ENHANCING STUDENT ENGAGEMENT BY DEVELOPING FLIPPED CLASSROOM APPLICATION ON TABLET DEVICE AND COMPARE WITH TRADITIONAL PEDAGOGIES STRATEGIES

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Abstract- The flipped classroom is an innovative pedagogical approach that focuses on learner-centered instruction. The purposes of this report were to illustrate how to implement the flipped classroom and to describe students' perceptions of this approach within 2 undergraduate information technology courses. The template provided enables faculty to design before, during, and after class activities and assessments based on objectives using all levels of Bloom's taxonomy. The software development courses have very strong practicality. It has put forward higher requirements for the training in class. If we apply flipped classroom model for software development courses, students could autonomously learn before class and develop the real project in class. It could enhance the students 'thinking ability, practice ability and innovation ability, and improve the effect of classroom teaching. The majority of the 142 students completing the evaluation preferred the flipped method and use flipped application on tablet device compared with traditional pedagogical strategies. When having evaluated in learning engagement, it indicates that there is a significant figure in increasing the average in learning engagement. The paper demonstrates basic principles and application and research status of flipped classroom model and analyses the feasibility of flipped classroom model for software development courses, then puts forward to teaching model and constituent elements of flipped classroom model for software development courses, it also provides theoretical reference for software engineering major

Keywords- Flipped Classroom, Active Learning, Learning Engagement, Flipped Classroom Application on Tablet device.

I. INTRODUCTION

Higher education has come under intense scrutiny with regard to the demonstration of student learning. Some of this discussion focuses on the idea that institutions should consider alternative ways to deliver curricula to meet the demands of the increasing amount of knowledge and skills students are expected to retain and use upon graduation. Educators have found that the in-class lecture continues to prevail as the predominant instructional strategy in most classrooms across the country. This form of directed instruction is what King referred to as the ‘‘sage on the stage.’’ 2 The classroom lecture alone has been criticized by many as an ineffective way to help students acquire needed knowledge and skills.4,5 In addition, research on lectures has demonstrated that a student's attention declines after the first 10 minutes of class, and although it may return at the end of a class, students remember only about 20% of material presented during the lecture.6,7 When used as the sole modality for a course, this type of passive learning takes classroom time away from challenging student thinking, guiding them to solving practical problems, and encouraging direct application of material through active learning with the instructor present. Although lecture has been criticized, it is well documented that this form of directed instruction is necessary to teach students in situations where they hold little or no prior knowledge and where skills must be taught for students to apply later in their career. King's 2 ideal of the guide on the side is rooted in the constructivist theory of learning. This theory indicates that knowledge does not come packaged in professors' or students' heads to be transmitted to one another.9 Rather, these individuals (professors and students) possess information, not knowledge. Thus, knowledge must be constructed or reconstructed by individuals by trying to make sense of new information in terms of what they already may know. The construction and reconstruction of knowledge in which students engage is best done through the use of active learning strategies (eg, problem-based learning, simulation, think-pair-share). A new instructional approach in higher education is the flipped classroom. This instructional approach combines both approaches described by King and enables faculty members to be more thoughtful and strategic in their course design to achieve all levels of Bloom's taxonomy10 with the students present.

In the flipped classroom, what is traditionally done in class and as homework are switched or flipped. For example, instead of students listening to a lecture on public policy in class and then going home to work on a IT governance paper, they read material and view videos on policy before coming to class and then engage in active learning strategies such as debates on current policy issues and case studies during class. This type of instruction enables the professor to be with students when they are engaging in higher levels of Bloom's taxonomy, such as application, analysis, and synthesis. Although there has been little research on the educational outcome as it relates to whether the flipped classroom increases student learning, there has been a lot of indirect research (eg, student and instructor satisfaction surveys) promoting this approach. Specifically, this

instructional approach is being used more often within several allied IT governance disciplines (IT Service Management) 11-15 and has demonstrated improved student–teacher interactions, opportunities for real-time feedback, and an increase in student engagement by ‘‘speaking the language of today's students through the use of technology.’’ Within the IT education literature, Pluta and colleagues11 reported collaborative learning trends using methods such as problem-based learning and digital media to enhance content delivery outside the lecture hall. Faculty in a graduate-level program reported that their software engineering course was not engaging students.12 Faculty redesigned the course using the flipped classroom instructional approach by adding weekly out-of-class videos and pre-class modules. Weekly online quizzes taken after students completed the modules assessed students' knowledge of the material. Graduate IT students reported satisfaction with the flipped classroom and the active learning methods used. Lecturer redesigned a basic incidents and problem management course using the flipped classroom approach with online videos replacing class lectures and structuring class time as active learning strategies. Student-centered goals structured the course redesign with active learning strategies such as pair-and-share activities, student presentations and discussions, and individual or paired quizzes empowering students to reach higher levels of Bloom's taxonomy. A new model of learning with flipped classroom by developing on tablet device helps students access their class and studies material in anytime, anywhere, and anyplace. The method of flipped application can transform lecturer to be as a coacher.

The researchers stated that students in the flipped class more often reported that instructors consistently encouraged active student engagement and learning compared with a traditional class. Educators at school of Medical Informatics, Rangsit University, redesigned a first-year course that was a large lecture-style class into small-group, case-based classes to encourage more collaborative learning. The purposes of this report were to illustrate the implementation of the flipped classroom and to describe students' perceptions of this approach within 2 Information Technology courses.

II. DETAILS EXPERIMENTAL

DESCRIPTION OF INTERVENTION

Lecturer Preparation

IT professors were invited to participate in a university-wide initiative focused on the flipped classroom led by the university's faculty associate for teaching, learning, and assessment. This initiative required faculty to engage in the redesign of 1 traditionally delivered course to a blended course (50% online and 50% face-to-face [F2F]) using the flipped classroom as an instructional approach. Faculties attended monthly meetings throughout the semester and were provided pedagogical resources to help them better understand how to flip the classroom for their specific course. One tool provided to faculty was a template outlining the 3 components of the flipped class: before class, during class (F2F), and after class. The template allowed faculty to be more intentional in their course design by requiring them to clearly articulate the activities to occur within each component for every course topic. In addition, the template encouraged faculty to demonstrate that all levels of Bloom's taxonomy10 were evident within a course topic (Figure). For example, the work students engage in before the F2F class focused more on lower levels of Bloom's taxonomy (eg, remember, understand) whereas the F2F portion of the flipped class allowed for higher-level learning such as application, analysis, and synthesis. The final component, the after-class, continued to build on these higher levels of learning through formative or summative assessments. In the end, when this tool was executed it allowed both of King's2 approaches to be easily accomplished to enhance student learning.

Application of Flipped Design

Incidents and Problem Management, IT Service Level Management (SLA), System Analysis and Design (SA), and Object-Oriented Technology (OOT), were identified to explore the feasibility of modifying traditional lectures into flipped classes for 4 course topics. The class formats used a combination of passive (lecture) and active learning strategies (discussion and case studies). During the semester of the application, 148 students were enrolled in 4 sections of SA and 48 students were in 2 sections of SLA. Students in OOT suggested spending more class time discussing cutting-edge topics such as major public policy changes and concerns with vulnerable populations. In SA, students practiced professional skills and needed more time for application and practice. The instructors of IT courses applied the template (Figure) to help organize the 3 components of a flipped classroom (before, during, and after).

Before Class

Designing the online portion of the flipped classroom (also referred to as offloaded content) took into account the work that the students could master individually and most often included lower-level learning (eg, knowledge, comprehension). A sample topic objective for the SLA course was Students will be able to recall policy changes as these relate to service contract. Both delivery and content were structured to help the student acquire content knowledge and prepare for the application of that content in the F2F class. For the flipped design, online modules included mini-lectures (between 10 and 15 minutes), videos obtained from sources such as Khan Academy17 or Technology, Entertainment and Design (TED) Talks,18 worksheets, or written

prompts to help students capture important material from the lectures. Also used during the before class session were textbooks and supplemental reading materials. Instructors used offloaded content that was relevant to the topic of the class session and avoided unnecessary overload or busywork for the student. Instructors used screen capture software (Camtasia, TechSmith, Okemos, Michigan, 2003; Snagit, TechSmith, 1990) to digitize lectures to create the videos. After recording and editing the lectures, the material was uploaded on the university's learning management system for students to use. Upon conclusion of the before-class assignments, students completed a table as a low-stakes assessment (low stakes is an assignment that is a minimal percentage of the final course grade as a way to ensure compliance for the before-class work). Students were required to bring the low stakes assessment to the F2F class to increase student accountability and encourage in-class participation.

During Class (F2F)

With the topic objectives in mind, the F2F class was designed to apply the knowledge acquired by students in the online component using active learning strategies. Active learning strategies enabled students to achieve higher levels of learning within Bloom's taxonomy (eg, application, analysis, and synthesis). There are many active learning strategies for educators to use in the F2F class. When designing the F2F component, it is important to choose only a few active learning strategies to use throughout the course rather than a different one for each class.

This will allow students to become familiar with the active learning strategy and avoid the risk of students focusing on the process of the strategy rather than the learning related to content. In the SA course, an active learning strategy called the jigsaw was used to teach theories and approaches to behavior in changing requirements. 19 This active learning strategy required students to use a worksheet table that was completed during the online component. Students were also encouraged to bring any other materials they needed to complete activities in class. Students gathered in their original workgroups (set up at the beginning of the semester). Each person in the workgroup was assigned a theory or approach. In accordance with the jigsaw activity process, all students in each group who were assigned Theory 1moved to the Theory 1 Expert Group. In these expert groups, students worked on a series of critical thinking questions provided by the instructor. Poster paper and markers were supplied to each group and group answers were recorded on the poster paper. The instructor monitored the process throughout and was able to guide student thinking as well as clarify misconceptions or incorrect information. After all expert groups completed the F2F class assignment and taped their posters along the walls of the classroom; students went back to their original groups. At that point, each group rotated around the room and the expert for each theory explained the information to original group members

After Class

Assessments are an integral part of the after-class component of the flipped classroom and should be aligned with the objectives of the offloaded content and the in-class activities. These can be formative (eg, at the end of the class assignment) or summative (eg, exam, or portion of an exam that covers several weeks of content). For example, for the topic of theories and approaches to behavior change using the jigsaw activity, students completed essay questions on the final exam. Because many activities were subject to either formal or informal grading by the instructor in the F2F class, assessments did not always have to be graded and were able to be part of a summative assessment. Assessments take many forms including, but not limited to, essay exams, case studies, presentations, reflection papers, test creation by students, and group testing

In this study, the important concepts in iOS application development. This is to understand the iOS design pattern and some basic concepts. Design pattern are iOS applications follows the MVC design pattern as the following A.) Model: Represents the business logic of your application B.) View: Represents what the user sees in the device.

Application Framework

iOS Framework is a free and open source mobile HTML framework to develop hybrid mobile apps or web apps with iOS & Android native look and feel. It is also an indispensable prototyping apps tool to show working app prototype as soon as possible.

The main approach of the iOS Framework is to give an opportunity to create iOS & Android apps with HTML, CSS and JavaScript easily and clear. It can offer ways of any solutions somehow. However, it is not compatible with all platforms. It is focused merely on iOS and Google Material design that could bring the best experience and simplicity. See Figure *1: iOS Framework.*



Fig. 1. iOS Framework

iOS Framework is definitely to build iOS or Android hybrid app (PhoneGap) or web app that looks like and feels as great native iOS and Google Material apps. To create iOS apps using a framework is easy as website creation. It needs just a simple HTML

layout and attached framework's CSS and JavaScript files. There is no need to write some custom tags that will be converted by JavaScript to something else. It does not force to write and describe all content in JavaScript (or JSON). Just plain HTML and it always get exactly the same to get when writing in the HTML.

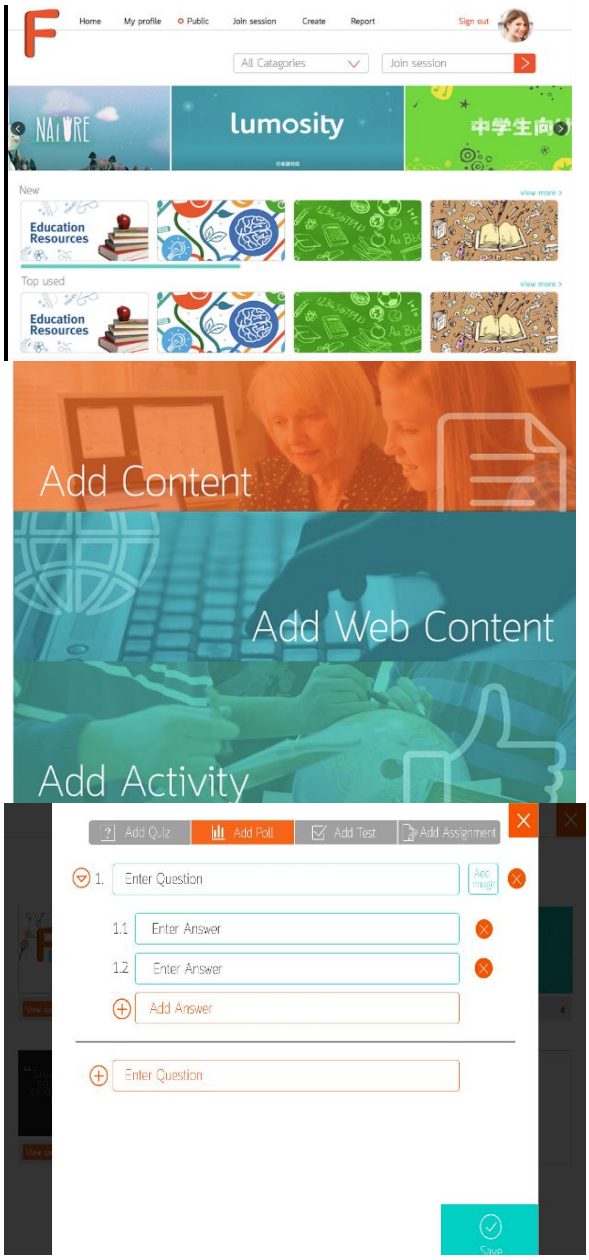


Fig. 2 Iteration Screens

It can be seen that Fig. 2 illustrated four different iteration screens. The design of flipped Classroom Application provides easy to use and compose with six main functionalities.

Home: this main screen allows students and lectures to meet and use teaching materials. Students can receive all news and activities by viewing this screen with push online notification

Myprofile: Lecturer can create and keep his or her teaching materials.

Public: Lecturer can send his or her teaching materials to others to view and download. The purpose for Public is to distribute a value contents to other can be used. When there is a high number of download, the system will indicate as "Top Used" or "New" to promote the contents.

Join Session: Students can access the flipped classroom vie enter PIN code to participate the class

Create: Lecturer create slide presentation or other teaching materials such as Slide Presentation, Excel, Word, or VDO (YouTube)

Report: The system can inform Lecture for checking for students' participation in the class and support grading system for examination

III. RESULTS AND DISCUSSION

DESCRIPTION OF EVALUATION

Students approved the surveys for this study. Instructors for SA and OOT distributed anonymous surveys either in class or via an online survey to all students (n ¼ 196) to assess their perceptions of the flipped classroom learning environment. The survey was constructed by the faculty associate who had experience in pedagogy related to this approach and led the campus-wide initiative on the flipped classroom. Cronbach alpha for the 5 Likert scale items was performed and revealed a value of .71, an acceptable value for reliability. 20 The survey also included 2 open-ended questions on students' opinions of the work before and during the flipped class. A total of 142 of 196 students (72%) voluntarily completed the surveys. The Table lists students' level of agreement on the key items from the survey. Approximately three-fourths of students (76%) preferred watching the video lecture over F2F lecture for the topic. A majority of students (64%) would rather participate in the in-class activities for 2 class periods rather than listen to the professor lecture for the same amount of time. Almost two-thirds of students (62%) thought that they learned the material more effectively by viewing the online recorded lecture rather than F2F lecture. Half of the students (56%) believed that they learned how to use the material for each topic more effectively using the flipped classroom format (eg, screen capture lecture plus active learning in class) compared with traditional methods (eg, lecture only). A majority of students (70%) felt connected to the teacher during the virtual online component of the flipped classroom. The open-ended comments of the survey revealed several major strengths of the flipped class format. Students liked the ability to work at their own pace and time and were able to apply what they learned during F2F class and throughout the course. Concerns raised by the students included not having the professor available to ask questions during the out-of-class portion and the possibility that other students would not be prepared for the F2F active learning strategies. These concerns are similar to

what have been discussed in the literature regarding criticisms of this pedagogical approach.21-23 Suggestions for improvement based on these concerns are the use of a discussion board that is set up to have alerts sent to the professor when the students post individual questions and ensuring a quality check is done by the instructor at the beginning of the F2F class for the low-stakes assessments that students complete. An example of a quality check would be the professor circulating the room and evaluating student work quickly at the beginning of class so students understand this work is valued and are more willing to comply.

Engaging in this type of course redesign is a rewarding experience but there are several things to be aware of to ensure success. The upfront time to digitalize lectures as well as think of appropriate active learning strategies to use in class is extensive. Faculty should seek help from instructional designers as well as teaching and learning centers on their respective campuses to assist them. Also, although students are more engaged with this type of instruction, it is important to obtain buy-in from students the first day of class. Specifically, students need to understand the what, why, and how as they pertain to the flipped classroom. In the end, instructors need to be direct with students and

LESSONS LEARNED

Table. Student's Perceptions of Flipped Class Before and During Class

Survey Items	Total Items	Strongly Agree, n(%)	Agree, n(%)	Neutral, n,(%)	Disagree, n(%)	Strongly Disagree, n(%)
I liked the ability to watch the video rather than having Straight lecture for this topic.	141	55(39)	52(37)	20(14)	11(8)	3(2)
I would rather have the professor lecturer for 2 class periods than complete the activities that were carried out.	140	6(4)	21(15)	23(16)	45(32)	45(32)
The use of screen casting (videos) the lecturer enabled me to learn the material more effectively than lecture alone.	142	32(23)	56(39)	32(22)	19(13)	3(2)
I learned how to use the material with these teaching methods (screen cast of lecturers and active learning in class) of instruction more than I did when we used traditional methods (lecture only) of instruction.	142	27(19)	53(37)	41(29)	17(12)	4(3)
I felt disconnected without a teacher being present during the virtual online class.	139	6(4)	19(14)	17(12)	59(42)	38(27)

Overall n = 142; not all respondents answer every questions

define what the flipped classroom is, why this learner-centered teaching approach may be better than what is done in most traditional courses, and how the instructor is going to accomplish this (eg, provide a clear example using a topic). There are several clips on the Internet that faculty can view and show the first day of class to capture this information and then speak to the video so that it is discipline specific to obtain student buy-in. In addition, it is important to remember that the traditional F2F lecture can be up to an hour long. However, with online lectures, students become bored or distracted if the recorded lecture is over 15 minutes.6,7 Therefore, even if content requires more time, recorded lectures should be purposively segmented (eg, 10–15 minutes maximum) to help minimize boredom and distractions. When applicable, faculty should seek alternative forms of lectures that capture the content, such as Khan Academy or TED Talks. In the flipped classroom, students are held accountable to complete activities before coming to class. For continual monitoring purposes, faculty should take advantage

of reviewing their course level analytics within the respective learning management software (D2L, Kitchener, Ontario; Moodle, East Perth, Western Australia; Blackboard, Washington, DC; WebCT, Washington, DC, etc) to track student log-in and time spent in modules for virtual class sessions.

Limitations

As previously noted, because of the novelty of this teaching approach, there is limited educational outcome research on the effectiveness of the flipped classroom. A limitation of this report is that the results focus only on students' satisfaction regarding their experience with the flipped classroom. However, it is valuable to understand students' perceptions and these findings are promising for future studies within the discipline. Specifically, future research can examine grades from assessments (eg, exams, papers, and projects) from past years when the course was taught in a traditional format, to be compared with grades on assessments from the flipped classroom.

CONCLUSIONS

IMPLICATIONS FOR RESEARCH AND PRACTICE

The flipped classroom is an instructional approach for use in college and university information technology courses. Active learning is being used by many in higher education. However, what makes the flipped classroom innovative is that it weds the sage on the stage with the guide on the side so that all learning styles can be addressed throughout the course. When this is done in a strategic and deliberate way as described in this report, faculty are able to achieve all levels of Bloom's taxonomy with the instructor present. Educators in other IT professions are using the flipped classroom approach to promote student-centered, active learning. The design of flipped Classroom Application, author needs to have four principles such as Information, Individual, Interaction and Immediate Feedback. In addition, User Manual documentation should be in place to explain how to use the flipped software application. This report describes the process of implementing the flipped class in 4 IT courses. Through this study the authors have demonstrated the potential for the flipped classroom approach in IT courses, building on observations from its use in other IT professions. They recommend that other IT educators consider redesigning appropriate courses to engage students in new, more meaningful ways and consider how to collect direct educational outcome research to add to the scholarship in this area.

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