (Reisner 2009). Students suffering from survivor's guilt tend to bring such anxieties and depressions into the classroom.

Why Should Educators Care?

Consider the psychological effects caused by an economic downturn. Students feel isolated from their fellow students, have a fear of forming new friendships out of concern that those friendships will end abruptly, experience undeserved feelings of being spared that run contradictory to feelings of elation and happiness for being spared and keeping their job (Goudreau, 2009). Some or all of the psychological effects that are experienced by students who are suffering from survivor's guilt translate into the classroom. Possible issues include: Lethargy (repeatedly late or last-minute assignments); Assignment quality very low (previously acceptable assignments now either unacceptable or marginal); High sensitivity to comments from other students (on discussion boards, within groups, or within the classroom); and continuous negative reaction to professor/instructor interactions (include grading comments, e-mails, or face-to-face interactions).

Identifying Affected Students

So how do we identify affected students? Begin by carefully reading and monitoring; introductions, e-mails, discussion comments, and others student to student interactions. Look for key indicators. Below are actual comments heard in the classroom (these are quotes taken from the authors classrooms):

- "My husband/wife just lost their job."
- "Sorry I'm late with this, but I'm now doing the work of three people at my job."
- "Hey, I'm unemployed too so I know just how you feel."
- "I'm trying to improve myself in order to get a better job than the one I just lost."

- "What do you know about how hard it is right now?"
- "I'm trying to survive on my benefits, look for work, and complete these stupid assignments."
- "I'm trying, but it's hard right now because of all the things happening to me."
- "What you care? You have a job!"

Motivating affected students.

Where does motivation come from? Motivation is "individual behavior influenced by a goal" (Evans, 1986). There are four types of motivation:

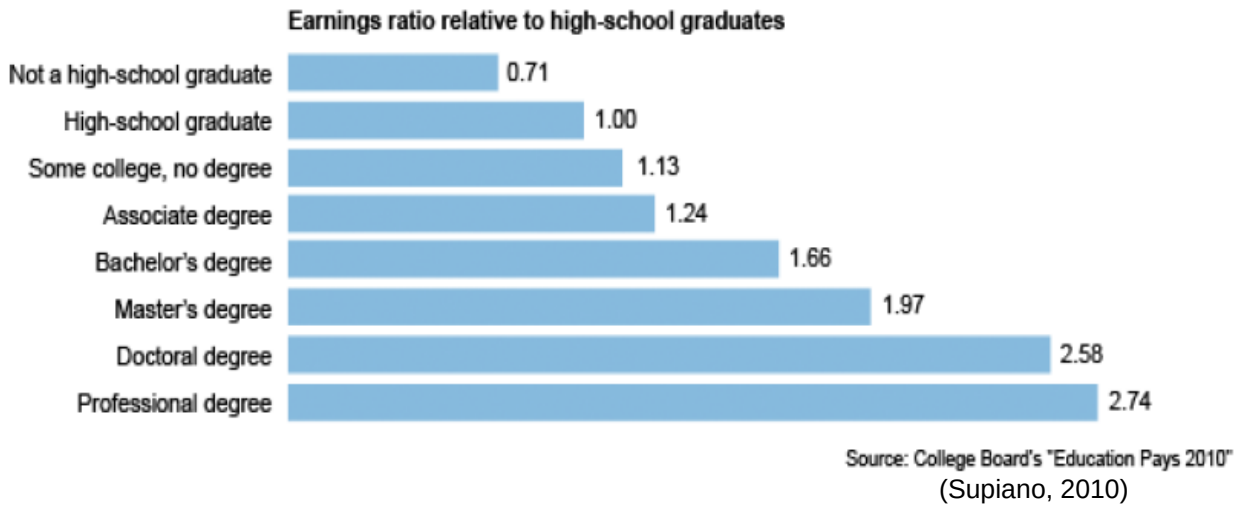
1. Intrinsic motivation – an internal sense of obligation (Austin, 2002).
2. Extrinsic motivation – motivation created or impacted by the words, deeds, or action of others (Austin, 2002).
3. Instrumental motivation – the belief that doing something will lead to tangible outcomes (Barbuto, Fritz & Marx, 2002).
4. Self-concept motivation – based on the expectation of others and the need to achieve social acceptance (Barbuto & Brown, 1999).

The instructor/professor has both formal and granted power and as such can motivate students via; directive, persuasion, negotiation, involvement, indirection, enlistment, redirection, and repudiation. This does not mean professors/instructors should make things easier for affected students. Instead they must take greater care to remain fair, and judge students accordingly while following the course rubric. Professors/instructors must be careful not to lessen grading standards for impacted students as this will likely de-motivate those students who are not impacted as you are applying a different yardstick based on issues outside of the classroom.

- Understand that motivation differs from person – to – person (there is no" one-size-fits-all" approach). Consider the following suggestions to motivate students:
- Encourage students by reminding them they are investing in their future.
- Suggested class study and research is a means by which they can ignore the pressing or depressing issues that are impacting them.
- Provide positive affirmations to the student; e.g. "I know it's been hard but you should be proud of yourself for hanging in there."
- Make yourself available to act as a sounding board (within reason).
- Identify options available through the school. Suggest they seek assistance if they are struggling academically or psychologically and discuss things with them in an upbeat manner (rather than it is a means to hand off the student to someone else).

Estimated Earnings

You can see from the chart below (exhibit 3) that one major motivating factor driving students to earn a degree is that college graduate's make more money than non-college graduates. In fact the average college graduate earns approximately 66% more than the typical high school graduate. Over the course of a 40 year career, in many cases, this is in excess of $1 million more in lifetime earnings (Supiano, 2010). The chart below indicates the progression of earnings as individuals seek to become more educated from no high school diploma through doctorate and a professional degree.



(Supiano, 2010)

(Exhibit 3)

Professors/Instructors can use facts to motivate students impacted by an economic downturn. Students can be made aware that college graduates are less likely to be unemployed compared to those only with only a high school education. On average (for those 25 and older) only 4.6% of those with a four-year college degree are unemployed versus 9.7% for those that are high school graduate only (Supiano, 2010).

Points to Ponder

A question that must be asked is whether the professor/instructor should do anything at all to assist those students impacted by the economy? Additionally, how are the events of the current economic recession different than dealing with the student who is simply suffering from a temporary emergency, from depression, or has a mental illness? It is up to each faculty member to use their discretion to evaluate the situation appropriately, and how deeply the issue impacts the student. We should all be mindful however to be flexible, be kind, and be compassionate.

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Editor's Note: Computers facilitate easy updating of lesson materials. The platforms and patterns discussed here facilitate initial entry, editing, updating, and consistent formatting of lesson content.

Educational Service Strategy:
Educational Service Platforms and E-Learning Patterns

Peter Weber and Ayman Abuhamdieh
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Abstract

Implementing e-learning in higher education institutions is a multidimensional challenge: pedagogical, technical and economic. This paper presents two approaches to overcoming these challenges: service platforms, and e-learning patterns. Service platforms are conceptual "tool boxes" used to create educational services, and patterns are reusable solution components for recurring educational challenges. These approaches assist educators and educational institutions in providing customized educational services based on modularization, and will help them in providing their services in an efficient and effective manner. The paper describes and compares the two approaches and outlines an integrated educational service strategy from the perspective of a higher education service provider.

Keywords: blended learning, competition, customization, educational service, e-learning, learning scenario, platform, e-learning pattern, reusability, service strategy, standardization.

Introduction

Remarkable technological developments like the very fast and broad diffusion and advancement of information and communication technology (ICT) are more and more impacting educational processes. Social changes like globalization and the growing importance of lifelong learning, the changing conditions in the labour markets, or the current financial crisis are changing the educational necessities and opportunities (see e.g. Marginson and van der Wende, 2007; Fiedler, Welpe and Picot, 2006; Zentel et al., 2004). In consideration of international political agreements such as the Bologna Declaration or the Lisbon Strategy in the European Union, but also with regard to the numerous other non-political triggers, established structures of higher education are being fundamentally rethought (e.g. see Commission of the European Communities, 2009; UNESCO, 2004; Commission of the European Communities, 2006). In addition, the educational landscape is getting more competitive and expectations are changing, for example because of the growing availability of accredited programs that are offered completely in a distance learning format (like at the University of Phoenix). Thus, the system of higher education is under pressure in many countries. Higher education institutions need strategies that help them to stay competitive in these changing structures. They must appreciate the importance and the challenges of consequent market/customer orientation and the need to think of individual efficiency and effectiveness strategies as a basis of sustainable competitive advantage. Development of strategies that will help them compete more effectively is essential to their continued success and growth over time.

Innovative teaching and learning concepts like e-learning, blended learning or ideas like open educational resources are thereby constantly gaining more attention. A great variety of developments and approaches has evolved, ranging from completely new and digitized offers to small-sized support opportunities for single sessions of learning arrangements with the help of virtual classrooms, blogs, wikis, etc. (see e.g. Stahl, Koschmann and Suthers, 2006; Salmon, 2008; Rungtusanatham et al., 2004; Gill, 2007). Such innovative educational services are considered valuable both in economic and pedagogical terms, but they require profound and interdisciplinary knowledge on the supplier's side. What's the best composition of elements and

methods and what degree of digitization should be chosen in a given class for example (Ahmed, 2010; Mykytyn et al., 2008)? How can profound and sustainable production and maintenance processes be established, and how can new and innovative services be developed efficiently?

This paper focuses on the value of educational service platforms and e-learning patterns, in order to facilitate the search for answers to these questions when it comes to e-learning. The paper elaborates the concepts of service platforms and e-learning patterns and shows how both can be combined in an educational service strategy. Building on similar underlying ideas, but deriving from different disciplines and backgrounds, suggestions for the adaptation of both approaches have been attracting notice recently in the e-learning community (Gabriel, Gersch and Weber, 2007; Derntl, 2006; Kohls, 2009).

The paper answers the following four questions:

RQ1: What are the origin and discipline implementations of service platforms and patterns?

RQ2: To what extent have patterns and service platforms been investigated in the e-learning context?

RQ3: How different or similar are the two approaches?

RQ4: How can the two approaches synergize and contribute to a more holistic educational service strategy?

In order to seek answers to these research questions in sections 2 and 3 both approaches will be summarized regarding their main characteristics, their origin, their major objectives and preliminary findings on their applicability in the e-learning context. Section 4 then discusses overlap and differences of the two approaches, before in section 5 a more holistic educational service strategy is outlined. The paper concludes with a summary and the identification of future research issues in section 6.

Educational services can be defined as a set of components (e-lectures, face-to-face lectures, blackboard courses, wikis, forums, readings, textbooks, etc.) for blended learning. Blended learning events combine aspects of online and face-to-face instruction with regard for learning conditions (target group, budget, available study material, etc.) and values (learning objectives, attitudes, motivation, etc.) of a setting (Garrison, Vaughan and Garrison, 2008; Graham, 2006). As a consequence of the blended learning nature of educational services, service creation processes need to consider both the characteristics of traditional teaching components and e-learning components. Traditional teaching implies high work intensity during the actual service provision, a need for synchronous presence of teacher and student, a more flexible structure, and is difficult to prefabricate and reuse. E-learning objects, in contrast, represent digital goods and thus usually imply high first-copy costs, low reproduction costs, no quality loss within reproduction processes and multilevel standardization opportunities (Shapiro and Varian, 2008). Thus the discussed educational services on a pedagogical level combine the advantages of e-learning with those of traditional teaching, while on an economical level the service creation processes need to consider the relevant characteristics of the different components of the intended service bundles.

[Educational] Service Platforms

In their internationally renowned standard reference “The Power of Product Platforms” Meyer and Lehnerd define a platform as “a set of subsystems and interfaces that form a common structure from which a stream of derivative products can be efficiently developed and produced” (Meyer and Lehnerd, 1997, p. xii). Platforms are the systematic foundation of common core technologies used to plan and create product families. Product platforms (Meyer and DeTore,

1999; Muffatto and Roveda, 2000; Simpson, Maier and Mistree, 2001; Huang, Simpson and Pine II, 2005):

- are a substantial component of multiple products,
- themselves consist of a combination of elements like subsystems and interfaces,
- build the common basis for the development of multiple similar, but still differentiated products.

In his research report Marc H. Meyer points at Hewlett Packard's ink jet printers as a successful example of product platform architecture. While the different subsystems like the mechanics, the electronics, the software, the ink, as well as the production processes have been improved repeatedly over time, the main platform has remained largely constant for several generations of ink jet printers (Meyer, 1996).

Platform strategies focus on the identification and bundling of invariant product inherent elements and on the systematic management (evaluation, maintenance, further development, etc.) of these elements in platforms. They aim to foster and improve the systematic development of new products and provide an answer to the challenging combination of growing customization demands, decreasing product life cycles and higher development and production costs (Stauss, 2006). According to Meyer & DeTore (1999) they address "the most difficult yet important challenge facing firms seeking continued growth", which is the integration of markets, products and embodied technologies (Meyer and DeTore, 1999, p. 65).

Stauss (2006) and Meyer & DeTore (1999) were the first to introduce the platform idea to the service sector. The service platforms concept was derived from the idea of industrial product platforms and was inspired for example from the success in the automotive industry. Service platforms can be defined as sets of optional components and interfaces that form a reusable structure for services. Consequently, service platform strategies target more efficient and effective creation of differentiated service bundles, cost reduction, shorter periods of new service developments and more differentiated services that consider customers' needs. In contrast to Porter's generic competition strategy alternatives cost-leadership or differentiation, service platforms intentionally combine standardization and customization efforts and thus elements of cost-leadership and differentiation strategies (Porter, 2004; Huang, Simpson and Pine II, 2005; Pine, 1993; Gabriel, Gersch and Weber, 2006; Gilmore and Pine II, 1997).

Table 1
Types of service platforms (based on Stauss, 2006)

Platform Type	Characterization
Outcome Platforms	Outcome platforms are based on standardized service outcomes. These outcomes are the basis for different service versions and/or service bundles, in which they are combined with other service components.
Process Platforms	Process platforms contain standardized activities and can be part of different services creation processes as such.
Preparation Platforms	Preparation platforms represent sets of standardized components for the service preparation, like equipment, personnel, technology. These components are the basis of different service accomplishment processes and are experienced by the customers as part of the service.
Customer Platforms	Customer platforms consist of customers and their objects (customer specific information, rights, etc.) as external elements of service creation processes.

Standardization and thus service platforms can thereby focus on the preparation, the accomplishment, the outcome, the integration of the external factors (customer integration) or on combinations of these aspects of a typical service process (Stauss, 2006; Gabriel, Gersch and Weber, 2007). Table 1 characterizes the types of service platforms as suggested by Stauss (2006).

An "Enhanced" Cloud Computing (ECC) platform may serve as a first example of educational service platform architecture. Cloud computing is a recent development in the history of online services where applications and data are stored in the 'cloud', a place where location does not matter, just as the exact source of electricity generated does not matter, as long as the service is provided (Han, 2010). In the production facility platform, different mechanisms and components are added to create something. The components are usually readily available near the product assembled. Similarly, in a service platform for the creation of educational services, the necessary components are available in the ECC, which would house several components such as learning modules (e.g. online classes), learning facilitators (blogs, wikis, discussion boards, chat applications, and so on), and the data used to create and that is produced by the users. We call it enhanced because the current form of cloud computing is geared mostly towards storing data and providing limited application services. Expanding that into an educational service platform architecture is what enhances it.

An educational service platform strategy, a special type of service platform strategy, can be of value for commercial educational suppliers and for non-commercial educational institutions like universities. Against the above described changes and developments, the efficient and effective development and accomplishment of educational services is currently one of the dominating challenges for these institutions. Educational service platforms as addressed and outlined by (Gabriel, Gersch and Weber, 2007) and in this paper can be either for complete educational services, called "learning scenarios", or subsystems for specific educational procedures as "phases of learning scenarios". In addition to these platforms, modularized and standardized educational components play an important role, since they are essential elements of the platform development process and also means for the customization of the actual service bundles. An educational service platform strategy is thus at heart a profound orchestration of educational service components, phases of learning scenarios, and learning scenarios, as depicted in Figure 1.

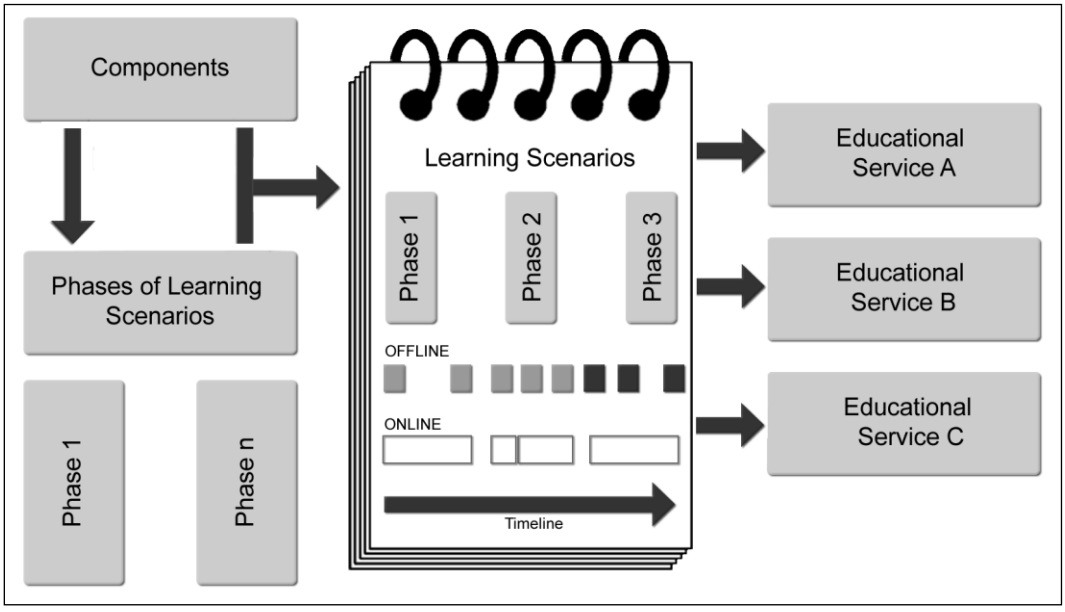

Figure 1: Components, phases of learning scenarios, learning scenarios

As service platforms, learning scenarios are models for certain types of classes. An example could be a learning scenario for an international collaborative e-learning class like described in Gabriel et al. (2007). The learning scenario depicts approved and reusable main procedures of such international settings like a promising basic order of events, an appropriate timeframe, successful procedures for video conferences, evaluation patterns, discussion boards, etc. Instead of a monolithic structure (developed just for one class), it combines a set of phases of learning scenarios, which themselves represent reusable sub systems and consist of ideal typical processes, interfaces and educational components. Each phase focuses on a certain educational goal, such as the assimilation of basic knowledge, the facilitation of collaboration within a case study setting or the repetition of topics in combination with a preparation of the students for upcoming exams. Like in the ink jet printer example in the beginning of section 2, using a platform (the learning scenario) and the implemented phases of the learning scenarios as a constant basis for the development of international collaborative e-learning classes helps to improve the class concept continuously, and to derive new high quality classes effectively.

On all three levels of the strategy (components, phases of learning scenarios and learning scenarios) opportunities for a customization of the resulting service bundles and learning processes can be embraced. Within the learning scenarios different standardized phases (subsystems) are combined according to the learning objectives for a specific target group or market segment. Thereby several adjustments like the bandwidth and topical focus, the interaction pattern and the operating principles can be made according to the target group's needs. If prepared carefully, complete online settings and hybrid (blended learning) settings, individual and collaborative learning processes, interactive and self-guided learning processes can be derived out of the same educational service platform. In addition to general options like the target group specific combination of standardized components and procedures, educational service platforms also allow a didactically grounded self-individualization of learning processes:

- In blended learning settings learners can be enabled to define their specific learning paths more easily than in traditional settings, for example with regard to the choice and order of sources of information they want to use (web-based training systems, case studies, literature, e-lectures, participation in face-to-face classes, etc.). Such self-individualization not only leads to unique learning experiences for each student, but also to more efficient learning processes in consideration of different learning styles.
- Constructivist elements as a second example of didactically grounded customization opportunities lead to individual learning processes and individual mixtures of covered content, even within replicated educational services. As they enable the active construction of solutions within complex, problem-based tasks, they always merge in unique learning experiences, using the same technologies and starting with the same standardized task definition (Savery, 2009).

Conclusively, educational service platforms help to systematically analyze, modularize, and develop educational services. They allow more efficient service development and accomplishment and they help improve the quality and the effectiveness of educational services, since experiences and expertise can be embraced in the platforms and thus made reusable.

E-Learning-Patterns

The systematic and detailed consideration of patterns was introduced by Christopher Alexander in architectural theory in 1977. Alexander dealt with the construction of towns and buildings, and concluded that "Each pattern describes a problem which occurs over and over again in our environment, and then describes the core of the solution to that problem, in such a way that you can use this solution a million times over, without ever doing it the same way twice." (Alexander, Ishikawa and Silverstein, 1977). According to this understanding, patterns aim to capture the

invariant components of approved solutions to recurring problems, so that lessons learned can be considered, and typical mistakes can be avoided when dealing with a certain type of problem. Thereby patterns not only focus on the solution to the identified problems, but also on the relevant contexts and the problems themselves, since only in an adequate combination of these three elements the success of a solution can be replicated (Alexander, Ishikawa and Silverstein, 1977). A modularization and combination of small scale patterns within large scale patterns as part of a pattern language is thereby seen as a way to raise the degree of reutilization, since like in a spoken language the patterns can be arranged in an unlimited variety of combinations.

The patterns approach has been adapted in other industries and disciplines since then, among them the object-oriented software design as one of the most influenced ones (Rising, 2007; Gamma et al., 1995; Buschmann et al., 1996). One of the key challenges when dealing with patterns in any context is the right degree of abstraction, which needs to be high enough to allow a flexible adaptation of the patterns in different environments, but at the same time low enough to secure their significance (Rising, 2007). In his entertaining exaggeration Joseph Bergin points out that a too high degree of abstraction reduces the patterns idea to absurdity, since for any problem in the world we would only need one pattern in the end, which is “Do the right thing” (Bergin, 2002; Rising, 2007). On the other hand patterns without abstraction are useless outside the specific context that they were written in, so that the abstraction discussion is of high relevance and needs to be considered by any pattern author. The development of patterns, which is called pattern mining, is dominated by inductive practice. Patterns are the result of observation, analysis, extraction and documentation, whereby both good and poor examples can be used as starting points.

Lately, some efforts have been made to adopt the patterns approach also within the educational context in general and the e-learning context in specific (Kohls, 2009; Finlay et al., 2009; Derntl, 2006; Niegemann and Domagk, 2005; Bergin, 2007). In their publications and projects, authors point out the value of patterns when trying to identify and share successful examples of solutions for typical educational challenges, such as the facilitation of learning processes through web 2.0 technologies (Finlay et al., 2009) or the design of appropriate procedures for e-assessments (Knowledge Media Research Center, 2010). An example of a pattern language is the online pattern collection by Joseph Bergin, in which the author describes fourteen interrelated patterns for Computer Science course development (Bergin, 2007). As in the original approach, an efficient and effective reuse of approved solutions is intended in order to avoid reinventing the wheel. For example in his “Early Bird” pattern Bergin recommends to organize courses so that “[...] the most important topics are taught first. Teach the most important material, the "big ideas," first (and often). When this seems impossible, teach the most important material as early as possible (Bergin, 2007)”.

As these efforts seem natural and very promising, serious problems need to be considered as possible reasons for the yet restrained success of e-learning patterns:

- Niegemann & Domagk (2005) point out that e-learning patterns so far often are a lot less approved than architectural and software design patterns: “In the domain of pedagogy things are by far not as clear: There are frequently used design patterns which actually do not function well: E.g. there are animations on the screen explained by written texts, there are written texts accompanied by the same text spoken, there are “stories” inserted in e-learning modules, following the assumption that interesting stories would motivate learning and make it more effective (Clark and Mayer, 2003). As replicated experiments showed, none of the “patterns” just mentioned is efficient. E-learning design patterns need a thorough proof of their quality; they have to be systematically evaluated in detail. So it seems clear that currently used design patterns in the pedagogical domain are not always suitable solutions to instructional design problems.” (Niegemann and Domagk, 2005, pp. 5)

- In contrast to architectural and software design patterns, e-learning demands higher levels of abstraction. It is rare to deal with the same educational environment (different students, different teachers, different examination rules, different and continuously developing technical equipment, different previous knowledge on the teachers' as on the students' side, etc.). A modularization of large patterns (e.g. for e-assessment) into smaller and less abstract patterns (as discussed in (Kohls, 2009)) might help to isolate reusable elements, but it also leads to more complex and fine-grained pattern languages, which are more difficult to understand and adopt. The definition of appropriate delimitations and levels of abstraction for e-learning patterns thus appears to be of special difficulty.

In Summary, patterns can be considered a promising approach to deal with technical and pedagogical challenges in the field of e-learning. Compared to architectural and software design patterns they face special abstraction and quality assurance problems that need to be considered in the process of pattern writing and adoption.

Discussion and Integration of the two Approaches

Table 2 summarizes the described characteristics of educational service platforms and e-learning patterns. We will now discuss overlap and differences between the two approaches with regard to their interoperability and possible mutual assistance.

Both educational service platforms and e-learning patterns build on the idea of modularization and recombination. In each of the two approaches, standardized components, subsystems / sub-patterns are considered as an appropriate basis of flexible and adjustable combination processes, what in the pattern context is described with the metaphor of a "pattern language." Also both approaches aim at a utilization of learning curves, so that a basic conformity can be stated among them. Still the orientation of the two approaches is different: Educational service platforms aim at more efficient and effective service processes, improved new service developments and more customized service bundles. The educational service platform strategy is derived from a competitive way of thinking and thus focuses on one service supplier in the context of a specific value chain and its service offer and service production models. e-Learning patterns focus on the replication of solutions for certain problems within the whole e-learning community instead. Experiences and expertise that were developed by experts and which are embraced in their approved solutions for recurring problems are made available in pattern format to third parties. It is therefore reasonable that service platforms have been primarily addressed with regard to the economical challenges of educational service providers so far, while e-learning patterns particularly have been setting forth educational and technical issues. Since educational services imply an interdisciplinary set of challenges, a holistic educational service model that takes into account the ideas of both approaches sounds promising.

The development process of service platforms and patterns differs as well. An efficient reuse of patterns through players other than the pattern authors requires their generally comprehensible depiction, which is why patterns for pattern writing have been introduced (Meszaros and Doble, 2009). Since patterns need to be verified as approved solutions if not even best practices, their development process consumes a lot of energy, including "shepherding" as reviewing of patterns, the suggestion and presentation of pattern(parts) in conference papers and presentations, specific pattern workshops, etc. (Rising, 2007). In comparison, the more conceptually-held discussion of service platforms doesn't need such a standardized development process. It considers both an inductive and deductive platform development process as reasonable, while e-learning patterns de facto currently exclusively derive from observation of existing (mostly the pattern authors') solutions.

Table 2
Educational Service Platforms and e-Learning Patterns

	Educational Service Platforms	e-Learning Patterns
Definition	Sets of optional components and interfaces that form a reusable structure, which allows the efficient and effective creation and further development of differentiated educational service bundles repeatedly.	Description of "context-problem-solution-combinations", which refer to problems that occur repeatedly in the e-learning environment and that allow the reutilization of approved invariant solution components.
Origin	Industrial product platforms and service platforms (Meyer and Lehnerd, 1997; Huang, Simpson and Pine II, 2005; Muffatto and Roveda, 2000; Meyer and DeTore, 1999; Stauss, 2006; Simpson, Maier and Mistree, 2001)	Patterns in architectural theory and software design (Alexander, Ishikawa and Silverstein, 1977; Gamma et al., 1995; Buschmann et al., 1996)
Focus	Service development and accomplishment of a single service supplier.	Diffusion of generic and successful solutions within the e-learning community.
Objectives	Cost and time savings in the process of new service development and a greater variety of more customized services.	Reusability of experiences and expertise, and avoiding reinventing the wheel.
Development	Interdisciplinary, collaborative teams Top-down (a priori) or Bottom-up (a posteriori)	"Shepherding" Pattern workshops Conference papers/presentations De facto inductive
Requirements	Service understanding for educational offers Modularization of service bundles and standardization of service components Long term service development plan	Integrated consideration of problem, context and solution Modularization and standardization of solutions Generally comprehensible documentation
Examples and discussion	ECC architecture (explained on p. 7) Learning scenario for international collaborative e-learning (explained on p.(8/9) (Gabriel, Gersch and Weber, 2007)	Early Bird pattern and pattern collection by J. Bergin (explained on p. 12; Bergin, 2007) Pattern on facilitation of learning through web 2.0 (explained on p. 12; Finlay et al., 2009) (Kohls, 2009; Niegemann and Domagk, 2005)

Because of its strategic orientation, service platforms appear to be the more appropriate approach when it comes to a systematic and long term overall educational service strategy. With its explicit focus on the continuous development, differentiation and customization of a supplier's service offer, an educational service platform strategy helps to respond to the dynamic changes in the e-learning environment. E-Learning patterns on the other hand represent an excellent vehicle for the documentation of approved and definite service components. The discussion of patterns has led to a distinct identification of indispensable description elements, which ensure the reusability of the documented solutions for typical e-learning problems in typical educational contexts.

We therefore suggest that the most appropriate integration of both approaches is to use service platforms as a basis for long term supplier specific service strategy, while using patterns as a substantial basis for the service platforms.

Figure 2 shows the resulting integrated educational service approach from the perspective of a single university educational service supplier as part of a typical decentralized institutional structure. The overall service platform strategy of the service supplier (e.g. a certain department or faculty) comprises e-learning patterns as a substantial basis of holistic, efficient and effective service development and accomplishment processes. Thereby institution specific pattern collections (on the university level) appear promising, since they can help to alleviate the above described abstraction problems. They can refer to a more homogeneous context concerning the technical equipment, target group characteristics, e-learning competencies of faculty, etc., so that less abstraction is necessary in the process of pattern documentation.

The interface between the university-specific pattern collection and community wide pattern discussions and collections could be allocated to e-learning support institutions of the university. It would be the task of such institutions to manage the internal pattern collection and to coordinate the exchange with external collections. The pattern approach could thereby benefit from a similar differentiation of pattern types as suggested for service platforms by Stauss (2006): outcome patterns, process patterns, preparation patterns, external factor patterns. Such a differentiation would provide additional orientation to pattern authors and pattern users.

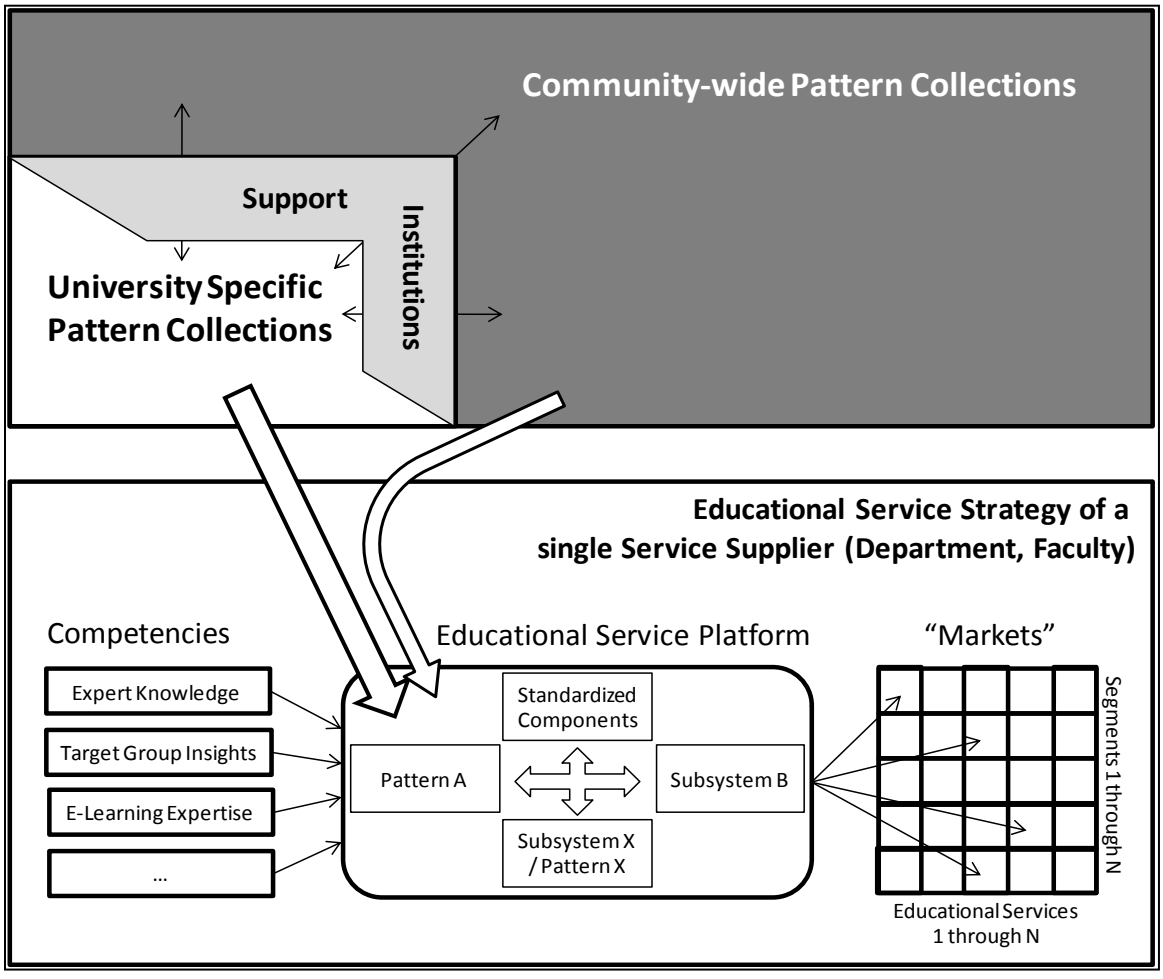

Figure 2: An integrated educational service approach
(based on Meyer and DeTore, 1999).

Summary and Future Research

Providing educational services – understood as service bundles for blended learning – is a complex undertaking, because partly conflicting pedagogical, technical and economic challenges and goals, and a dynamically changing environment need to be considered. Since attractive educational services have developed into important elements of competition strategies and also carry the hope of more effective learning processes, approaches like service platforms and e-learning patterns have gained growing attention lately. Both approaches build on modularization, standardization and (re-)combination, and aim at more effective and efficient service processes on the basis of systematic reutilization and learning curves.

The orientation of service platforms and e-learning patterns is different though. Service platforms focus on the development of a greater variety of customized service bundles, while e-learning patterns target a community wide exchange of successful solutions for recurring pedagogical and technical problems in the e-learning context. Because of the different backgrounds and orientation of the two approaches, opportunities for cross-platform learning and pollination could be identified. For example, pattern mining and documentation processes and the discussion of the abstraction problem could enrich the service platform literature. Additionally, integrating both approaches, as outlined at the end of the paper, appears promising. E-Learning patterns as part of service platform strategy introduces a holistic way of thinking that takes into account pedagogical and technical issues, and focuses on an economically sustainable service strategy.

As for future research issues it is necessary to identify implementations of both approaches in the educational industry. These implementations and an exemplary integrated service strategy should be subject to critical and empirical scrutiny. Additionally we see a great potential in a deeper and broader analysis of the adaptability of the ideas, procedures, instruments and approaches that have evolved in both the platform and the pattern community. We hope this paper would serve as an inspiration to other researches to pick up and to contribute to the idea of a systematic educational service strategy.

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