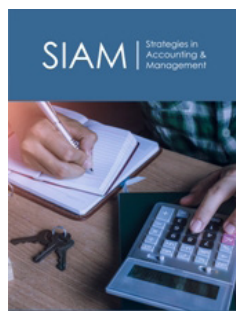


Practical Approaches to Enhance the Effectiveness of Student Learning in Internet Courses

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Abstract

With the current crisis of COVID-19, many universities are ordering shutdowns and moving courses on-line. Course offered via the internet is growing rapidly in recent years and will continue to grow into the future. We believe the recent crisis will further accelerate the growth of Internet courses. The reasons for this high growth include the need for social distancing, high cost of providing the education, the geographical dispersion of students who may also currently hold jobs, the students' increasing access to the internet, the increasing effectiveness internet tools, as well as the lowering of the costs, associated in aiding the communication and learning between the students and instructor. Unlike face-to-face classroom experience, in internet e-learning the instructor does not meet with the students and, thus, the effectiveness of the learning can be difficult to assess because lack of direct face-to-face contact. In this paper, we first discuss the state-of-the-art literature of e-learning. We then propose several important course design principles for asynchronous internet e-learning as well as suggest several implementation guidelines to ensure that such that the internet e-learning course is effective. Finally, we propose several important areas for further research for enhancing e-learning.

Introduction

Recent COVID-19 crisis has highlighted the importance of learning via the internet. Instructors have been asked to provide an alternative to face-to-face classroom experience via E-Learning. E-learning is defined as training delivered via a digital device such as a computer, iPad, and smart phone to support individual learning and/or organizational goals. This self-study learning occurs where all the interactions between the teacher and the students are conducted online. This means that the students do not have to go to a physical classroom nor do they have to be present when teacher is teaching. Here, we define e-learning to include on-line courses and on-line training programs.

It should be noted that there is a slight difference between e-learning and distance learning. Distance learning courses are also self-study and may involve e-learning. In distance learning items, such as textbooks, worksheets and DVDs, are being sent by mail between the instructor and the students. Sometimes these materials are also sent via email. In either case, the participants will work at home, usually alone, to complete the course. Distance learning courses sometimes don't involve a specific teacher-it's more about the students independently completing their work and sending them back for grading. Due to the advancement and the lowering of the costs in new e-learning technologies, most courses now involve only e-learning.

There are two forms of e-learning, synchronous versus asynchronous. Synchronous e-learning is when the teacher and students are present/available at the same time, albeit that they may be in different locations, and learning via chat and videoconferencing is real-time. It is like a virtual classroom where the students can ask questions and the teacher can answer those questions instantly. In asynchronous e-learning, the teacher and students are not present at the same time; that is, either the teacher or the students can be off-line. Here, the students work on the course at their own pace and the feedbacks may not be real-time. This form of e-learning involves coursework delivered via web, on-line forums, e-mails, telephone and message boards.

We expect both synchronous and asynchronous e-learning to grow exponentially in the foreseeable future for three important reasons. Probably the most important reason is cost.

In United States, from 1995 to 2015, the average tuition and fees at private National Universities jumped 179 percent to \$38,762 per annum, out-of-state tuition and fees at public universities rose 226 percent to \$24,015 per annum, and in-state tuition and fees at public National Universities grew a staggering 296 percent to \$9,803 per annum [1]. E-learning can help to contain cost by not having to build costly facilities or infrastructure such as classrooms and libraries to support learning. Another way to contain the cost is that e-learning could enable to teacher to scale up to teach more students. The second important reason is technology. Today, many younger students grew up with technology such as smart phones, iPads, laptops. Therefore, they more readily embrace and incorporate technology in their daily lives, which include e-learning. Moreover, new advancements in software technology such as in videos, testing, student monitoring also allow the teacher to be more effective conducting the lectures digitally. The third important reason is accessibility -geographically and temporally. Since the course are conducted online, the student and be practically anywhere in the world as long as s/he has access to a computer and internet. If s/he takes an asynchronous course, s/he can learn it at her/his own pace as long as the deadlines of the course are met.

The main concern about e-learning via the internet and videos is usually about its effectiveness in actual student learning. It should be noted that as early as 1947, a U.S. Army research shows that instruction delivered via film resulted in better learning outcomes when compared to traditional classroom or paper-based versions [2]. A meta-analysis by Barnett et al. [3] integrating research studies showed that some distance learning courses are much more effective than classroom courses and vise-versa but there are no practical differences between e-learning and face-to-face learning. Runnels et al. [4] concurs that e-learning can be as effective as classroom learning and students' learning is affected by the quality of on-line instruction. Selim [5] indicated that the critical success factors of e-learning acceptance include instructor's attitude towards technology and control of technology, student motivation and technical competency, and course content management. Course content management has the highest validity coefficient of 0.89.

Course Design Guiding Principles in Asynchronous E-Learning

In this paper, we present the guiding principles in asynchronous e-learning to ensure better students acceptance and better learning outcomes for the students. Unlike face-to-face learning, the teacher does to physically see the students in asynchronous e-learning. Therefore, the teacher may not know if the student does not understand any of the concepts in the course material by looking at his/her facial expression or when the students asks questions in the classroom. Moreover, the student may be reluctant to ask for help in e-learning because it maybe an inconvenient time for the instructor when the student has the question. Therefore, it is critically important to have a well-design e-learning course when compared to a face-to-face course. The following are important guiding principles of e-learning course design:

Simplicity

Although it seems obvious, it is not as easy as to do. Using a famous quote by Steve Jobs from Apple, "Simple can be harder than complex: You have to work hard to get your thinking clean to make it simple. But it's worth it in the end because once you get there, you can move mountains." It should be noted that the course material simplicity does not mean that the course should be 'watered down.' Rather, the instructor should explore all possible ways to present the concept, however complex, in the simplest and easiest to understand manner for the students. This may involve removing any material (text, video, URL, etc.) that does not contribute to the understanding of the concept. It also means that the materials are all presented in a clear, concise and consistent manner without any clutter. A similar analogy to the concept of simplicity in course design is the smart phone. Note that the smart phone is a complicated machine but it is designed such that the user can easily learn how to use the phone to perform many complex tasks. We need to constantly innovate to present complicated concepts in the simplest possible manner. Additional suggestions include the use of pictures and sound to illustrate a concept and different colors to highlight different degrees of importance of different subject matter.

Contiguity

Whenever possible, any concept should be able to be explained using text, graphics, etc. in one screen Clark et al. [6]. That means the student does not have to scroll the screen down and up again to understand any one concept. The reason is that doing so is distracting and also difficult for the student to understand material especially she has to study by herself, without the teacher by her side. If the concept is too large for one screen, break it up to smaller pieces so that each piece can be explained in one screen. Also, one can use voice-over to explain the concept if too much text is required to explain the concept. Also, research has shown that using audio, instead of on-screen text, can result in significant learning gains.

Modularity

Whenever possible, the course should be designed in blocks that are as independent as possible. This means that whenever possible, a student does not need material A to understand material B and vise-versa. Although, it may be difficult to do in some course, careful thought into this design will help facilitate the success of the course. There are several reasons for this principle. First, it does not penalize the student if she does not perform well in the prior sections and will not be as discouraged. Second, it allows the teacher to try out different sequence of course material that best achieve the desired learning outcomes. Finally, it allows the teacher to better pinpoint areas of difficulty faced by the students.

Consistency

It is not as easy for the students to change the format of the course from the face-to-face to e-learning environment. That is, they are not expected to attend classes on a regular schedule. Therefore,

it will help tremendously when there is consistency in expectations of the students. For example, the deadlines of exams, homework problems, cases, and all other assignments should be set in as a regular schedule. One suggestion is to set it at midnight on Sunday. The reason is that many of the students work and can only find time to do their assignments on the weekends. It is also recommended that the students are sent a 'gentle reminder' at least one or two days before the deadline of the assignments since there are no face-to-face time to remind them of the due dates of the assignments.

Course Implementation Guidelines

Prototyping

First the instructor should gather as much information as possible of the various e-learning technologies available as well as from other instructors who have taught similar distance learning course. Then s/he can begin to work on a prototype of the course. Prototyping is first creating a preliminary design of the course and then testing it with a few students to get their feedbacks. Based on their feedbacks, the format of the course, delivery methods, expectations should be adjusted to as to maximize the effectiveness of the course. It should be emphasized that since e-learning technology is rapidly improving, the instructor should continuously look for ways to improve on the course.

Clarity in presentation of the course materials and expectations

One of the major problems faced by students taking e-learning class is that they have difficulty navigating the course and are unclear of the expectations of the course. Therefore, the design of the course must be such that it is as easy to navigate as possible. Preferably, the all the lecture plan of the course should be laid out in a single page with syllabus, weekly study plans, examinations and assignments due dates.

Engagement

Unlike face-to-face format, one of the most important deficiencies in e-learning is that it can be more difficult to engage the students because the teacher cannot be physically present to ask questions and encourage feedbacks. However, other forms of feedbacks can be just as effective, if not more effective than face-to-face format. Examples include chatrooms where the students can discuss their learning experience in a more personal way such that all the other students can better understand the concepts presented in the course. Another example is that I ask the students who have done well as those who have done not so well in exams and cases to discuss their study methodologies. From these discussions other students can better learn how to improve on their class performance than the regular face-to-face classroom learning.

The Internet of things (IoT) is a set of devices and associated process that will lead to automatically collecting more data by the devices and processing and transmitting the data for directing the devices for action and storing the data for future use. While a wide variety of devices are being called IoT, they all aim at making

the technology ubiquitous. It is estimated that there were about 16 billion IoT devices in 2014 and the numbers are expected to grow to as many as 50 billion devices by 2020 [7]. Weinberg et al. [8] presents classification of IoT devices by application based on information provided by Texas instruments. It is interesting to note that educational application was not included in this classification. It is easy to understand that healthcare, wearables etc., were considered to be the prime target for IoT devices. However, it was clear to many educators, such as Gomez et al. [9], that IoT will play a significant role in enhancing the learning experience for students at all levels of educational institutions. For example, a prototype for interaction with computing hardware using IoT was presented by Gomez et. al., [9]. It will require more creativity to integrate IoT to increase the engagement of students in the e-learning environment.

Feedbacks and reminders

Feedbacks and reminders are important tools that can be employed to enhance student engagement and improve the learning outcomes of distance learning. The feedbacks have to be clear, thorough and immediate so that the students feel any questions that they may have are answered. One of the major problems of distance learning students not completing their assignments is that they forgot about it since they do not meet their teachers at all. Based on various studies, 'gentle reminders' is the most effective way to increase participation of the students and hence, their engagement. Some general areas where IoT can help students from any discipline include learning styles, potential areas of concern etc. For example, if IoT enabled webcams were placed when a student is reading a material and it is observed that a student is taking significantly more time to read quantitative topics compared to his/her peers then it may signal that this student has difficulty in learning quantitative topics. This may in turn trigger additional help and even career counseling to help the student appropriate area of study.

IoT can also be used to help maintain academic integrity during exams in a distance learning environment. However, this may need significant infrastructural investment from multiple institutions. A discussion on construction of classrooms for IoT is discussed by Yang & Yu [10]. IoT also enable substantial increases in collection, access, availability and quality of data. Charmonman et al. [11] presents three dimensions of information captured by IoT devices. With this increase, academic administrators face the challenge of balancing the need meet privacy and security needs of student and at the same time provide easy access to the students. IoT not only changes how materials are delivered and how students learn but will also change how data are collected, used and stored by academic institutions. Researchers such as Weinberg et al. [8] point out that institutions have to be proactive to design security systems to alleviate the concerns of IoT users.

Academic integrity

One of the biggest challenges of providing Internet courses is to ensure that there is no or minimal cheating. Since the instructor

cannot physically monitor the students' work, it is very difficult to ensure that every student does his/her own work. However, there are several suggestions to ensure academic integrity. Although, quite expensive in terms of effort and cost, each student can be computer monitored via videocam while taking his/her examination or performing the assignments. The instructor can also use readily available software packages such as 'Turnitin' to check the students' work to ensure that it is actually his/her own work. If possible, instead of using the assignments/tests in the textbook, we encourage the instructor to create new assignments/tests. The reason is that students now can easily access the textbook solutions in many websites that provide solutions without actually helping the students learn the material. In our experience, the most important recommendation is for the instructor constantly change and modify the assignments and tests so that students will not be able to find the readily available solutions.

Conclusion

With the current COVID-19 crisis, E-learning is gaining in importance and relevance. Rapidly advancing technologies now enable more effective e-learning. In this paper, we discuss the design principles for asynchronous e-learning and provide implementation guidelines. It is obvious that newer technologies will further bring significant benefits to higher and distance education through e-learning. Many of the e-learning concepts discussed here can be significantly enhanced by IoT devices. For example, simplicity and contiguity are important but the relevance of these components is moderated by student, location etc. An IoT device interacting with the student as a learning aid and monitoring factors such as time taken to read a topic, the number of mistakes made in a quiz or any other relevant trait can help present appropriate level of material to the student at that time. Teaching modules that are difficult to implement in a typical e-learning environment, e.g., case analysis and presentation, can be enhanced by appropriate IoT that can provide an interactive environment. A virtual reality glass such as Oculus might simulate the environment of a real-life presentation in front of hundreds of people and collect presenter information such as heart rate to identify if the presenter was nervous during any

part of the presentation. Although the possibilities are limitless, the challenge for administration is to decide where to invest the limited resources and how to protect the very personal information that are being collected by these devices. Significant research is needed to best utilize the emerging educational environment.

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