Flipped Classroom Module

An Interactive Qualifying Project
Submitted to the Faculty of
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By

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Abstract

This report explores the feasibility and effects of implementing a flipped classroom teaching methods at the Beijing University of Chemical Technology (BUCT). The report will reflect on current developments with classroom teaching at the Worcester Polytechnic Institute (WPI) and cases of flipped classrooms being used. This will be used to support the implementation proposal at BUCT. The goal of the Flipped Classroom Teaching IQP is for BUCT to begin to prepare for the addition of flipped classroom and blended learning teaching methods. The IQP will examine current teaching assets and research at BUCT and evaluate additional teaching assets used at WPI. To accomplish these tasks students from WPI and BUCT will work together in various studies in order to make recommendations to BUCT so that they can begin to implement flipped classroom teaching methods to their curriculum.

Acknowledgments

The authors Brendan Casey and Gabriela Meza would like to acknowledge those who have made significant contributions to this project. Firstly we would like to thank Professor Martha Cyr for helping us to understand WPI's teaching resources and flipped classrooms. We would also like to express our gratitude to the information technology center and Kate Beverage for giving great insight into teaching assets and blended learning. We would also like to thank Professor Craig Putnam and the BUCT professor who preferred to remain anonymous (Zen) and Professor Tao Xia for their participation in our research. Finally we would like to especially give thanks our project center advisors Jianyu Liang and Amy Zeng as well as all the respondents to our surveys for their exceptional contribution to the project.

Executive Summary

The Flipped Classroom is a teaching method which seeks to improve the learning environment for students by using blended learning; a method that delivers teaching content outside of the classroom. Modern flipped classroom teaching methods started when high school teachers wanted to change the common trend of drop outs and encourage students to pursue a higher level of education. This proved to be such a successful method of improving learning outcomes that soon enough their recorded classes began to pick up in popularity with teaching institutions and spread tremendously. (Edudemic)Although flipped classrooms started in high schools there are many successful higher level institutions that have noticed the success of flipped classrooms. Both Worcester Polytechnic Institute (WPI) and the Beijing University of Chemical Technology (BUCT) also seek to bring the success of flipped classrooms to their campus. They have done so by pursuing improvements in their curriculum an important topic for research and development.

The purpose of this project was to do research on how to best direct BUCT to prepare for the implementation of flipped classroom teaching into their curriculum. This was to be conducted by researching other cases of flipped classrooms. In order to give useful recommendations it was necessary to conduct additional field studies, focus group studies and academic research around both institutions paying particular attention to the assets used. Our studies investigated the usability and effect of the teaching assets at both institutions to better be able to draw comparisons between the two and to identify the most useful assets for BUCT.

The team identified that online resources played the most critical role in flipped classrooms at other institutions. The field studies further found that WPI had more technology and other resources in the classroom than BUCT. The most important asset found at WPI however was the learning

management system that brought together the most important resources in an online platform. From these studies we recommended BUCT to adopt a learning management system of their own as this would be the best way to bring blended learning to their curriculum and prepare for flipped classrooms while circumventing most of the existing infrastructure and classroom resource issues at BUCT. The team then further researched into available systems for purchase for BUTC; two came up as the most promising systems. These two systems were Blackboard and Canvas by Instructure however due to time constraints and communication problems this follow up research had to be cut short.

Authorship

In addition to the IQP team of Brendan Casey and Gabriela Meza two BUCT research teams contributed to the paper by offering up their work for our use. These teams were the Web Expansion Team comprised of Weixiong Wu and Duan Xihua and the Classroom Participation Team comprised of Fan Cunhang, Chen Ningbo, ChenZhudan, GengZhe, and Xu Ruimei.

Table of Contents

Table of Figures

Introduction

The Idea behind a Flipped Classroom is to improve the learning environment for students by using blended learning. Blended learning utilizes out of class education and interaction with students to engage the classroom in the material. This is accomplished through discussion and outside of class resources to teach most of the material. Many colleges have implemented the idea of a Flipped Classroom to their curriculums, including WPI, to great success. Flipped Classrooms have proven to improve student understanding of the material usually out performing non-Flipped Classroom in testing and student feedback. Due to this BUCT desires to start researching and implementing a Flipped Classroom ready environment with the help of WPI students. BUCT has particularly emphasized the expansion of their online resources as opposed to changing than their classrooms. This expansion aims to improve the ability for students and teachers to use online resources and access teaching material. The goal of this is for students to be better prepared when testing and to identify and address problem areas for them so they can relearn the material.

Methodology

History & Literature Review history and literature review. The importance of this in regards to our paper is that it serves to create a basis knowledge and understanding of the research we needed to conduct the project. It furthered our knowledge on what the flipped classroom learning system is and how it is used. It also allowed us to be able to explore the many options available to us in regards to the way one can flip there classroom. Such understanding was important in order for the IQP team to be able to make recommendations to the BUCT team.

External Case Studies

Case studies were conducted in order to further our knowledge in understanding up to date technology used in other institutions. We also used these case studies to broaden our base of

knowledge so we can compare technology at WPI and other higher level institutions. The importance of this was that it helped us broaden our understanding by investigating what was going on in other institutions with flipped classes.

Field Studies

Field studies were conducted to ascertain information and other resources outside of the laboratory. This was done through active research and outreaching to technology services at each institution. This included visiting the teaching spaces to view how the resources in the class were used, researching the resources available and communicating with the technology staff. The goal of these field studies was to create a complete picture of the assets and resources of interest at each institution.

Compare & Contrast

For an institution to effectively host flipped classrooms in their curriculum there needs to be enough supporting technology. This makes identifying and evaluating these technological assets the highest priority of this project. However due to the vast amount of assets that any university could claim affected the effectiveness of potential flipped classrooms or other blended leaning based methods in the curriculum it was important to limit the types of assets that would be evaluated and the manner in which they would be evaluated. To do this we researched what a simple flipped classroom needs to be effective based on the assets that were best available to us at WPI. From this we determined that the technological assets that we would look into at both institutions would be limited to video/audio capture systems, class participation technology and learning management systems. However this still leaves the issue of evaluating the available assets. This created a dilemma as to use each system and do an in-depth evaluation of the effectiveness and availability would be impractical for the team given the timeframe and resources of the project. Therefore we determined that conducting interviews and

surveys to collect feedback on these systems to bolster our own knowledge would be the best course of action.

Focus Groups

Focus groups will for the base of this project's conclusions about the teaching assets. To conduct the focus groups the project will collect small samples from the focus groups. These small samples will be given questions in a non-directed manor about relevant subjects. It was important to define what groups would be a part of this project for investigation. We decided the groups to focus on based on the criteria that they must be most affected by the implementation of new teaching methods and can affect the decision for adoption. For this project it meant that the teaching staff and undergraduate student population would form our focus groups.

Professor Interviews

Interviews were the best way for us to get an in-depth understanding of an individual professor's views not only about resource availability and usability but also their teaching preference. This would let us build up a better picture of how teachers use the available resources and what would affect them the most. However there was an immediate problem as contacting professors during the summer period proved difficult so we were forced to choose professors to interview by convenience rather than random sampling. However the opinions of these professors are still valuable and with our own understanding of the system can give a better idea about the effects of the teaching resources available at each institution respectively. To conduct an interview we either convened at a predetermined time to discuss their teaching methods and gain an insight into how they understand flipped classrooms or sent them a questionnaire and follow up with an open discussion. Next we discussed their use of the available teaching technology and asked for their opinion on the effectiveness

and usability of what they are or have used. For one of the interviewees we were able to sit in on their class and see for ourselves how they taught the class.

Student and Teacher Surveys

Surveys are where a majority of our opinion data came from as they can reach out to the most people and give quantitative data. Two surveys were developed; one for WPI in English and one for BUCT in Chinese. Despite the larger number of respondents to the survey than interviewees the survey due to its bias and low expected response count could not be reliably used on its own to draw conclusions from. However with the other methods of collecting data this can give a better idea about the effects of the teaching resources available at each institution. For the survey we drafted questions based around each teaching asset that had been identified and asked for participants to note their use and opinion on each as well as give some information about their experience at the institution. For the WPI survey we also had to address the additional hurdle of being approved by the Institutional Review Board which required an approval form and sample questions to be submitted. However we also were able to gain insight from a survey of individuals at each institution that was not constrained by the need for approval.

History & Literature Review

Modern flipped classroom teaching methods started up when high school teachers wanted to change the common trend of drop outs and encourage students to pursue a higher level of education. Two individual innovators played a key role in this. Back in 2007 Teachers Jonathan Bergman and Aaron Sams at the Woodland Park High School in Woodland Park, CO discovered a type of software that recorded power point presentations. They decided to record some of their lectures and make them available to students that missed class for whatever reason. Soon enough the online lectures began to spread tremendously and it was very successful. It was so successful that Mr. Bergman and Mr. Sams

were asked to speak about this innovative technology around the country. Soon enough many teachers began to use online videos and podcasts to teach students outside of normal class time. The purpose of their innovative work was to help students fulfill high school graduation requirements.

What is Driving Flipped Classrooms

There are two key factors that are driving the changeover to flipped classrooms; poor learning outcomes and the prevalence of online videos. According to a report on high school learning outcomes high school students graduate only 69% of the time while 31% don't (Edudemic). Yearly high school drop outs adds up to at least 1.3 million a year (Edudemic). This raises many concerns to high school institutions. In 2007 15% of internet users were on the internet looking up teaching videos because they did not fully understand the material taught in class however by 2010 the amount of internet users looking up teaching videos has increased to 30%. What these users are mainly resorting to is an incorporated system such as Khan Academy, offers over +2,400 online video lessons (KhanAcademy)

Implementation

Teachers started by creating three videos a week these videos were of about 5-7 minutes in length. The students would watch these videos at home or at school if they did not have access to the internet at home. During class time they usually would do labs or any other types of interactive activity. These activities redelivered the learning concepts of the class that had been given for them to learn about that previous day. The greatest benefit of this system was that the students received instant feedback. Students could identify if they needed help by assessing if they did not understand the videos. This made it easier for teachers to identify the students that needed further explanation of the difficult concepts. By understanding this system students learned to stay calm and not be easily frustrated by material they did not understand. This creates a resiliency buffer zone that the students built up as they had the videos to fall back on and could get one on one attention from teachers. This was of great

importance as a student being frustrated lead to them not compete given homework, not participating in class, receiving disciplinary action, or dropping out of school all because the student would giving up on trying to learn the material.

The teachers found that working out the problems in class one on one with the student would help minimized this frustration and build confidence in the student. Students were also able to minimize their frustration and build confidence by watching the online lectures at their own pace. (Edudemic)This was accomplished by allowing the students to stop the video and continuing it when they want to move on. These videos helped students take better notes by avoiding the problems of a normal lecture class. In a lecture class the teacher often wants to cover as much material as possible and just keeps moving with the class material without receiving feedback on the pace of the class because many students are afraid, intimidated or believe that the topic has already passed the point where they can stop to review by and asking questions. The videos also helped teachers as they were able to revisit concepts students did not understand from the video feedback as students would write down questions after they watched the videos. Through this feedback teachers also gained a better idea of problems with the teaching material the class body was having. Another way it helped was that the teachers support the students in class; if they did not fully understand the material the teacher encouraged an out of class meeting time.

Results

After analyzing the effects of the flipped classroom module they did a comparison of before the flip and after the flip. Before the flip +50% of freshmen failed English while 44% failed math which totaled to a number of 736 students. After the flip the data they found that the numbers progressively went down to where only 19% of freshmen had failed English and 13% failed math at the time of the review which totals to a number of 249 students which is a huge difference. This however is just an

example how the 9-12 grades system decided to start implementing a flipped classroom module and how it has helped them increasingly. (Edudemic)

Since 2004 flipped learning has exploded onto larger educational scenes it has been one of the hottest topics in education and still continues to grow. The reason for its growth according to an online survey conducted by SOPHIA is that two years ago (2012) 73% of teachers recognized the simple term of flipped classroom. In 2014 about 96% have fully understood the term of flipped classroom and in 2012 48% have chosen to flip there classroom since 2012 to 2014 the percentages have gone up by 20% now the current percentage has gone up to 78% even though the majority of flipped teaching is happening in High Schools the number of elementary teachers and college instructors has increased significantly over the past two years. This does not seem to be a trend in new teachers just starting the survey concluded that about close to half of teachers that have been teaching for +16 years and 96% of them would recommend the method to other teachers. Also 9/10 teachers from the survey noticed a positive change in student engagement. This number has increased tremendously due to a survey done by the FLN in 2012 they report 80% then SOPHIA's survey done in 2012 showed an 85% increment but the number has gone up in two years by it now being in 2014 about 88%. Not only has student engagement gone up grades have gone up from 2012 there was a 67% increase in 2014 the increase went up to 71%. This is a significant improvement and only speaks to the merit of a properly executed Flipped Classroom. (Edudemic)

External Case Studies

Although flipped classrooms started in high schools there are many successful higher level institutions that have noticed the success of flipped classrooms. These institutions have sought to bring that success to their own campus through investing in technology. The technology that made flipped classrooms a success and classroom participation technology have been priorities for their investment.

In this section we will review two notable cases of higher level institutions that are using flipped classrooms.

The University of Minnesota

The University of Minnesota focuses on the technology and teaching dynamics of a classroom. There flipped classroom modules are called ALC (active learning centers). An ALC is a student-centered, interactive, integrated, flexible, and active learning space. It features large round tables with seats for nine students , each table supports three laptops which switching technology that connects them to a to a fixed flat-panel display projection system, and three microphones. There is a centered teaching station which allows the instructor to select and display table-specific information. Multiple white boards or glass-surface marker boards are distributed around the perimeter of the class room. A typical setup would look something like this.

(University of Minnesota)

Figure 1A typical ALC in the Science Teaching and Student Services Building (STSS)

The greatest benefits of teaching in this type of environment are that it increases the learning gains for students and gives higher student satisfaction than other learning environments. Although there are many additional benefits there are also additional challenges. Such challenges include that the space may have no front or focal point; this would change the teaching approach needed to utilize the space, it is easier for there to be many distractions that can impact individuals with disabilities and due to the use of technological resources people that are not that up to date with given technology resources will need help in becoming accustom to them. Some may not know how to operate the technology or be opposed to its use. With many other aspects this teaching environment requires a great deal of time effort, and a major change of teaching styles to utilize this teaching environment effectively.

(University of Minnesota)

Columbia University School of Continuing Education

The School of continuing education at Columbia University has created types of flipped classroom modules in their curriculum. Through these flipped classroom modules students are offered a variety of masters and certificate programs in fields such as communications, technology, and sustainability. Many of these programs are online/hybrid programs. Much of the material and courses is taught online but there is also face to face sessions offered in each semester. The learning management system used to organize and facilitate academic activities is Canvas by Instructure. Canvas is setup so that the majority of the material is posted and social exchanges can occur. Such material and social exchanges include syllabi, activities, readings, videos, discussion forums, and assignments. Apart from this they have weekly live sessions often held on Adobe Connect that can range from 1-2 hours. During these live sessions they have virtual events; lectures, group work, student presentations, and other forms of classroom interaction.

This system for teaching greatly benefits the graduate student population. There are many are full time working professionals that need some type of flexibility to self-teach themselves when they are not at work or are fulfilling family obligations. This teaching system can reach out and accommodate their lifestyle while offering them the education they desire. When The School of Continuing Education at Columbia University received feedback from the graduate students they all seemed to be very positive. This was in part due to the videos in these programs that included screen-captured PowerPoint presentations, instructor-focused content lectures, animated videos, short documentaries, and simulations. The media in these two programs have a wide range of production values, length of time, and instructional purposes. Some responses from graduate feedback are the following:

“The most engaging videos for me [are] when the professors use wit and humor."

"The reading is very didactic or academic, but the videos are very real-case scenarios. The instructor narrates: 'How do you take that academic learning into the real world? What does that mean when you're looking at these financial statements?'"

"[The videos] are better than just reading the material because it has more of that human element."

(Columbia University School of Continuing Education)

Many students enjoy this teaching method offered by The School of Continuing Education at Columbia University as compared to a traditional class room setting. There was a focus on the videos and online content given to them that sponsored a positive response from these students.

Other higher level institutions have decided to incorporate some types of flipped classrooms into their curriculum. Even the graduate classes have got on this curriculum and it becoming something very popular because of this Flipped Classrooms are occurring in many campuses around the United States.

(Columbia University School of Continuing Education)

Sponsors Background

WPI

Worcester Polytechnic Institute (WPI) was founded in 1865; it seeks to educate men and women in engineering, science, management, and humanities in preparation for careers of professional practice, civic contribution, and leadership, carried through by interactive learning. WPI was founded in order to create the latest science and engineering knowledge in ways that would be most useful to the society from which its students came. WPI strongly believes in the motto theory and practice. (Worcester Polytechnic Institute)The curriculum at WPI reflects this motto with many classes having a required project. The projects challenge students to put into practice what has been learned in the classroom. This approach seeks to improve students' grasp of the material and demonstrate how it is used in practice.

WPI has always strived to keep up with teaching technology to that end they have outfitted most of their classroom with technology in mind. Most of these classrooms cater to students using electronics with school wide Wi-Fi and available power strips for charging devices. All of these classrooms are outfitted with teaching equipment this includes a projector with a screen, a podium and white or black board. WPI has also invested in improving classroom participation with active participation tools that record in real time student's responses to a teacher's question. WPI has made online resources a focus for investment; many online resources are available to improve the teaching and learning experience with an emphasis on improving access to teaching material. Through these investments in classroom and online resources WPI has been able to keep up with the ever progressing teaching technology. WPI has a majority of its curriculum as lecture based classes that teach the material to a large audience of students through the use of technology in and outside of the classroom with challenging tests as incentives to keep students studying and projects to further students

understanding of the application of the material. However a number of teachers now use flipped classrooms at WPI with the project based curriculum to bring the students learning experience and rate of knowledge gained to a level beyond the lecture classroom.

BUCT

The Beijing University of Chemical Technology (BUCT) was founded in 1958 and is affiliated with the ministry of education. Their core curriculum is based on science, economic management, languages, and other liberal arts. Although these subject make up BUCT's core curriculum the institution has shared great passion for scientific research. BUCT has focused a great deal of resources upon building 15 research institutions and 8 research centers which are the National Research Center for Carbon Fibers, the Ministerial Research Center for Membrane Engineering and Technology, the Ministerial Center for High Gravity Technology, and the Key Laboratory of Science and Technology of Controllable Chemical Reactions. (Beijing University of Chemical Technology)They have also taken up a large numbers of research projects focusing on key state sponsored science and technology tasks supported by the National science foundation, various ministries and other enterprises. This has strengthened BUCT's technological ties through cooperation and resource sharing with many key research individuals as well as many huge enterprises. This has helped the institution through the associated social and economic benefits. As China becomes increasingly open to the world, the university has established links for academic exchange and cooperation with many foreign universities and industries.

BUCT has a small campus with most of its teaching spaces set up with a focus on lectures that can present PowerPoint presentations to the audience. However not all buildings have the same technology or resources available to them. Many of the buildings on campus differ in what is available. There are buildings with classrooms that resemble active learning centers with screens for presenting information as well as learning stations. These active learning centers were found mostly in the labs of

the Electrical Computer Engineering department. However there is a great difference just across campus with the mechanical engineering department the labs that mostly just had a desktop with a single monitor and keyboard with no ability to use PowerPoint or even a screen with a projector. But even these barren labs were not the worst to be found as when looking into other classrooms the very old buildings were relics of the past. Classrooms located in these buildings had hardly changed since they were constructed and some only had barely usable and old fashioned projectors that could not even adequately present PowerPoint presentations. Despite BUCT's apparent trouble keeping up with teaching technology the institutions have made efforts through research projects into available types of technology to change the campus and learning environment.

Field Study

Compare & Contrast

In this section we will break down each asset found though our field studies or group of assets and if possible compare it to a similar asset or group of assets at the other Institutional.

WPI Class Capture

Class Capture at WPI is the set of teaching assets that enables and enhances classroom recording as well as online material upload from the teacher directly. This includes videos, audio recordings, PowerPoint slides and more. The following teaching assets are included in the Class Capture system or are associated with it.

Echo 360

(echo 360)

Figure 2 Echo 360 Example

Echo 360 is a very capable program used to create the final class capture material for the teachers and students. The program handles the uploading process, the delivery of the material and can handle various levels of manipulation. This material includes video, audio, PowerPoint and document camera recordings. This material can be uploaded at various qualities based on the available connection speeds. Automatic uploaded and even recording is possible if the teacher has set up the Echo 360 class capture system to do so. The system is integrated such that it can make use of the available in class devices, depending on the classroom, if the classroom is setup properly to do so. The devices that work with this system include the classroom camera, both wireless and goose neck microphones and the in class main computer. The computer can be used as a capture device but also functions as the main

controller for the Echo 360 class capture system when it's active. This computer can be found in almost every classroom for the teacher to use as a part of the Podium system. Once it has been uploaded the stored data is still able to be manipulated by the teacher or administrator to change how it is presented to the students and can be link it to other teaching material. This manipulation has the ability to create links outside of the service. However to access this material a user needs to be authenticated by WPI's Central Authorization Service by using their username and password to create their unique WPI online user identity. Once a user has been approved to access the material it can be streamed directly to their computer at a reasonable quality for their connection speed or downloaded as a video or audio file that can be used while the user is offline. It is also available through mobile application so it can be used by tablets, phones or other similar devices.

(echo 360)

It is also useful to note that this is not the only available resource for this type of content however it is the resource we were directed to for this system.

The Podium

The Podium is the platform for most of the technology across almost every classroom and laboratory at WPI. The reason for the Podium was to collect all the instruments that a teacher might need to teach their class and make it easy to access without the need to leave the focal point of the classroom. It does this by housing the most used electronics in the classroom to be easily accessed by the teacher. The Podium contains a document camera, the main computer for the classroom, a mounted microphone, multimedia players, classroom control panel, power distribution outlets, multiple connection ports, and can contain more equipment depending on the classroom. The goal of the podium is to encourage teachers to bring technology to the classroom and to improve the quality of teaching by the use of its teaching tools.

Figure 3 WPI Podium Example

WPI Document Camera

The document camera is a part of the podium but can also be used as a standalone device. Its primary use is to give an output display that can be inked up the projectors or display screens in the class from the camera mounted on the device. The devices camera is able to move around on two axes and has an auto focus function but it robustly attached to the base so it won't move in an undesirable manor and won't be damaged. This flexibility of the device allows for many types of material to be handled by the device.an example of complex material the device is useful for displaying are three dimensional models. The camera has a high resolution that brings a level of clarity that is very useful to see the finer details of the material and allows the image to be zoomed into without excessive blurring to occur. It also can be tied into the class capture system as a video source for recording. This device was adopted because it allows a professor to show the entire class non-electronic material that they can be working on such as a printed document they have brought to class and are marking up. This saves on

time by skipping the handout process and allows the professor to show exactly what they want to. This helps keep students engaged in the class by having the document in front of them.

(Academic Technology Center)

WPI Wireless Microphone

The wireless microphone is an audio capture device that is worn by the intended capture audio source. It features a short range microphone so that background noise will be greatly dissipated. It also features a multi band wireless transmitter / recorder. Its range is great enough to be used throughout a classroom or teaching environment. This device can be tied into the class capture system and uploaded as an audio file or linked into other sources to create a more rich media source for upload. This device allows for audio recording of the lecture both while the teacher is at the podium and when they are walking around the class to better explain the material and not restrict the teacher.

(Academic Technology Center)

WPI Blackboard

Black Board is a learning management system (LMS) that enhances learning on every possible level. It provides forms such as engaging students in exciting new ways such as incorporating new technology within the system that helps them stay informed and involved in learning and encourages students to collaborate together. It provides a central location to access information about the class such as syllabus, course materials, grades, homework, testing, class capture, audio/ video, lecture slides, debates, discussion forums, class roster, as well as gives teachers a platform to upload material and respond to students in an effective matter.

(Academic Technology Center)

BUCT Developing Teacher Student Information Exchange Website Expansion

Description

BUCT student's initial idea for the implementation of flipped classroom teaching methods is to use the schools existing data network to improve the education offered. The idea is to create a new self-learning environment for students. This would lead to an increase in self-awareness about the material and improve student learning through the process of increasing the ability for students to access information and teaching material. The BUCT project team believes that the flipped classroom model can give full attention to the enthusiasm of the students through this self-teaching environment. In order for students to self-teach there needs to be an e-learning platform. This e-learning platform should support material that can be set up in accordance to the topics relevant to what the students are learning in the classroom. The system ideal should be able to hold a lesson and if the student should faces difficulties with the material online the student and the professor should be notified so that the student and the professor are able to work together to analyze and discuss the subject of the issue. Through students and teachers conducting this kind of interaction in the classroom it would help deepen students understanding of the class material and improve class grades.

Objectives

The BUCT project team plans to create a webpage where they can have access to e-learning materials so that they can bring to fruition the desired student teacher interaction in the system and help students understand the class material. The intended plan is to have professors be able to upload testing material so that the student could test themselves before class. The thought behind this testing before class is so that when the students give an answer incorrectly the system would prompt them to what they got wrong and suggest the material for them to go back and re-learn what that they do not

seem to understand. Such assistance would give students a much needed way to receive better feedback so they could know what they got wrong but more importantly why.

Interface Design

This is the designed that inspired the BUCT team design and what they want the e-learning module to look and behave like but within their system.

Khan Academy Design Inspiration

Network Home Design

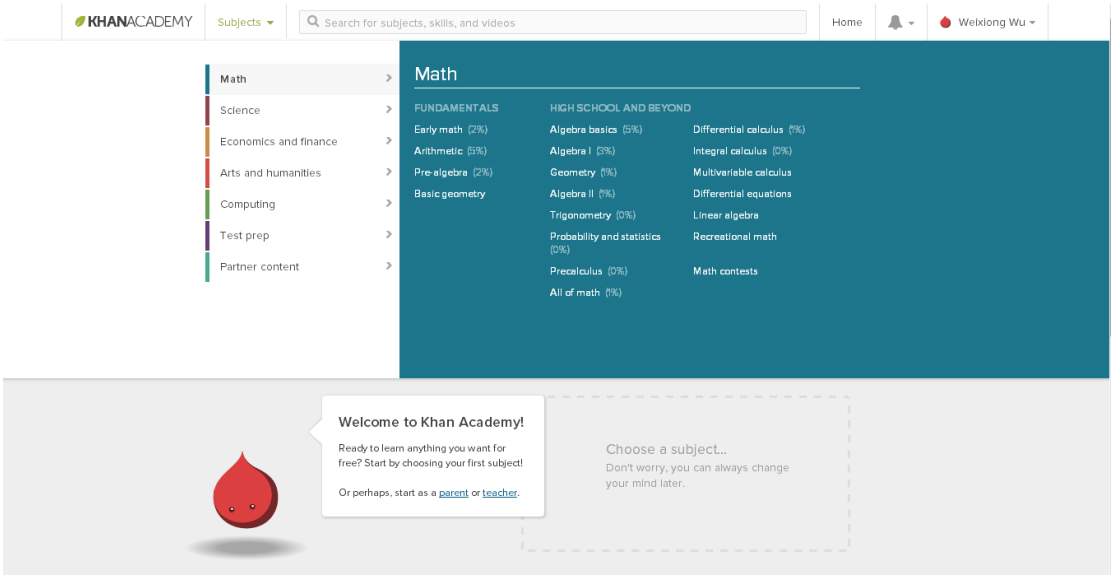


Figure 4 Main Menue Example P1

(KhanAcademy)

- An elegant but powerful interface design.

Network login interface design

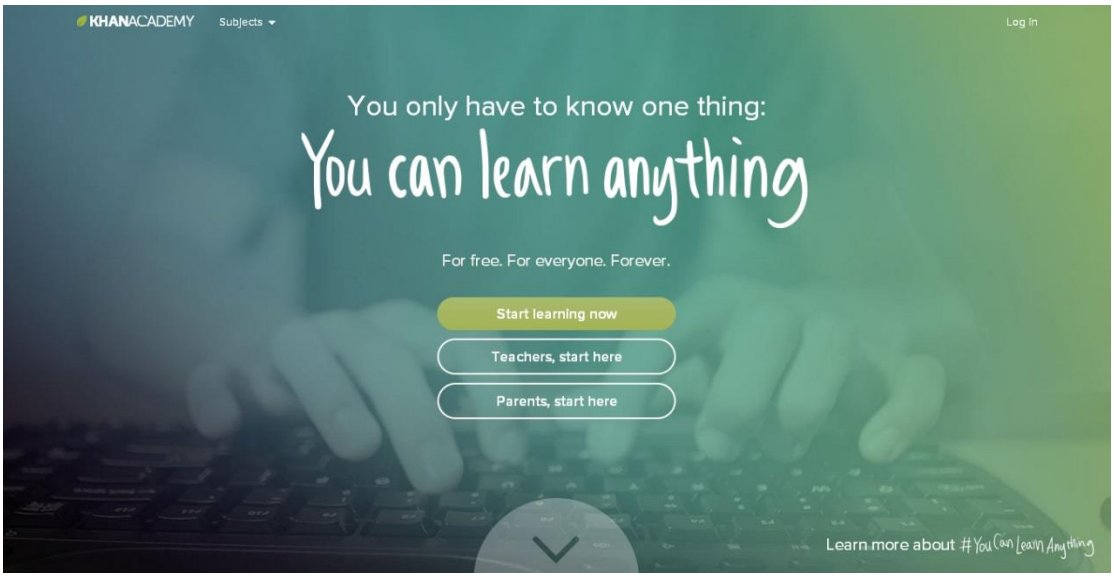


Figure 5 Splach Page Example P1

(KhanAcademy)

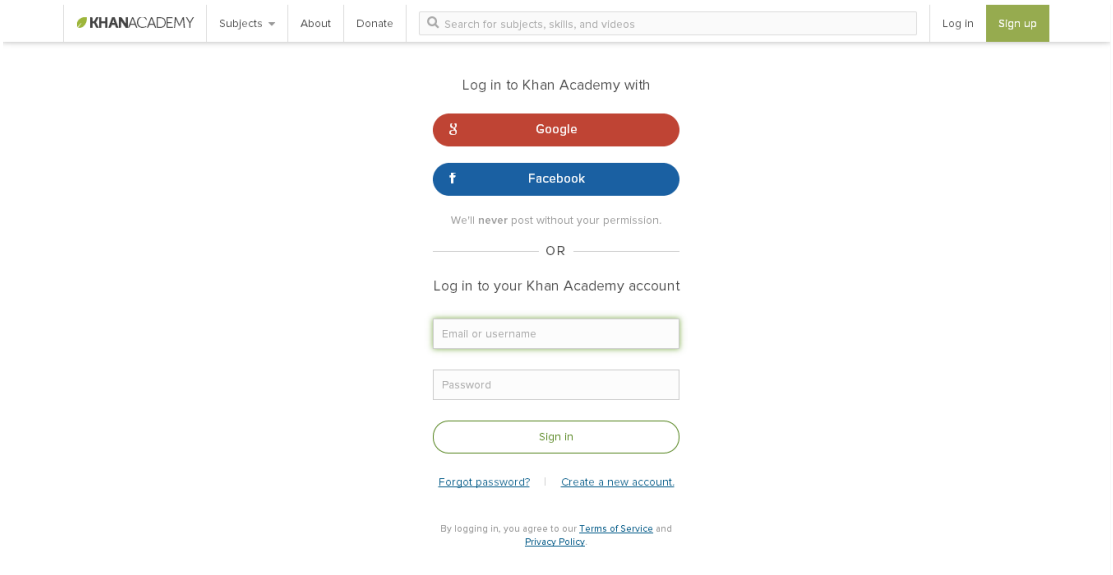


Figure 6 Login Example P1

(KhanAcademy)

- An easy to use interface design that can handle both teachers and students for login purposes.

Subject Interface

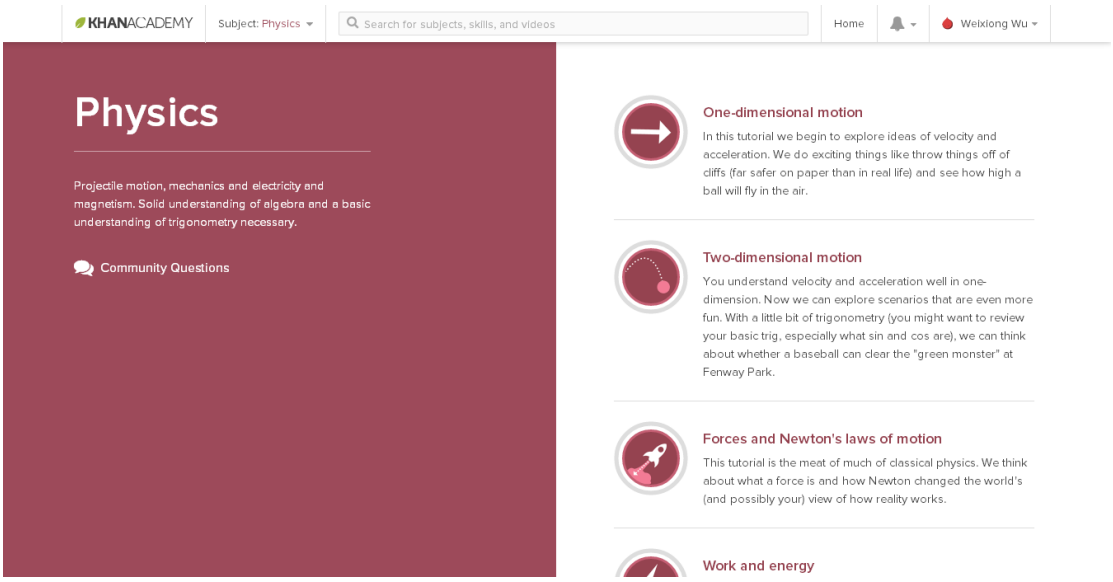


Figure 7 Subject Breakdown Example P1

(KhanAcademy)

- The ability to break down the subject into topics for easier compartmentalization of the material.

Video Learning Interface Design

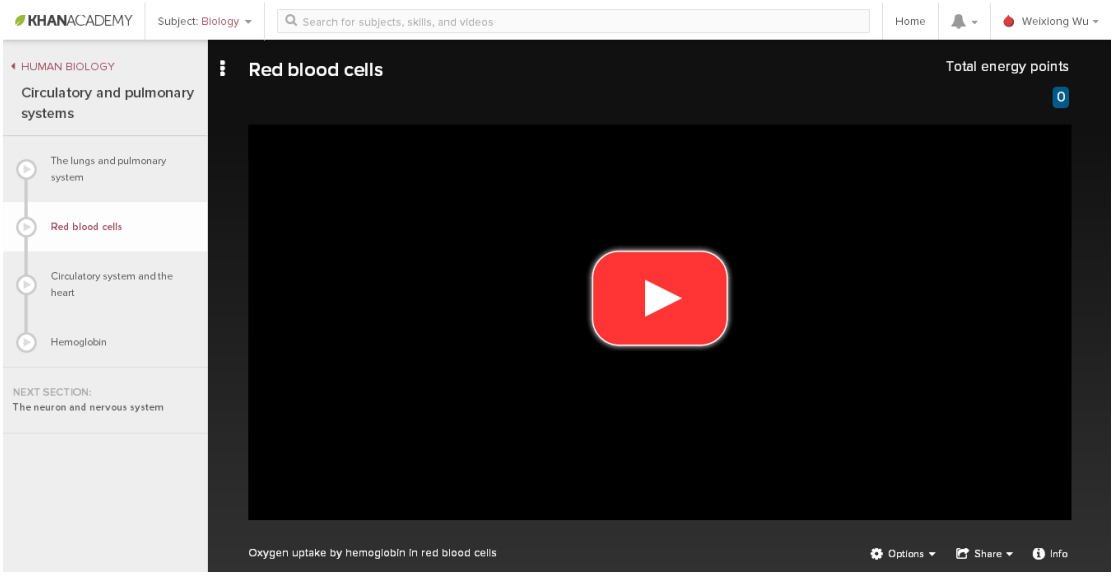


Figure 8 Video Content Example P1

(KhanAcademy)

- E-learning environment with section separation and the ability to display complex material such as video.

Student exchange seminar interface

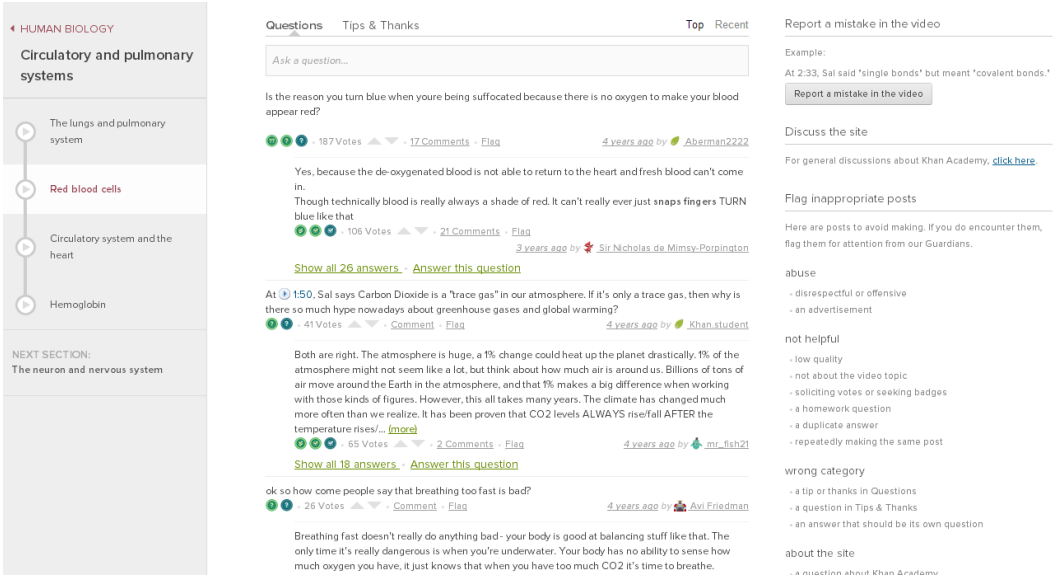


Figure 9 Forum Example P1

(KhanAcademy)

- Discussion area that can utilize “links to” and support document viewing.

Quiz testing and review test interface design

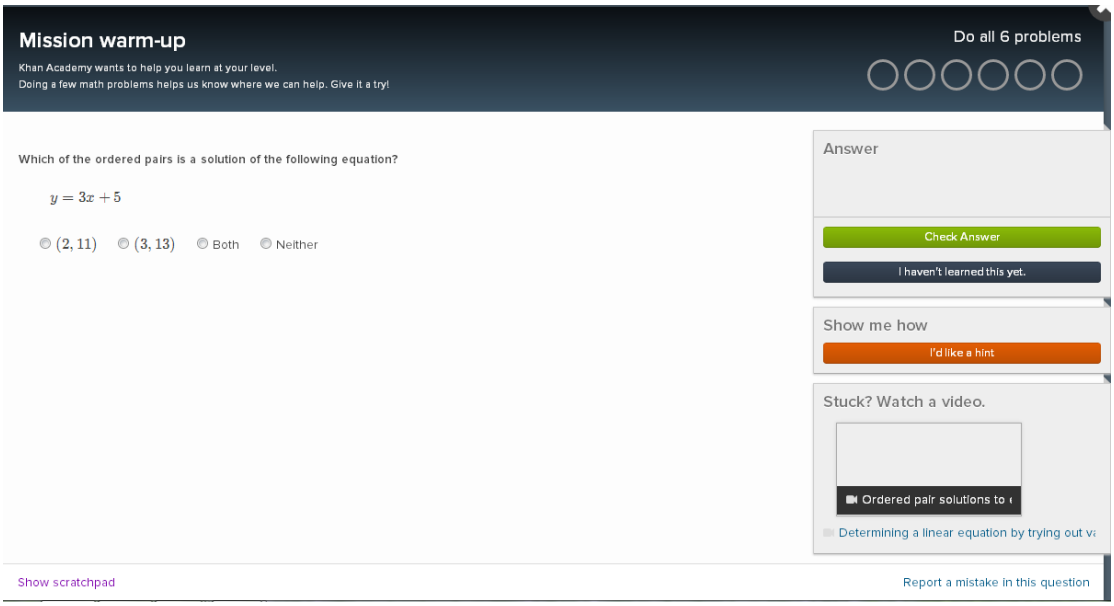


Figure 10 Testing Example P1

(KhanAcademy)

- Testing capabilities for students with prompts to take them to the material the question covers.

System Features & Modular Design Explanation

BUCT Login Screen

Online course login system has three roles these are administrator login, teacher login and student login. When a user logs in the system should automatically determine the user's role based on their history with the system. The user would then enter the different modules according to their different role. To obtain the appropriate permissions to perform different functions the system is broken down by role logic that gives the permission based on the role the user is logged in as. This login logic is displayed in the BUCT team's login logic diagram.

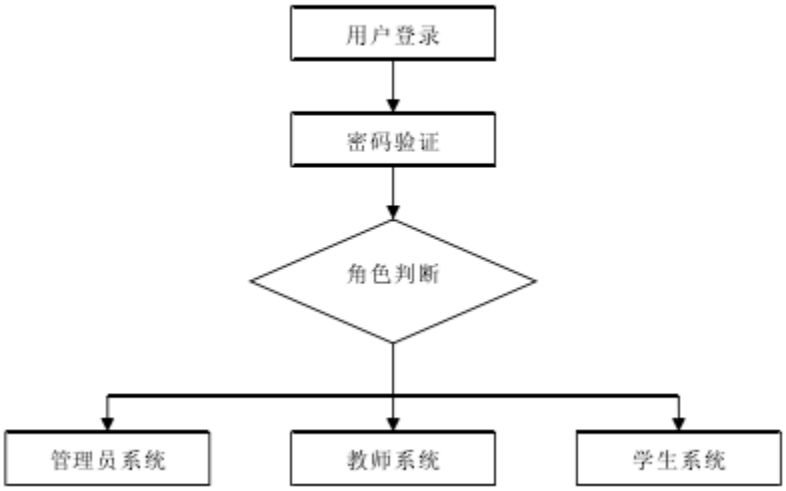


Figure 11 BUCT User Login Function Design Diagram P1

Administrator Function Modules

Administrators have the permission to manage any user. This management includes student information management, teaching information management, teacher and administrator identity management. It also can also manage the curriculum, add news bulletins, send short message as well as manage resource used by the system.

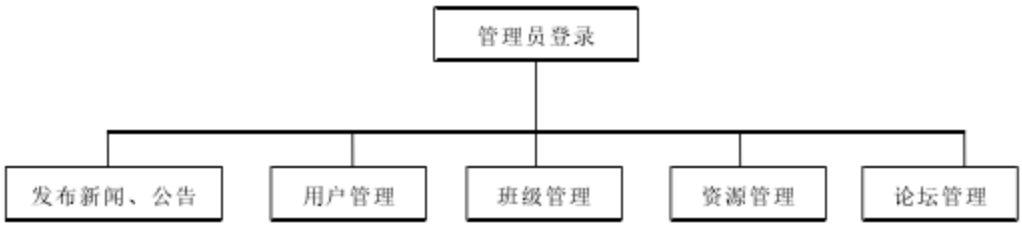


Figure 12 BUCT Administrator Function Modules Diagram P1

Teacher Modules

After a teacher logins they will have permission to access the teaching network, course content, courseware, teaching information, student information, short messaging system, forum operation management and personal teacher information.

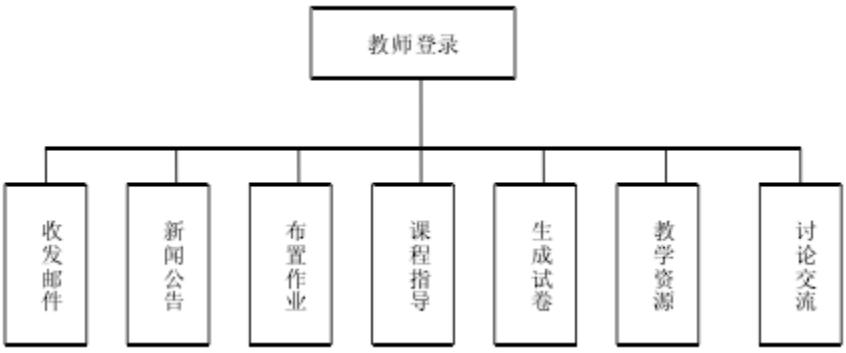


Figure 13 BUCT Teacher Modules Diagram P1

Students' Functional Modules

After a student logs in they can send and receive mail, modify their personal information, view the announcement board, access teaching information exchange forums, download resources and take online tests.

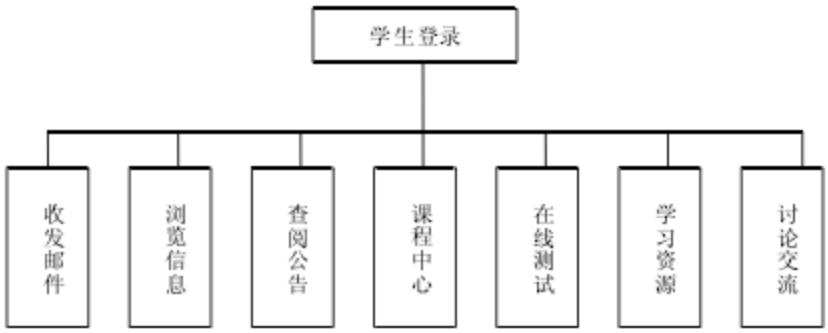


Figure 14 BUCT Students' Functional Modules Diagram P1

Course Management & Users Design

The online permission distribution is divided into three types of users these are online courses background administrator, teachers and students. Network administrators manage user permissions for teachers, students and manage users and their permissions.

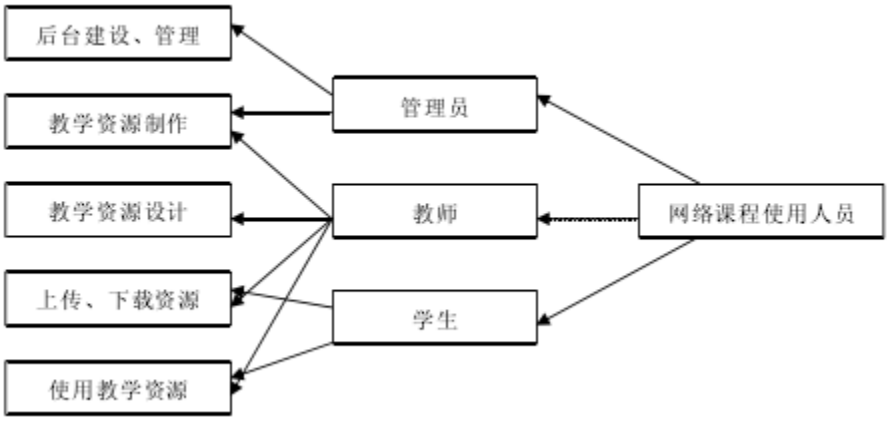


Figure 15 BUCT Network Administrators Permission Diagram P1

Database Design

The database uses SQL Server 2000 and its design is constructed in an application environment optimized database scheme. The established databases and applications, store data, in order to meet the user's application requirements.

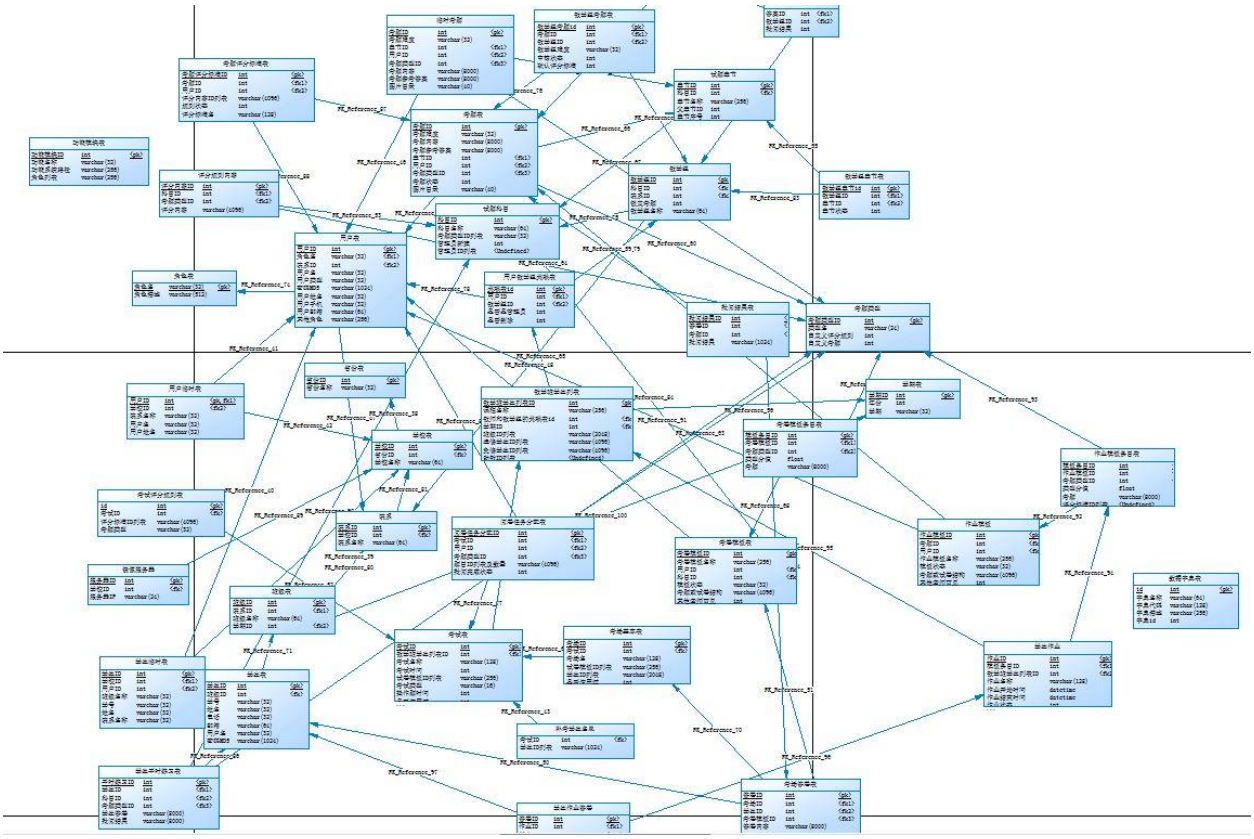


Figure 16 Partial Database Graph

Flipped Classroom Model Design

Before-class Design module

(1) Teaching video production
(2) Targeted exercises before class

Classroom Activities Design Module

(1) Identify problems
(2) Independent exploration
(3) Collaborative Learning
(4) Achievements exchange
(5) Feedback evaluation

Tools Used

In hopes of being able to create this module the BUCT project team used J2EE (jsp) MyEclipse, and the existing database (MySQL).

J2EE

J2EE stands for Java 2 platform which is a programming language. The java platform is a virtual machine that translates computerized instructions into functions. It is very useful in that it allows a cross –platform communication between multiple kinds of devices. This helps the programing efforts greatly because if the person writing the code can develop Java code on a desktop computer the program will make it very easy for the program to be accessed on other computers, servers, and even mobile platforms. The BUCT team chose to use this type of programming to set up the database because it is a very power full set of source code and most importantly it is free. It also makes it easy for people who do not have access already to it to download it so that new team members or those who want to work with the project can do so easily.

MySQL

The reason why MySQL is needed is that many computer programs or web-based programs like management systems or blogs need to store and retrieve data. For example if there is a Blog then it needs to be able to store the posts and be able to retrieve them when a visitor goes to visit the site. What many people do instead of implementing their own system of storing and retrieving data is to use other types of software to uses the database. One of the most popular types of software is a language called SQL it works to make it easier for other programs to access data by enabling the database itself to handle the low-level work of managing data. MySQL is just one of the brands of this database software that is very popular because it is free.

(MYSQL)

MyEclipse

MyEclipse is a type of programming environment that is tailored to web design. It has a lot of support for programing languages and available solutions to many problems one may encounter when writing code. One can unify development into a single Java IDE or Java EE that will support anything one

really needs. It gives easy access to set up Java apps and it makes coding easier to understand. It also makes it easier for one to access cloud systems.

(myeclipse)

Results

The BUCT project team worked on the web expansion for a span of 7 months they ran into many problems while creating this expansion. One of the complications was that only one of the partners would do all of the coding for the web platform by himself. He did however ask for help from the graduate teaching assistant and the professor that assigned them this project.

However he became involved in other projects that were required for his major and could no longer work in the web expansion. We asked him to show us what he had completed for the project.. When he ran the code the only thing that came up was a basic log in screen with a username and password once they entered the given username and password for the system it redirected one to a site that had a posted video. After this he said he ran into many difficulties that required a lot of time to code that he did not have. He said he had to learn how to modify the system so that it can be edited and someone could upload any given information they wanted to add for their class. He said this was too difficult for him. Below are the images of what they were able to do with the web expansion.

Figure 17 BUCT Forum With Video Example P1

Once you log into the system you are prompted to this page where there is a video uploaded. This is considered to be the home screen.

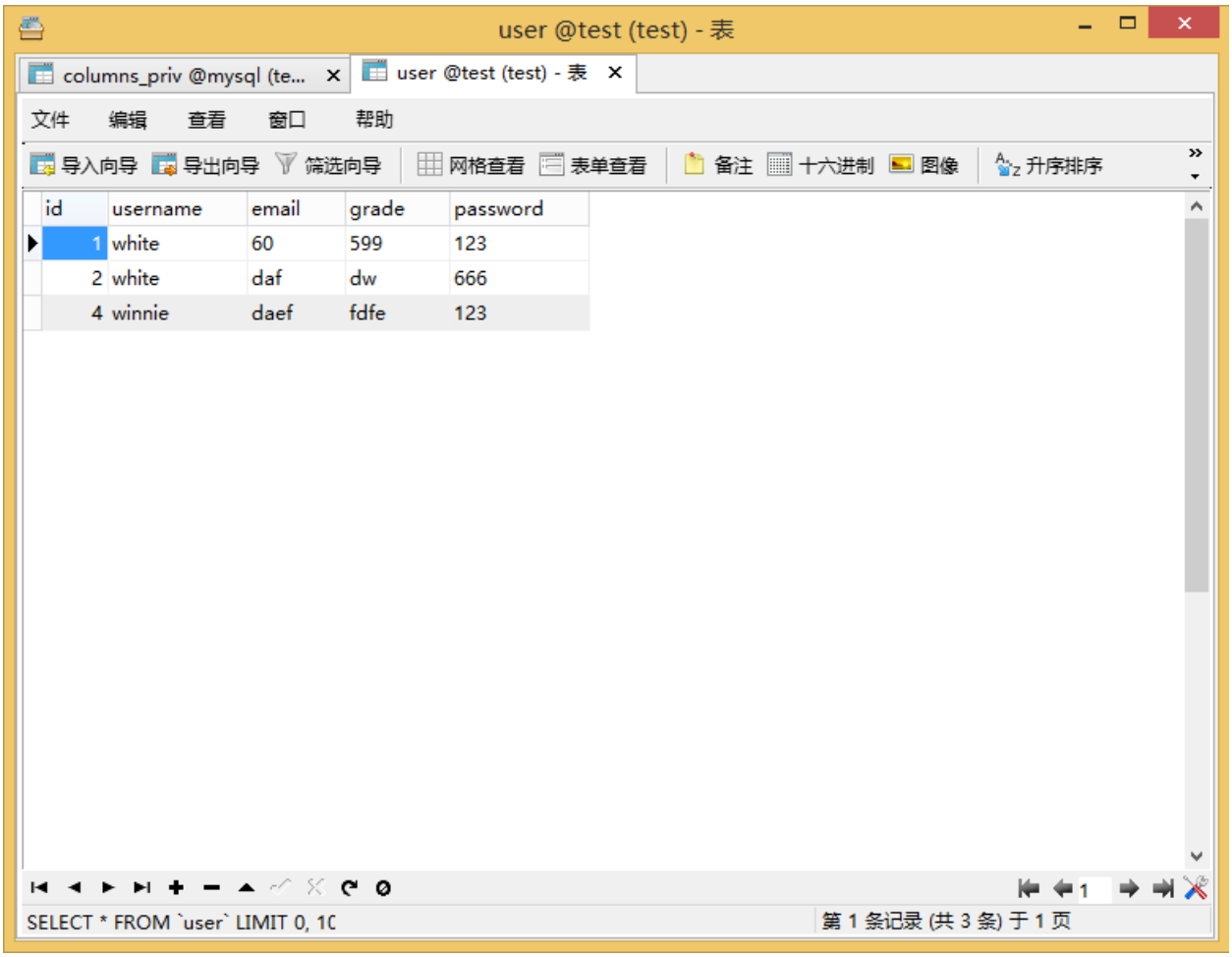


Figure 18 BUCT Stored Student Data P1

This figure shows the username of the students and their current grade for the class the way you are redirected to this part of the web expansion is by clicking one of the bottom links of the home screen.

Figure 19 BUCT Student Data P1

This is the database where if you are another student enrolled in the same class you cans see who else is currently in the same class. This allows one to be able to have access to their email address so one can message another class mate and meet up to do course work together.

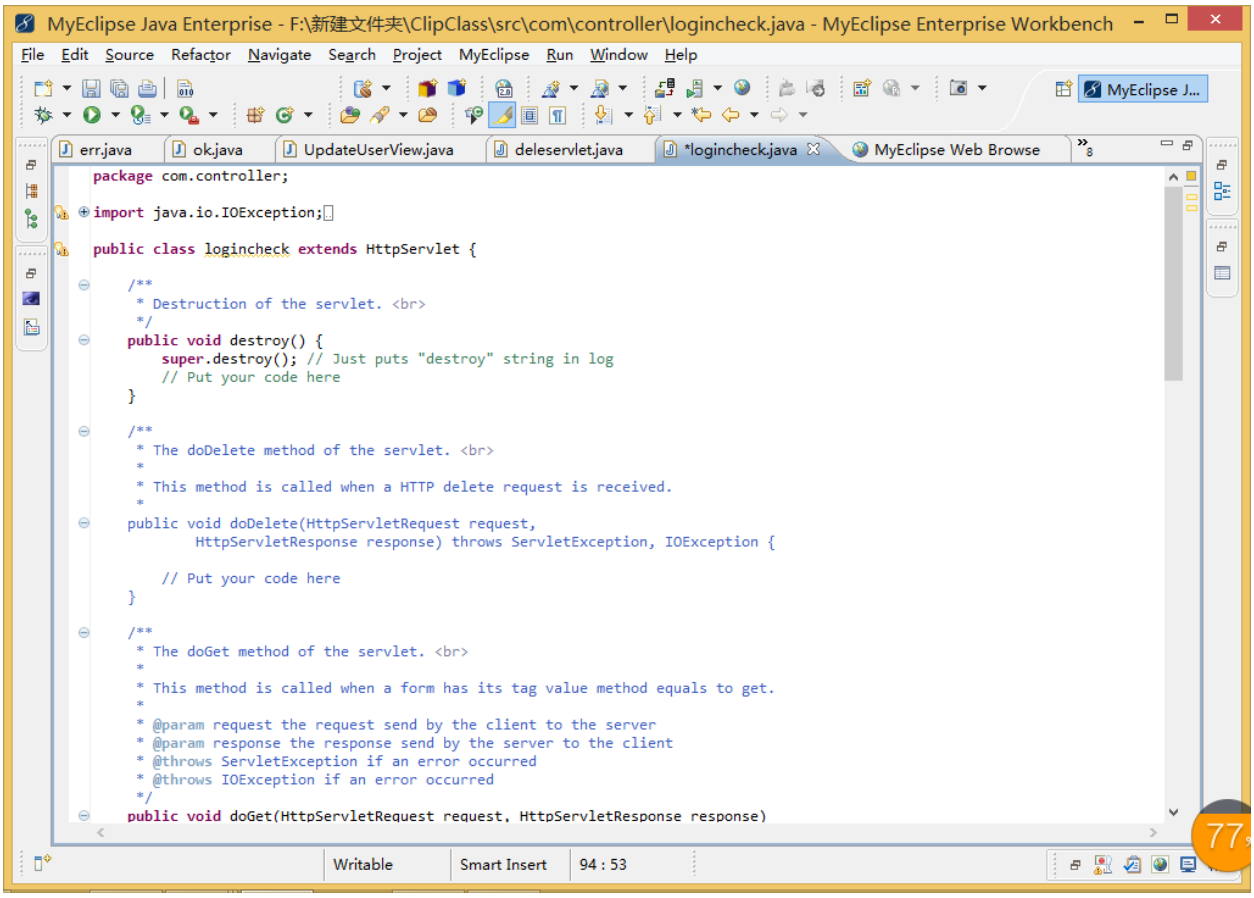


Figure 20 MyEclipse Example P1

This figure shows the detailed code that was used to code out the web expansion page. As we can see the main program used was myeclipse.

Result

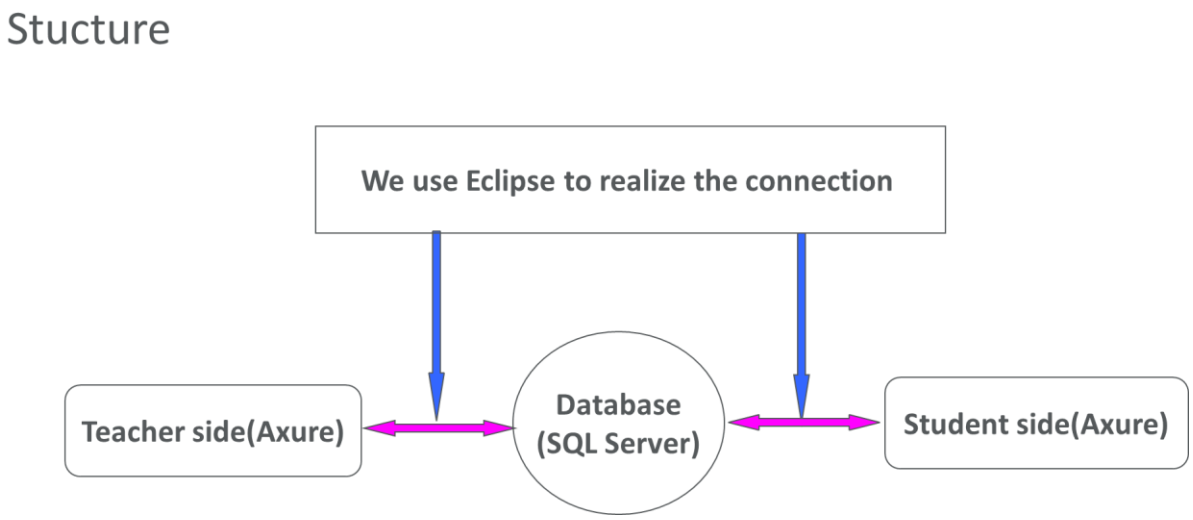


Figure 21 BUCT Program Structure P1

Result

The BUCT team was able to successfully develop and produce a test version of their design. This final product is able to demonstrate the key points of the system but was not brought forward for classroom testing due to it being the end of the project timeframe.

The final software output with labels demonstrating the functionality.

Comparison BUCT Developing Teacher Student Information Exchange Website Expansion with WPI Blackboard and Class Capture.

WPI's class capture system combined with Blackboard completely eclipses the capabilities of existing BUCT assets and what the students at BUCT are working on with their web expansion project. WPI's systems are far more capable, easy to use and available than their counter parts at BUCT. To

better discuss these differences the section will be divided by relevant topics that cover what both systems offer in more detail

Recording & Playback

WPI's class capture system can handle the entire recording and playback process. The system can record material in a variety of ways to capture almost any type of material content a teacher could reasonably want to include in a recording and most importantly it is available in almost every teaching space at WPI. Unlike the BUCT system where the material must be recorded by the teacher themselves and relies on what the teacher has available to them which varies from teacher to teacher. Furthermore the WPI system can stream or download the content for the user through the Echo360 system allowing for a richer content than a normal video to be used. The BUCT system on the other hand works through downloadable or linked content and is not entirely handled by the system in itself. The WPI system is more capable and can handle a wider range of function to record and playback content than the BUCT system.

Online Interaction

Both systems have the capability to host discussions, forums and messaging system. However the BUCT system would be better able to use the messaging system within the program. This messaging system would be better because it would be able to handle richer content and be a more prevalent and easier to use asset in the site than WPI's system. Apart from this there are no outstanding differences in the functionality between the two systems. They both can handle basic and complex interaction functions for both teachers and students in a manner that can be controlled by an administrator.

Teaching Material Availability

The ease of use and availability of teaching material is the most important factor for hosting blended learning classrooms. Both systems can handle uploading content outside of recordings. WPI and BUCT use a course derived approach to deliver and control the content given to the students. This provides a convenient and easy to understand method to access relevant material that the teacher has uploaded. However BUCT has limited space on their servers and only some class can use this system and there is a limit on how much the teacher can upload. This is a very big issue for BUCT and must be resolved before any blended learning classes can be effetely used in the curriculum.

System Availability

WPI and BUCT are hosted in two very different environments. BUCT is restrained in what can be used and where; lacking the ability to remotely connect to the system outside of the campus. WPI on the other hand doesn't have these restraints and its system can be utilized from anywhere that can connect to WPI through the internet. Disregarding these external circumstances the WPI site still has better availability with more resources for students and teachers throughout the campus. BUCT's resources vary from building to building and not every classroom has the capability to utilize the necessary technology.

Testing

BUCT and WPI both can conduct testing online. However the BUCT system for testing is developed to improve the students understanding through a self-learning ability. These tests would give helpful feedback based on the answers the student provided and would be capable of redirecting them to the relevant material. This system is far more advanced than what is available at WPI however it would also be more difficult for a teacher to set up as each question would need to reference the material that it is based off of. Despite being more difficult the potential benefits of a testing system

that would also be able to teach the students based on what they have gotten wrong would be revolutionary for an institution to adopt.

WPI Classroom Participation technology

Figure 22 Clicker & Wireless R/T

(Worcester Polytechnic Institute)

Clicker

Clickers are classroom interaction tools for students to respond to their teachers through a remote answering device. They are characterized as small handheld devices that have a display screen and a multi button input panel. They are designed to work wirelessly in the classroom and be integrated with a capture device that the teacher uses. Each student is given a device and registers it with their unique WPI student identity so that it can be used in class. They are intended to be useful for students to submit answers to questions prompted to them by the teacher and can be used though PowerPoint

prompts. The goals of these devices are to make the classroom more engaging for the student and improve the teachers understanding of the class.

(Worcester Polytechnic Institute)

Turning Technologies

Turning Technologies is the classroom integration software/tool that allows the “clickers” or other in class participation technologies to fulfill their function. This system uses a wireless receiver/transmitter to communicate with the devices in the classroom. It records the responses of each student and can integrate with a PowerPoint plugin that allows the data to be viewed in real time. These responses can also be stored or used with Blackboard to create graded tests or quizzes. It is also not uncommon for the cumulative response rate of the students to be counted at their class participation grade.

(Worcester Polytechnic Institute)

BUCT Developing In Class Participation Technology

Classroom participation is an important factor in any healthy learning environment. Ideal participation in a class gets the students more engaged and interested in the material being taught so that they learn and remember more. It also keeps students from feeling board or left out of the class which helps students feel comfortable and confident in the class. Participation by the students also helps the teacher gauge the rate of learning and can help to give direction to the class so that the teacher can give the best teaching experience they can.

With developments in teaching technology an entire set of teaching tools has been directed at addressing classroom participation. These tools boast real-time response to questions, multiple input displays some have full display screens and others are developed to work with enhancing software platforms. These tools are available in all shapes and sizes that one would expect to fit the varying

requirements of the classroom. This variation makes choosing the right system difficult to find and potential very expensive to implement. However this technologies ability to improve classroom participation often times make it worth the investment.

Overview

The lecture classes at BUCT do not have a way for students to actively participate in the class and can become boring for the students. This project from BUCT students seeks to understand the importance of classroom participation by developing their own system to improve classroom participation. To change these lectures the project focuses on how to implement the backend software for the in-class wireless devices that can be used by the students to improve classroom participation. The project looked into existing systems to gain an understanding of what could be used and the impact these systems had on student learning. Then the BUCT team began developing their own system that was directed by their research and the schools resources. This development focused on the software that would be used in the system.

Planning & Development

The BUCT team divided the software functionality and created two sides to the program. One side was developed for the teachers that would handle the management of the class, creation, distribution and management of the questions and management of the class itself. The other side was developed for the students that would handle the login and question completion. This software would form the base of the program that would allow the full system to improve classroom participation.

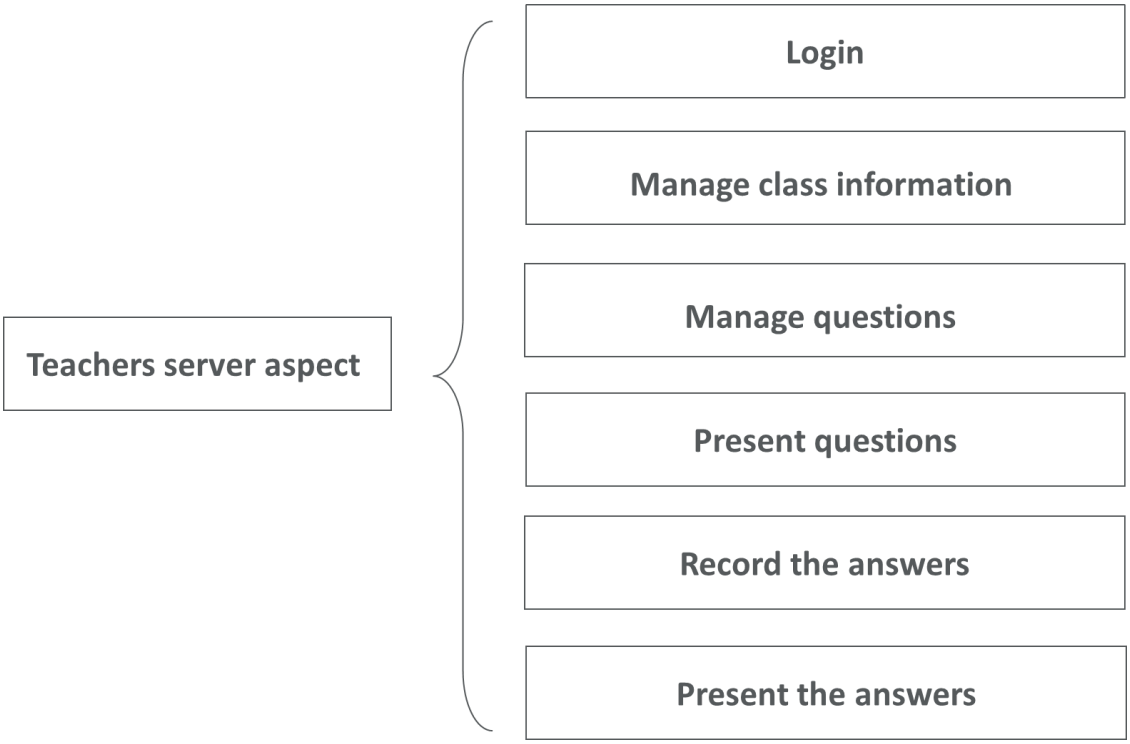


Figure 23 BUCT Teacher Server P2

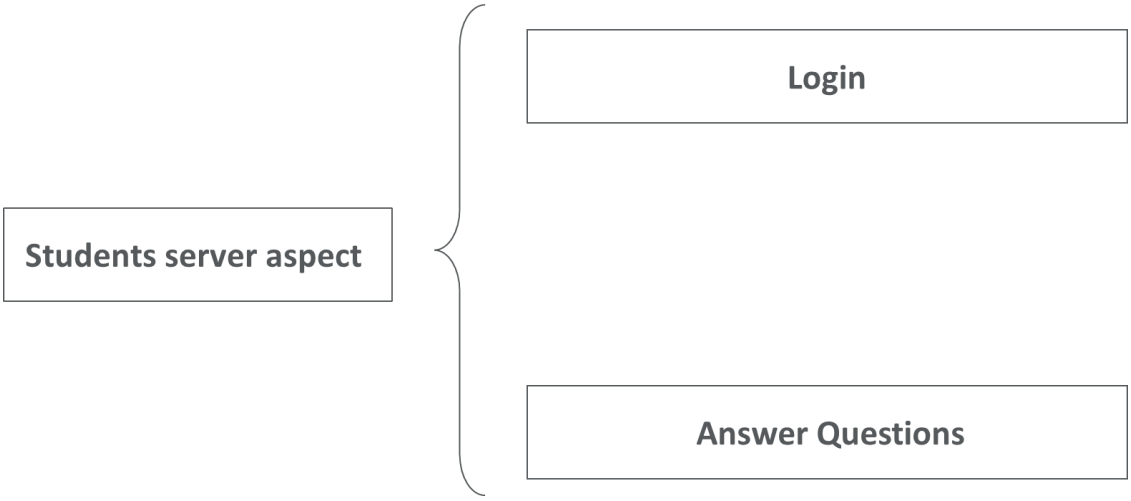


Figure 24 BUCT Student Server P2

The project development continued with the design of the feedback system that was once again divided for the use of students and teachers. This feedback system was focused on improving classroom awareness for both the teachers and students. This was done to improve how the students view this

tool; it was not simply an answer recoding and submitting instrument but a part of a larger system that could be used to give feedback to the students as well.

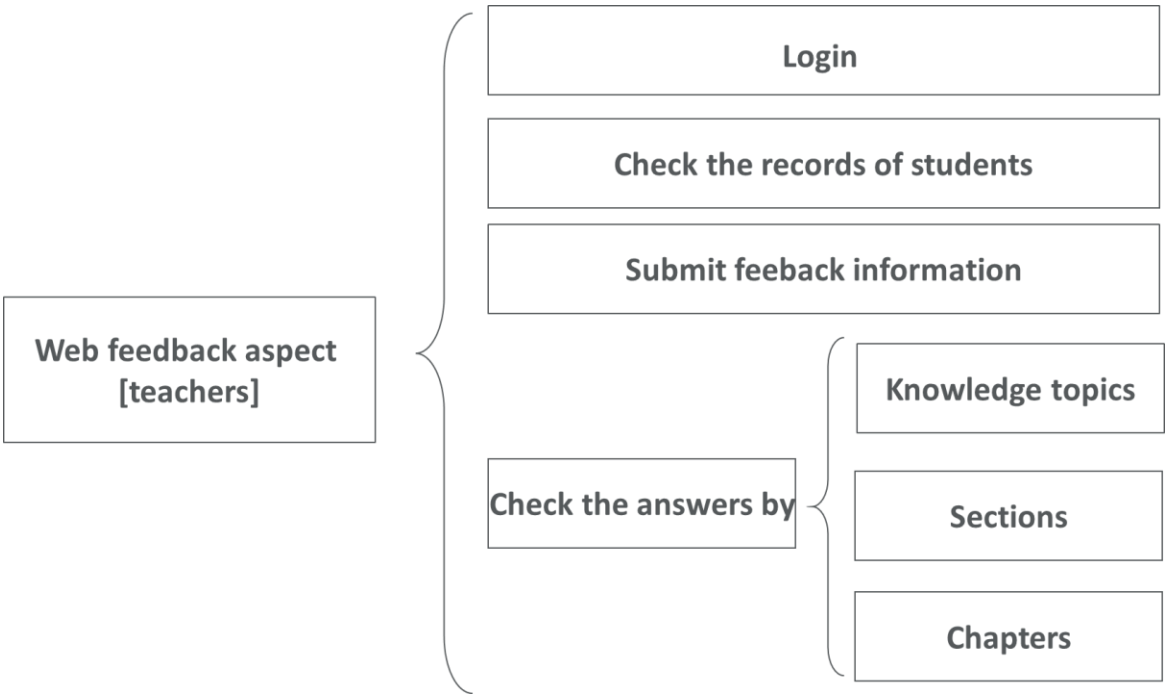


Figure 25 BUCT Teacher Web Feedback P2

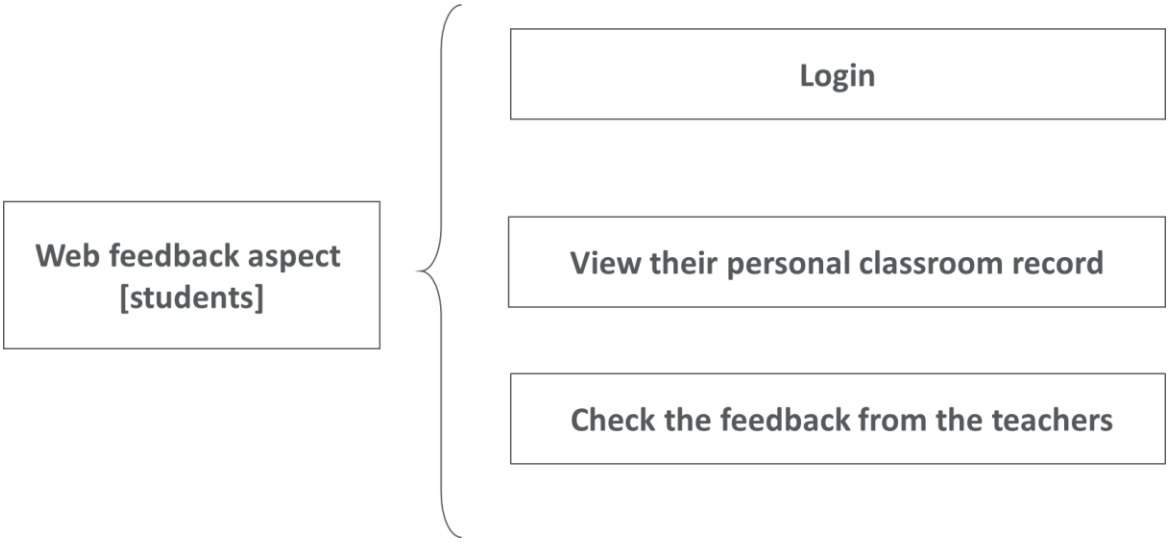


Figure 26 BUCT Student Web Feedback P2

Tools Used

The BUCT team used Eclipse as the main programing platform in the project as it was a familiar environment for the students. The main programing language for the project was Axure as it offered drag and drop placement, resizing, and formatting of widgets. This made it ideal for the rapid prototyping this project was working towards. In addition SQL was used in order to communicate with and use the schools database server and the students program.

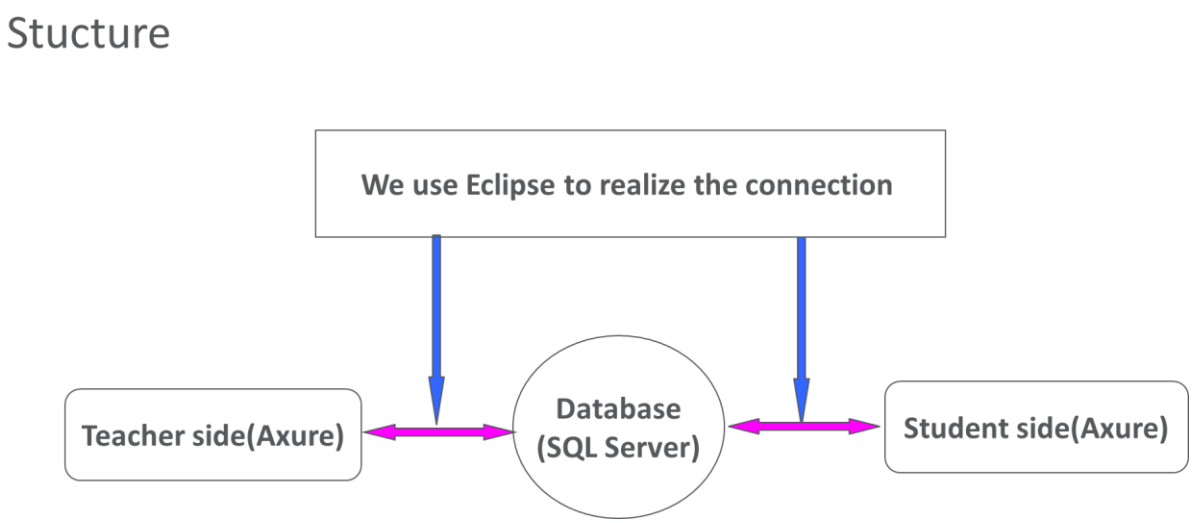


Figure 27 BUCT Structural Diagram of the programs communication centered on the database P2

Result

The BUCT team was able to successfully develop and produce a test version of their design. This final product is able to demonstrate the key points of the system but was not brought forward for classroom testing due to it being the end of the project timeframe.

The final software project with labels demonstrating the functionality.

Figure 28 BUCT Teacher Login P2

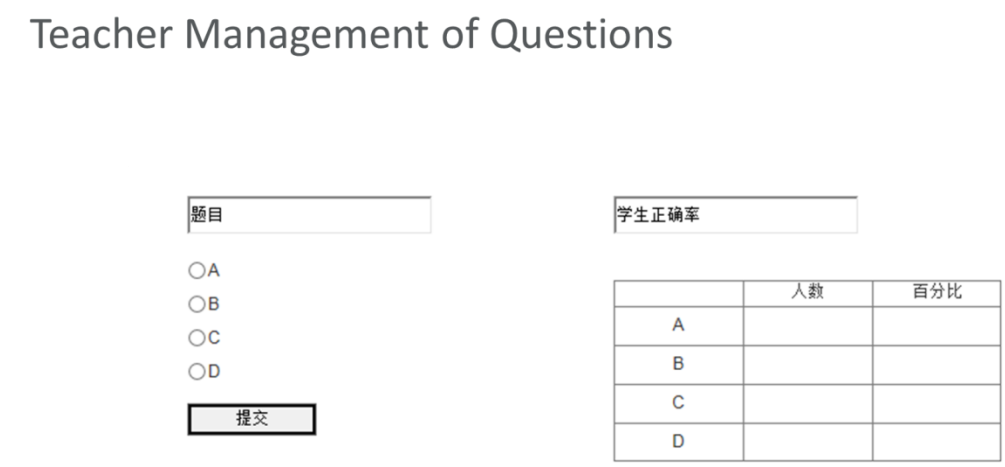


Figure 29 BUCT Teacher Question P2

Figure 30 BUCT Student Login P2

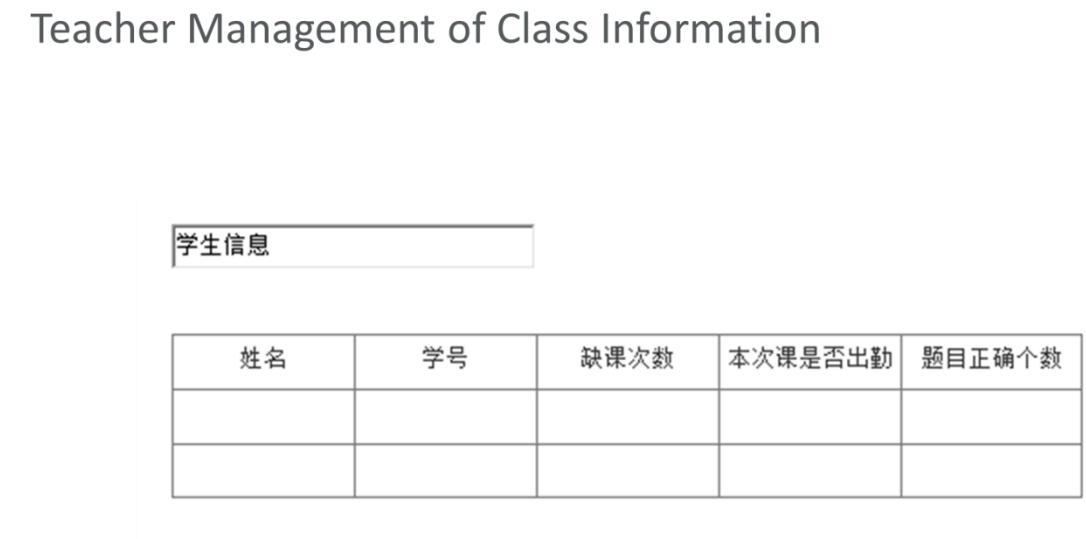


Figure 31 BUCT Teacher Information Management P2

Comparison BUCT Classroom Participation technology with WPI Classroom Participation Technology

Classroom participation technology is very important for teacher as assets to better understand their students. The BUCT project believes that this technology is very promising in its capabilities but it lacks the investment and commitment from the institution to make the system work. WPI has invested a great deal into making their system work. There needs to be enough systems to distribute them to enough teachers such that there would be a visible impact in the quality of teaching, teachers need to

be educated on the system and teachers needed time to adapt to the system to use it effectively. This kind of investment has not been made by BUCT and is most likely outside of their short term reach in money, time and resources let alone the need for pressure and guidance needed to counter the inevitable resistance from teacher who are not use to the system from the administration.

Focus Groups Studies

WPI Interviews

WPI Professor Cyr

Dr. Cyr always desired to become a professor in the engineering field; through her life experiences she knew she wanted to be the best professor. She completed her undergraduate career at the University of New Hampshire and graduated with a Mechanical Engineering major in 1982. She was always interested in experiencing and learning from many different teaching styles which lead her to seek to tutor other classmates. She expressed that she was very satisfied when they understood the material. She continued to work toward completing her master's academic career at the University of New Hampshire but she later decided to take a break for a year. After this year she decided to start calling up graduate schools and stumbled upon WPI. She finished her masters at WPI in 1987 and soon enough was offered a NASA fellowship grant to complete her PhD, her PhD was completed at WPI in 1997 soon after this she accepted a job position to work for Tufts University where she worked as the Director of Engineering Outreach Program.

She stumbled upon some WPI colleagues for lunch and her interest for WPI grew. In May of 2003 WPI offered her a position as an adjunct Professor in the mechanical engineering department and Director of K-12 outreach programs she accepted the position and has been working for WPI ever since. She is currently teaching Heat Transfer and is the executive director of science, technology, engineering,

and Math (STEM) education center at WPI. At her job for WPI she focuses upon making sure that the K-12 teachers and education leaders are well prepared to implement STEM curriculum in schools. She loves her teaching job; always focusing on incorporating different hands on learning experiences. She claims she has great passion for it because “I can teach however I want- add a research project, mix it up” (Cyr). She has a different learning theory in that she would rather have students know a few topics in depth rather than knowing a little about a wide variety of topics. The current research she is undertaking is in the STEM education and teacher learning field.

Analysis

The class we sat in on was a class taught by professor Cyr that was on the engineering science course ES 3003, which is a heat transfer course. The goal of this sit in was to analyze her flipped classroom setup. Once we began to observe the class, the students that were walking in had a sheet which they turned in. The professor was asking them if they had any questions or problems with the material as they handed in their papers and sat down. Some students responded with their questions about the material which were quickly answered in an open class discussion, professor Cyr answered all of their questions within a couple of minutes. She then moved on to the next topic and started to hand out sheets of paper with questions covering the material for the start of the class. It was noticed at this time that the teaching assistant was also walking around in the class helping students. The handout that professor Cyr had prepared had three sections to it. The sections of the handout imitated how a student should approach the problem. The first section covered the question in its entirety and contained another question grounded on general knowledge needed to answer the question. The second section asked for the equations needed to solve the problem. The final section had an area for calculation to solve the initial problem in its entirety with the two previous sections being on the same page to help in understanding of the question and completing the calculations.

From Cry's observed style of teaching during the handout we discerned her approach to teaching the class. At first she encouraged everyone to do the problem on their own to embed the students in the problem material. Then after a while she started to lead a discussion about the problem to get students talking with each other about the problem and the key learning topics. This then naturally led into a discussion about the steps that needed to be taken to answer the problem. This step by step approach to the problem was led by professor Cyr's with the occasional student jumping in to give the next step first. After a while she walked around with the TA answering questions the students still had on the question and the material being covered.

We also noticed many of the students were dynamically forming and working together on the problem. The students quickly retrieved a large amount of material on the subject the question was covering. This material included notes from before class, old class problem sheets that she had returned previously, chapters in the textbook covering similar material and many also had their laptop opened up to videos lectures. These lectures were seen as being rather short but dense with information, often students would work on the problem start to watch these videos then pause these videos and continue to work on the problem. Within thirty minutes of the class students started to turn in the problem sheet. Once they turned in the sheet they started to walk out leaving only those working on the problem for the professor and teaching assistant to focus on helping. After the class finished we had a personal interview with Professor Cyr during which we asked why her class is set up this way and what her teaching style and methods really meant to accomplish.

Personal Interview

After the class was finished we began the personal interview with professor Cyr. She started off by talking about why she decided to flip her classroom. She said teaching an engineering science course at the 3000 level like heat transfer it is a very difficult class. Still she noticed that there were too many

NR's [class requirement completion failures not recorded] in the system. She wanted to change that failure rate. To do this she looked into the technologies the ATC had to offer and with this available technology in mind decided that she wanted to flip her classroom in its entirety.

She stated that at first the students did not like the flipped class it or understand why the class was flipped or how that would really impact their learning experience. The way she decided to flip her classroom was to implement her flipped classroom teaching methods on Monday, Tuesdays, and Fridays. In professor Cyr's flipped classroom teaching methods students on the day before lecture need to go on to the MyWPI website (Blackboard) to watch and take notes on short videos that she makes herself for the class. These videos feature professor Cyr's lecturing on the material topics for that day's class. To ensure the students adequately paid attention and understood the material being taught to them during this lecture video after the end of the video they have to solve some problems based on the video. She also stated that all the problems she asks to solve are all problems she writes out by herself. She commented on this approach and said that by doing it this way it does not encourage the student to look up the answers anywhere and actually learn the material.

In response to our inquiry about the sheet the students turned in at the beginning of the class she said that it was these question that they had to complete from the online video lectures. She went on to say that she usually debriefs at the beginning of class by asking if they needed any help or have any questions. Then she proceeds to hand out another problem. This problem is very similar to the material they had just learned the night prior in her video way they are actually working out the problem and are able to be helped by herself, the TA, or other students in the class. She said she encourages these problems to be worked out without the help of others at first. However after a short period of time if they get stuck or see another classmate in need of help they are encouraged to give any help they want without solving the problem for the other student.

The way she has set up her classroom teaching method is for on the other days when she does not use her flipped classroom teaching method she is teaching the class in a different way. On Wednesday she conducts research with them and encourages them to see what is going on in the STEM field by encouraging them to look into articles, ongoing research and published work. Usually she will have a review with the students as well on Wednesday because every Thursday they have an exam. This exam covers up to that weeks the material to test what that they have learned. She said this is a very effective way to help student for the exam because then she can see what students did not fully grasp and she can later lecture on it or make a review sheet for later exams. She said that so far this set up that she has, has been very effective. She has seen an increase in grades as well as class participation in her classes she has taught using these flipped classroom teaching methods. Students have also reported that they have retained the knowledge from her classes she has taught in this way better than other classes.

(Cyr)

WPI Professor Putnam

Professor Putnam is a professor at WPI he received his BS from Lawrence University in 1974 and then proceeded to receive his MS at Penn State University in 1976. Before he taught at WPI he taught at Daniel Webster College in Nashua, NH where he taught for eight years. He then moved to WPI where he has currently taught for five years. At WPI the current research he is undergoing is in robotics and wireless communications. He is involved with FIRST Robotics where he is a parent, mentor, and team leader. He also partakes in FLL and FRC tournaments at the regional, state, and international level where he is a Judge. He takes great pleasure in being a professor at WPI and helping students start off their introduction to engineering courses and is always grateful to get students who come back and thank him. On his free time he takes part in scuba diving, underwater photography, and has been brewing his own beer for eight years.

Personal Interview

At WPI his favored teaching style is focused mostly on the traditional lecture style he likes to be very interactive with his class he does it as much as possible. The way he chooses to interact with his class is by using Turning Point (clickers) in order to engage the student, help him understand how the class is doing with the material taught, and to administer and partially grade quizzes. He also uses multimedia (videos, etc.) when it is possible. He is a professor at WPI that has set up hands on experience encouraged by team based labs as well as term-long projects where the students are involved in building robots or robot-related subsystems.

What has helped him in being able to make his class as interactive as possible is the available technology at WPI. Some WPI teaching assets that he uses are Blackboard, Camtasia which in his experience is better that echo 360 and Turning Point that is used for quick polls in the lecture as well as for administrating weekly self-paced quizzes in some courses. He uses black board very often and he has found himself using it in every lecture. He mostly uses it to manage lectures and related content such as labs, videos, other reference resources, and posting grades in the grade book. His experience with Blackboard (BB) is that it has never gave him any problems he has not fully explored BB to its full content so there is some functions with BB he has not been able to explore. Some aspects that he dislikes is the UI where it is annoying because he cannot select and mark multiple objects with one command, it needs to be done individually which is more time consuming. In regards to echo 360 he used it this past winter (2015) due to the school having many snow days where school was cancelled. In his opinion it was easy to install and get a recording but he found that the video editing capabilities were quite limited. He decided to contact the ATC (Academic Technology Center). He decided to ask about using another resource Camtasia which has the similar uses as echo 360, to no surprise the ATC had it. In his opinion it has a longer learning curve but is a much better tool. He uses turning point in most of his courses. The main reason for his use of turning point is to enhance student engagement in lectures,

also uses it for “on-the-fly” polls in lecture to gauge students’ understanding of various lecture topics. This has helped him greatly because from the information he collects he is able to determine whether or not he needs to spend more time on a topic or he can move on. He uses the clickers to administer and partially grade weekly quizzes but he does not use turning point for all his weekly quizzes. We asked him his opinion on the ATC he said he favorably enjoys it but he said there are restrictions to content he would like to use such as apps that he would like to run but he cannot because of how the network is organized be says he knows the ATC is not responsible but it is an aspect that he can find annoying sometimes. But he has found them to be very helpful when he has had issues with the podium computer, and question about or problem with BB or TP. One of his concerns was that the podium computers are starting to get old with time which is making them run more slow and lethargic. He hopes they will be changed soon but other than that he is very happy with the teaching assets that are available to him as a professor at WPI.

When asked about changing anything about his classes he said he is always looking for more interaction and a better way to deliver course information/material. A current technology he has looked into purchasing is a digital oscilloscope (DSO) that will allow him to easily bring lectures that are related to programming / signal processing / etc. The concept behind it is that he can project the DSO display onto the screen so everyone can see what is going on in real-time. He said he has not looked into flipping his classroom or introduced such idea as blended learning but he would definitely be interested in doing this or looking into it. He seems to be a professor with quite a bit of humor as he ended his interview in our flipped classroom chat by saying “I once flipped myself over backwards in a desk chair while trying to demonstrate the concept of gimbal lock (a singularity condition) in a robotics class. I’m sure that was a pretty memorable lecture for the students – I know it was for me!”(Putnam).

(Putnam)

BUCT Interviews

BUCT Professor Tao Xia

The advisor for the BUCT projects that included of the web expansion forum and improving classroom participation was ran by Professor Xiatao. The IQP team has been working with his students in his lab and he has helped us with any questions we have. Professor Xia graduated from BUCT with his PhD in 2003. From there he accepted a job at a very well-known factory in Beijing called Simens. He worked at the factory for a total of 3 years. After a spam of three years he knew that working at the factory was not something he enjoyed or wanted to continue doing. He decided to go back to BUCT and at first was a TA for one of his favorite professors at BUCT he found himself enjoying teaching the students so he decided to ask if he could be a professor at BUCT. BUCT approved his demand within a year he was working at BUCT as a programming professor. He has been teaching only at BUCT for a total of 9 years. At BUCT he teaches any type of programming classes from C Programming, to matlab, to java, and mysql. He said he teaches once a week about 128 hours a year per term.

Personal Interview Professor Tao Xia

We asked how does he set up his classes and he said it is mostly based on homework assignments he said he likes to set up his class that way because when teaching programming classes the students need to understand that the only way they can master or understand programming is by practicing it every day so by him assigning homework every day they are encouraged to practice it. He said that the only available technology he can use in his classrooms are power point presentations and a projector he says he will usually bring his own laptop and adapter so he can be able to project it to the whole class. He said he also makes all the students bring their laptops to class so they can open up the programming language they are using and practice it in front of him along with his help. The way he assigns homework, quizzes, and exams is through his own website that he created. He said that he does

not enjoy the class portal it is very hard to navigate and if the students want to submit programming homework it is not possible. But he said that though the website he created it makes it easier for him to upload content and look over homework submissions it is hard to keep up with the maintenance of it when he has so many other commitments. He said along with teaching classes he is always available in his lab and students are encouraged to go sit there and do work. Current research that he is working on is the expansion of the class portal that BUCT uses. He was also the project advisor for the web expansion team at BUCT.

He said that even though the web expansion team could not finish their project he will try to finish it for them because he wants them to see the final code. We asked him if he would change anything about his classes at BUCT and he said he would change everything. We asked him why and he said he does not like teaching here he said the classrooms are too small and he has to bring everything in order to fully teach his classes. He said that one of the most annoying things he has had to face with at BUCT is the online resources they use for email and homework. He desires it to be completely different that is why he picked up the job to help BUCT make it better and have all the things a professor would like to see. He said in regards to how the classes are set up he said that the BUCT professors have been discussing this for a while and BUCT is awaiting a grant that will help them buy technology resources and help them remodeled some of the classrooms at BUCT.

(Xia)

BUCT Professor Anonymous

This professor teaching at BUCT requested that they would remain anonymous such that they could not be uniquely identified in the interview. For the purposes of this interview the professor will be

referenced to as professor Zen. Professor Zen has taught at seven major Chinese universities, including BUCT, as well as at several American universities. Zen has been teaching students from the undergraduate to post graduate level for over ten years in China alone.

Personal Interview

Professor Zen prefers to teach small groups of students, usually less that fifteen at a time. In these small groups Zen prefers to conduct seminars and discussions to engage the class. Zen does this so that the students can better teach themselves the material through active participation. However Zen commented that many classrooms are not able to accommodate this teaching style. This is due to the chairs being bolted down or the classroom being set up in such a way as to prevent the movement of the class furniture. Zen sees this as a big issue especially prevalent with institutions in China and in particular famous Chinese research institutions. This is because these institutions have large class sizes that are not conducive to discussions or have lecture settings to bring in visiting professors who cannot or prefer to not hold discussions with the class. In addition in China the students have been brought up to "think there is a right answer". This "right answer" mentality makes discussions and seminars particularly difficult for Chinese students as they want the teacher to tell them the correct way of thinking rather than discovering a way of thinking about the problem themselves. Zen continued to say that this was the largest of a set of problems that included the inability of many students to speak clearly and audibly to an audience and the inability for some students to bring substance to the argument.

Zen has used various technologies throughout the more than ten years of teaching. However in China Zen commented that it is rare not to find fault with the technology or support that was provided. When asked to talk further about the support available Zen said "Huhhhhhh. Problematic, a few geeks that are good, no professional faculty or few" (Anonymous) One example of this is of Zen's experience

trying to get a classroom with a working projector, computer and internet connection. Zen was moved six times while attempting to teach a class that required these resources at one point the projectors color bulb exploded but Zen could not get a hold of anyone who could fix it. Furthermore the support Zen received when trying to fix issues within the classroom always became a communication and bureaucratic nightmare. Most of the staff would simply redirect the question to other staff member and this usually did not end until someone being out of the office was found being the only one who could have helped. Zen commented that most of the online systems available for teachers in the institutions are confusing or impractical to use. This was because either the internet in that area was too slow and unreliable or the system itself was not supported enough to answer questions on how to use the system. Zen said that the only online system that was workable was provided by an American institution for the class. Zen's best review about the IT staff was of a student working for the department who was at the very least eager to help. Despite these difficulties Zen has had some success in the past by using videos sources outside of the classroom for students to watch. Zen mainly sources video content from CCTV.

When we were discussing our project with Zen the issue of intellectual property was brought up. This was directed at the owners of the online content used to teach students as Zen believed that this work should be the property of the teacher not the institution. This is a very important problem in the debate over blended learning however we were unable to sufficiently answer Zen's inquiry about this problem due to the scope of the project.

(Anonymous)

Interview Conclusion

WPI

After completing our interviews with the WPI professors we know that they appreciate all the available technology assets that WPI provides them with. Also we know that many teachers at WPI are aware of flipped classroom teaching and are interested in looking into it. We also know that many professors at WPI without even realizing it have introduced some aspects of blended learning to their curriculum. Many are interested in completely flipping their classrooms which is great in that flipped classrooms could be a more prevalent impact the students learning outcome in the future.

BUCT

After we concluded our interviews at BUCT we have learned great deal of important things. One is that BUCT professors do not have any type of technology assistance when it comes to teaching their classrooms. This is something the institution as a whole has found annoying because they want to be able to freely teach their classes without any hassle. After being here for a the project we know that is a major concern of theirs but since the school is funded by the ministry of education they think it will be hard to get the necessary funding to change this. However BUCT is currently undergoing a review to accept a grant for the purpose of remodeling the older buildings on campus which is greatly needed and might begin to address the issue aforementioned. But it cannot be stressed enough that they understand that some type of learning management system needs to be introduced to their curriculum to help them with technology and improving their learning environment.

Survey

Surveys are our largest data point asset in this project for evaluating the use and general opinions about the teaching assets at each university. However due to the time frame being very limited

for the deployment of the survey, the exceptionally low expected response rate due to the survey being over the summer months and being without a reward the data collected is expected to not be precise. One of the biggest issues is that due to the low number of students expected to respond and the fact that a response in itself will have bias the data cannot be viewed independently to draw conclusions from. This means we will not be using this data independently to give an opinion from the entire institution. It is also expected that students who know of and have used the technology mentioned in the surveys will be more likely to submit the surveys than those who don't. Knowing the issues the surveys have all of the aforementioned issues have been taken into account to the best of our abilities when evaluating the surveys.

WPI Survey

Two surveys were developed for WPI one for the teaching staff and one for the students. This was done so that we could construct more specialized questions that reflected the expected experience with the teaching assets that these groups would have had. Both surveys were constructed and carried out in such a way as the identity of the participant would not be revealed to the IQP team and no uniquely identifying information could be collected from the answers. This was done to protect the participants and to better adhere to the regulations about surveys.

To create the student survey we requested information about how much they knew about flipped classrooms, their major and their status as a student. This was done to help identify different groups within the WPI population. Students who had been at WPI longer were expected to have more knowledge about the teaching assets and students in certain majors were expected to have more exposure to teachers who used these assets. We then asked about their experience as a student including the types of classes they had attended and asked them to rank the different assets by their usability and effectiveness. For the teacher survey we expected to find different groups within the

population depending on department. We requested information about the teachers teaching experience during their career and during their time at WPI as well as the types of classes they had taught. This was done to help identify these different groups within the teacher population. We then asked them about their experience as a teacher with the assets at WPI that our project was interested in and asked them to rank the different assets by their usability and effectiveness. Due to the team being in China the survey was conducted through an online survey website.

The response rate for both of these surveys was expectedly low. There were less than 40 participants for each survey. This low response rate makes these surveys unreliable by themselves. We had to account for a much higher variation in the data than what we would have liked. We also had to account for the response bas of participant as we contacted many ourselves and asked for them to take the survey rather than just sending a general email to the student body. This way of conducting the survey however helped remove some of the normally experienced response bias by increasing the number of participants who might not have otherwise answered the survey.

Student Survey Result

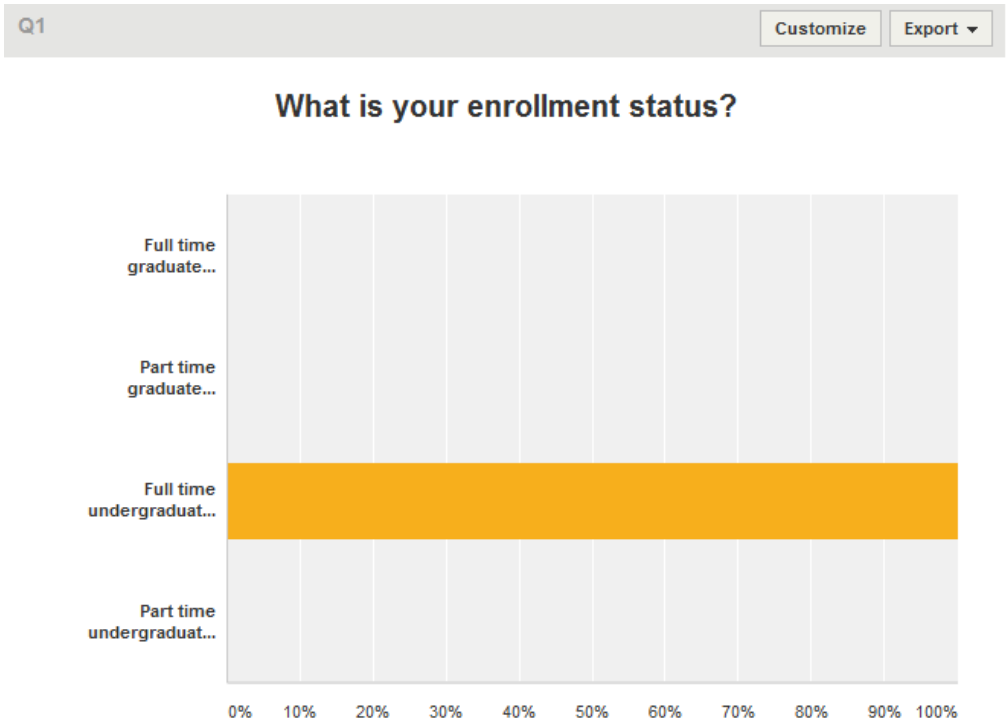


Figure 32 WPI Student Status

Question 1: What is your status as a student?

All of our responses we were able to collect were full time undergraduate students. This creates an issue as we cannot account for the graduate population that usually has a larger impact on the administration than the undergraduate population. It also meant that our survey would better represent teaching than research as our respondents would all mostly have experience with knowing how classes are taught at WPI through their experience in the classes.

Figure 33 WPI Student Major

Question 2: Asked the students what is your major?

Many of the respondents we had consisted of IE, chemical engineering, Mechanical engineering, biomedical engineering, and robotics engineering. This has a lot of good variation and helped us by not causing any unusual skew in our data.

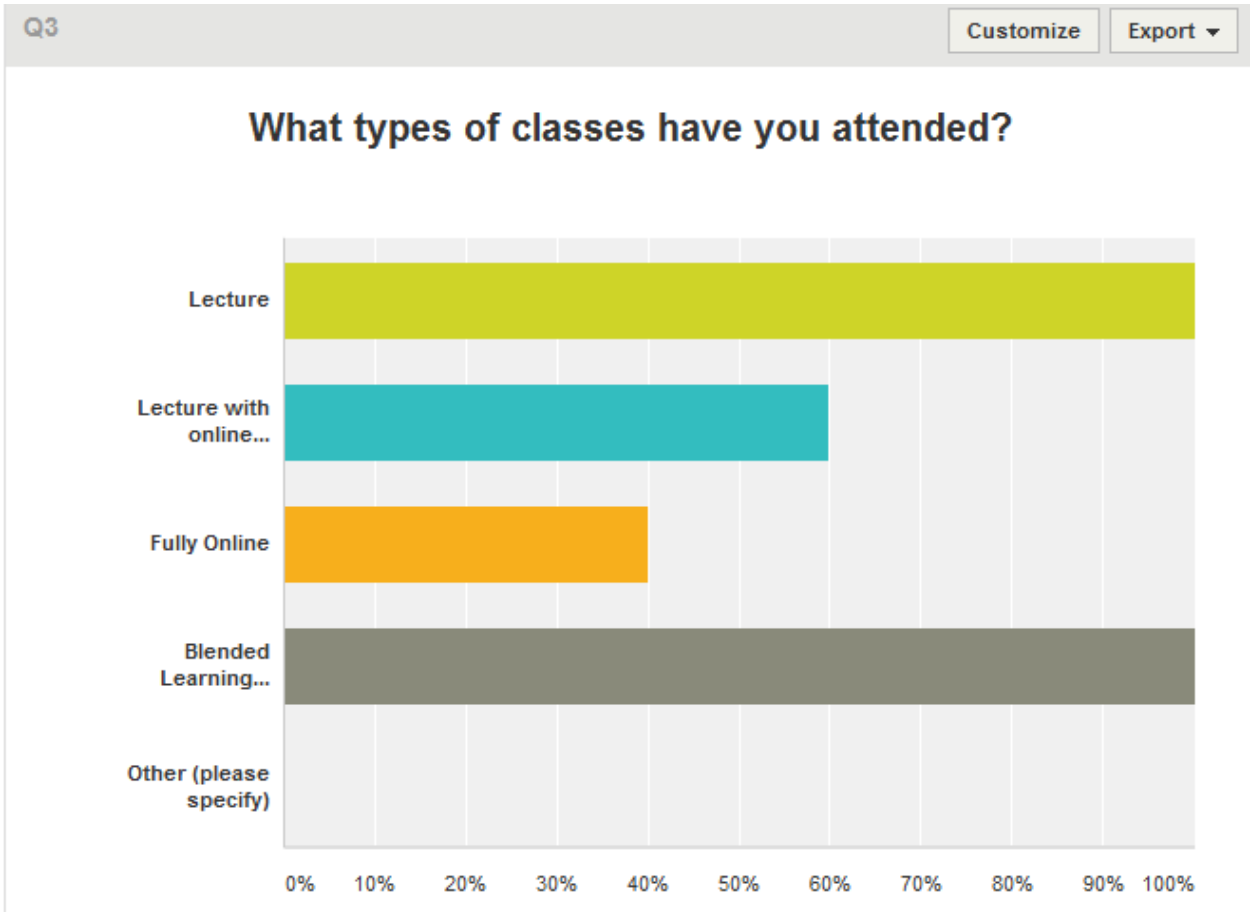


Figure 34 WPI Student Class

Question3: What types of classes have you attended?

The majority of the people that answered responded that they had lecture based classes and blended learning classes. This is great because it shows that many of the teaching professors at WPI are using blended learning in their classrooms. It also indirectly shows that those who responded to our survey are knowledgeable about blended learning by the low non-response count indicating that the respondents knew about blended learning. This is important as it suggests that student at WPI are educated about emerging teaching techniques.

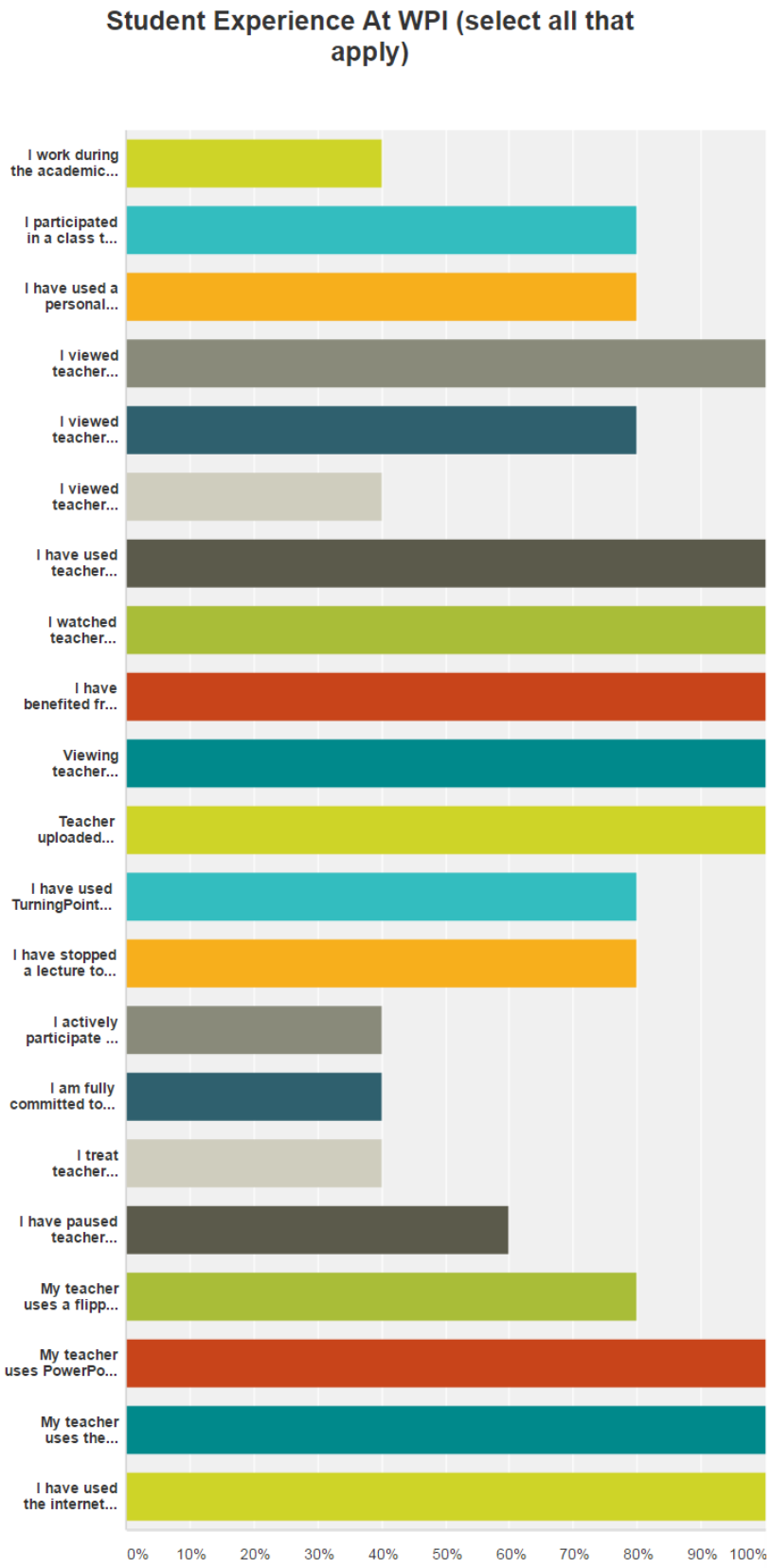


Figure 35 WPI Student Experience

Question4: We asked their experience as a student at WPI.

The reason why we asked this was because we wanted to know more about the students to identify any unexpected groups and to form a picture of how students get resources and information both in and outside of the classroom. From this we found that there were no unexpected groups. We also found that technology is more prevalent in the classroom than we originally thought. The amount of students who had experienced flipped classrooms was also unexpectedly high and could indicate that there is a broader understanding of a flipped classroom that what this project is using. Students also reported that they almost universally benefited from the technology in the classroom, search the internet for answers and have used uploaded content to learn the material outside of lecture.

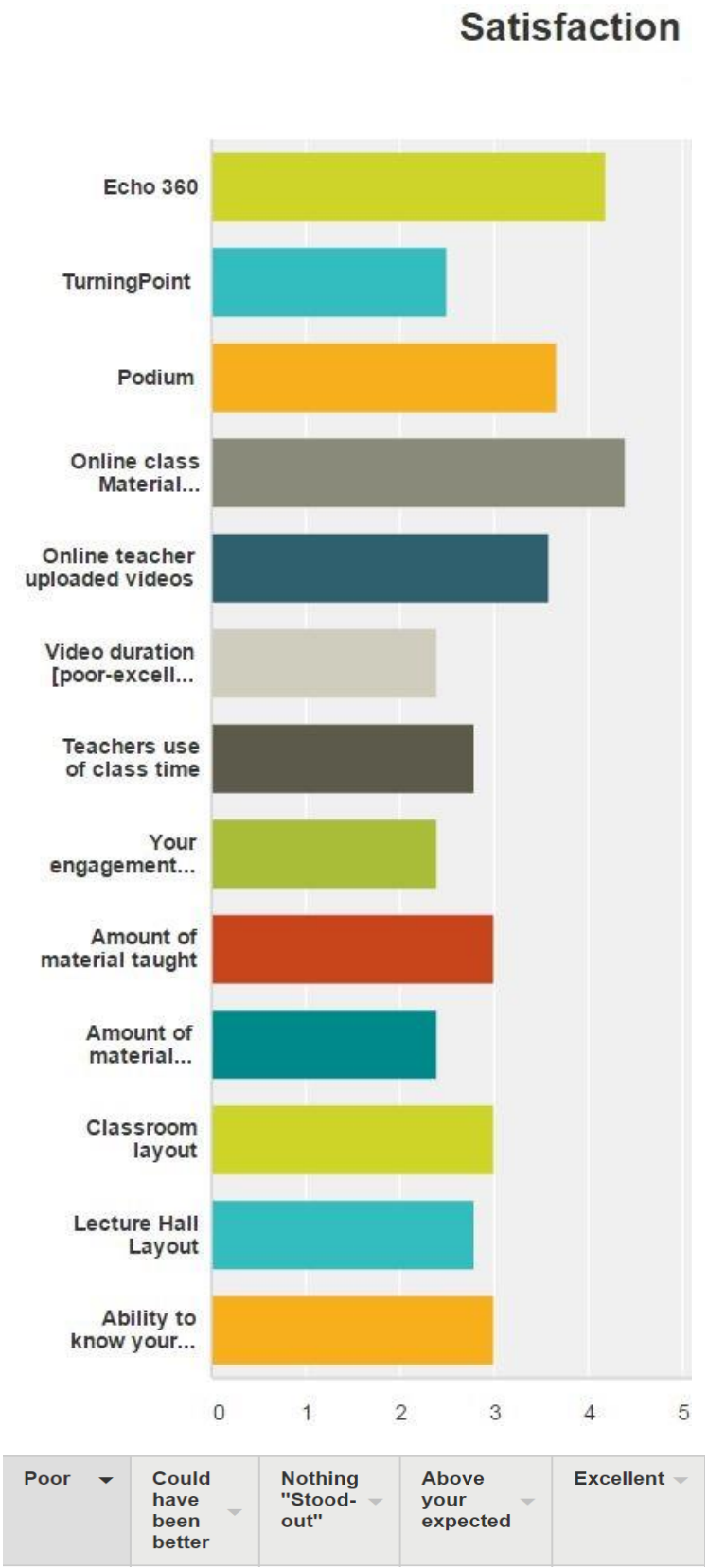


Figure 36 WPI Student Satsifaction 1-5 scale

Question 5: Asked the level of satisfaction about teaching technology and other resources.

Most of the assets given scored decently but out of them the uploaded teaching content and assets related to online learning scored the highest on average. This shows that the students believe that there could be some improvement with how classes are held at WPI and how resources are used but that they are content with the resources available now. This important because it shows there is interest for better teaching methods at least among the student body.

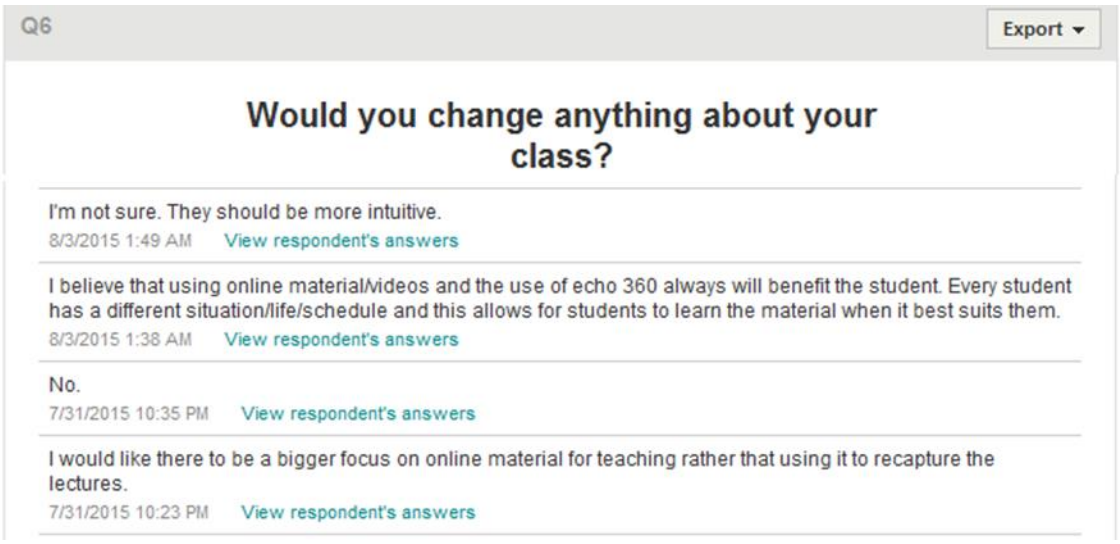


Figure 37 WPI Student Class Changes

Question 6: Would you change anything about your class?

Many students said no but a number of them wanted more online accessibility to materials. And yet others wanted professors to change the way they taught classes. This reflects the belief that there could be a lot of improvement with how classes are held at WPI and how resources are used.

Survey Conclusion from Students

After we finished our survey on the students from WPI we can support our claim that almost all of the WPI students are using the resources available both online and in class. We also can say that students generally enjoy and appreciate these resources. This indicates that WPI is beyond the first step for the school to be interested in professors flipping their classrooms. This is because many of the

students expressed that their professor is already using blended learning and the technology available in their teaching method.

WPI Professor Survey

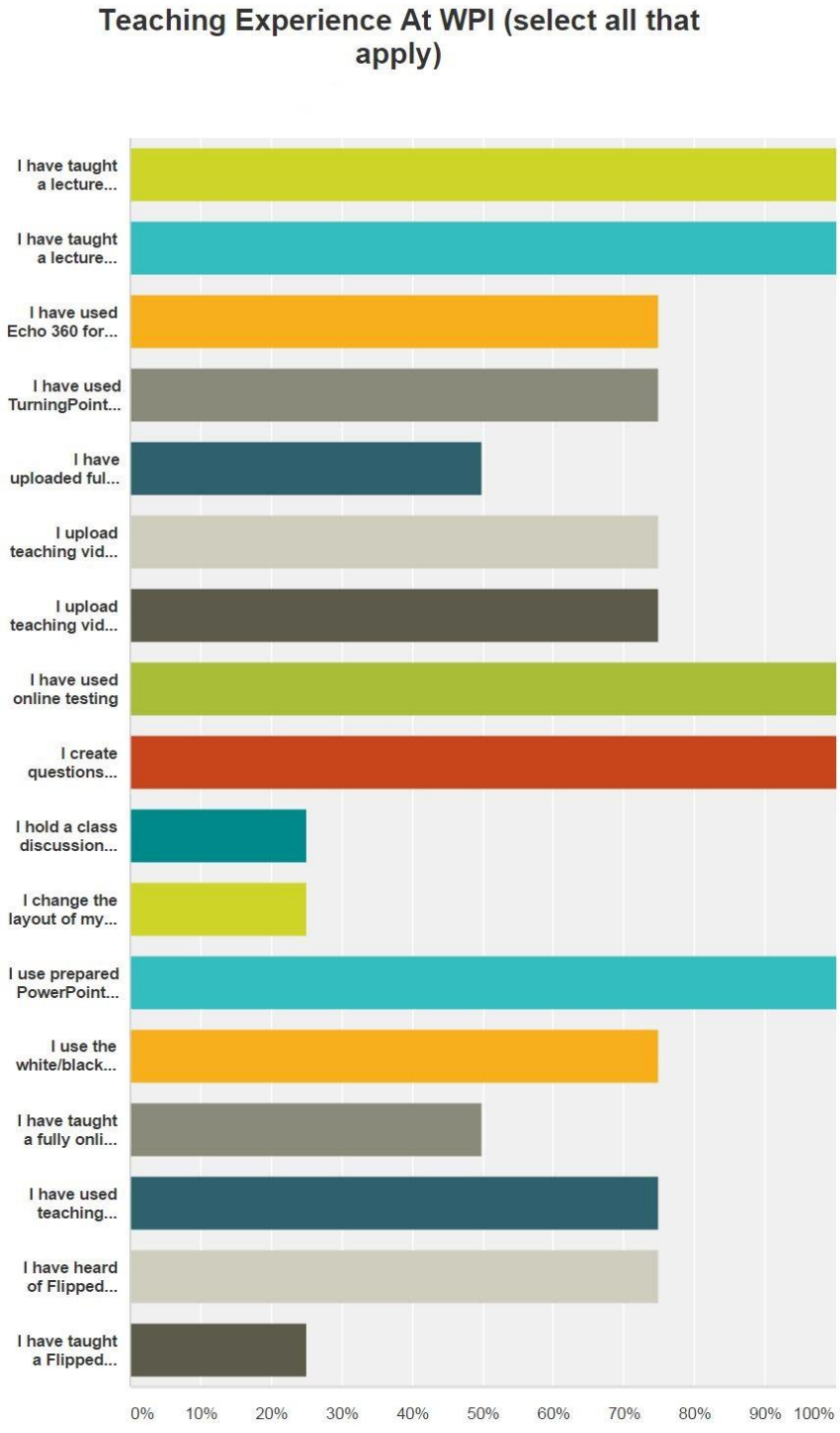


Figure 38 WPI Teaching Experience

Question 1: Asked about the teaching experience at WPI from professors and what resources they use. We can say that most of the respondents have heard of flipped classroom teaching, use lecture formats, online testing, like to create questions themselves, use PowerPoint and still use the black / white boards to teach. Some have taught fully online classes and only a few have taught fully flipped classrooms. Most of the teachers also have used a large number of the resources available at WPI as well.

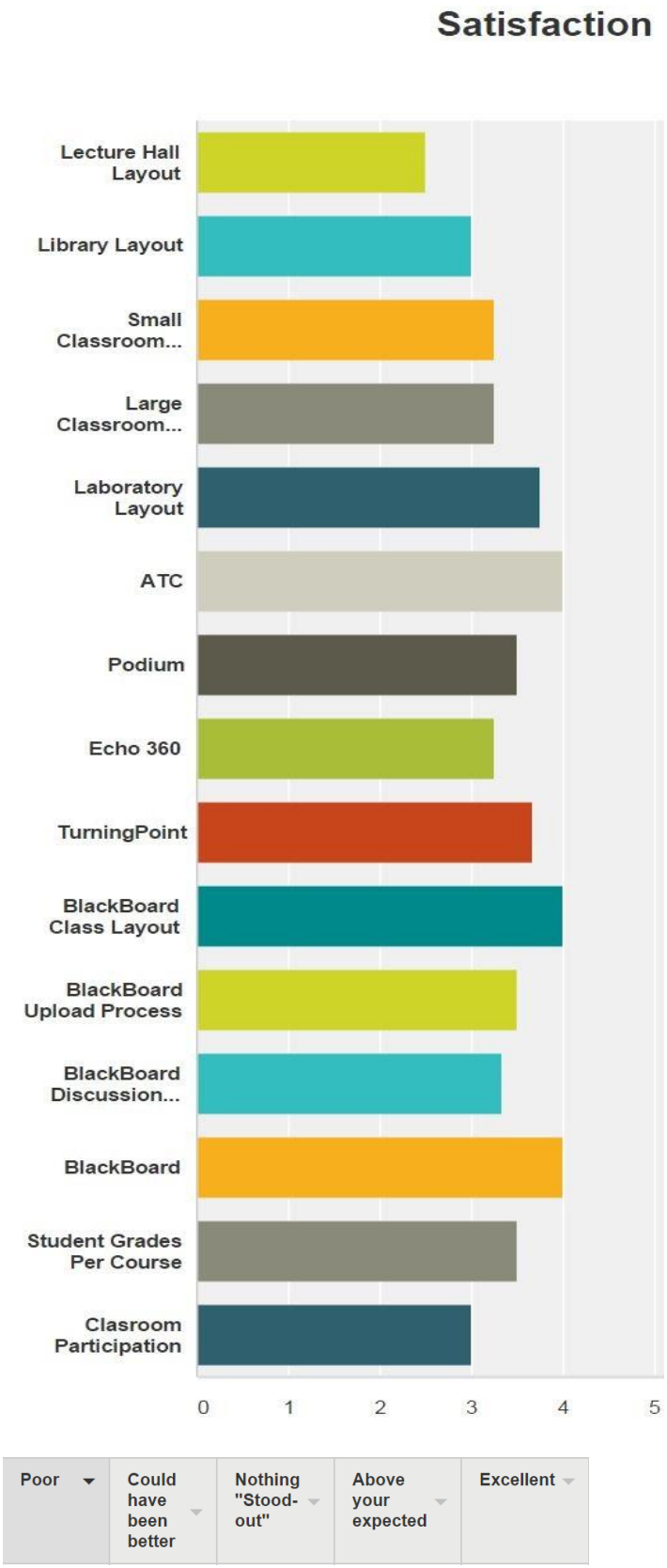


Figure 39 WPI Teacher Satisfaction 1-5 scale

Question 2: Asked for the level of satisfaction relating to resources they have used.

The teachers had a better satisfaction rate than the students. It was interesting to note that Blackboard and related resources scored the highest. This shows the return on investment from WPI's focus on teaching resource.

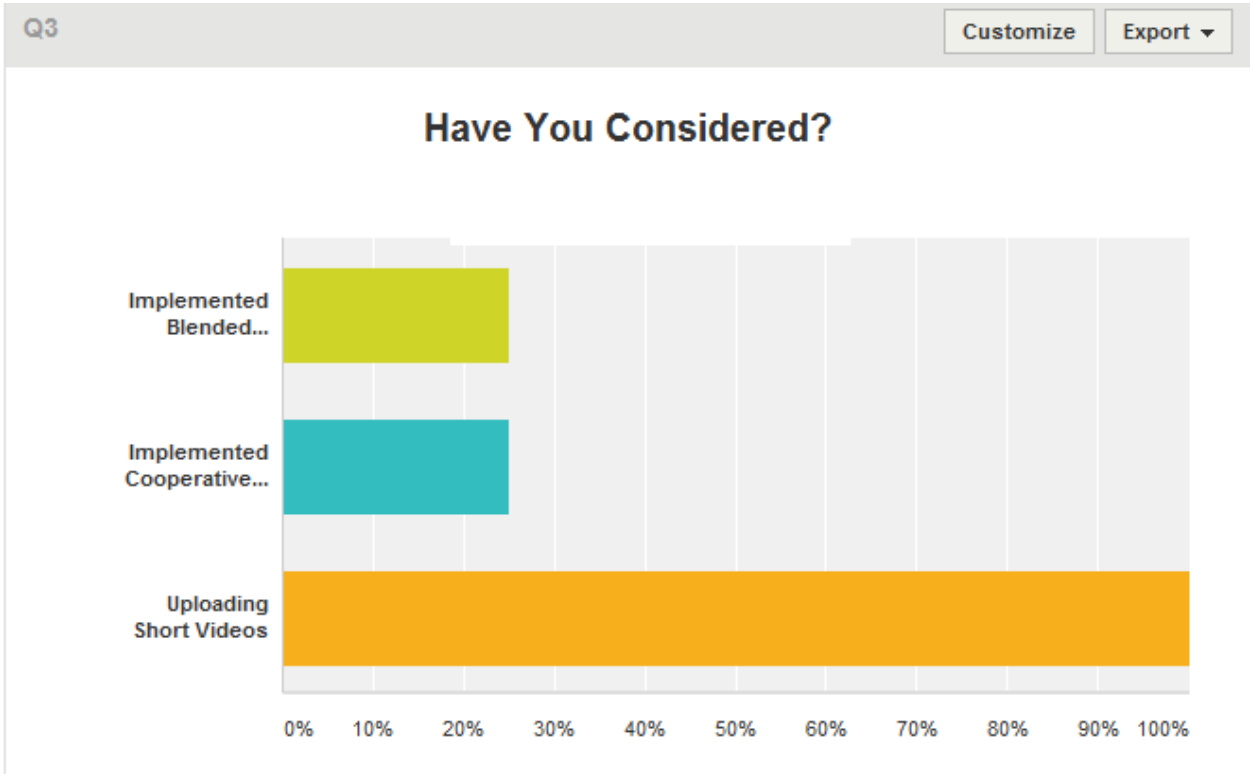


Figure 40 WPI Teacher Ideas

Question 3: Asked if they had considered implemented learning, implemented cooperative, and uploading short videos.

Many were on board with uploading short videos which is great to hear as this is a start to introducing more usable blended learning content into the classrooms.

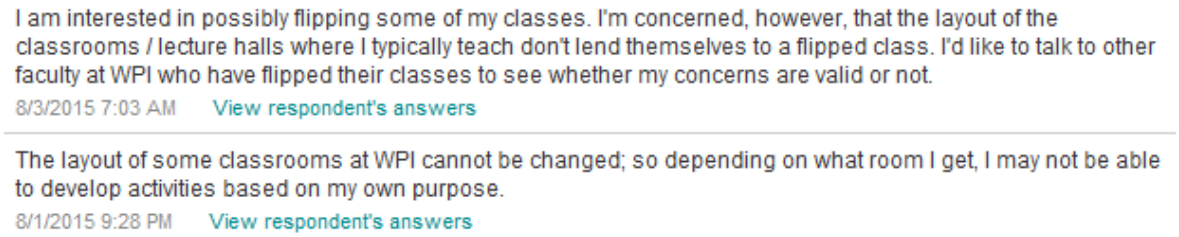


Figure 41 WPI Teacher Class Changes

Question 4: Asked the professors if they would change anything about their class.

Some said they were interested into looking into a flipped classroom setting but only for some of their classes. Many were concerned about the layout of classes as it is not at this time a layout designed with flipped classroom teaching in mind.

Professor Survey Conclusion

After the survey was done we know that WPI is up to date with a lot of technological resources that help teachers improve the way they teach a class. But many were unhappy with classroom layouts at WPI. This indicates that WPI should now focus on classroom layouts as it seems to be a big barrier for professors to start implementing a flipped classroom set up than anything else surveyed.

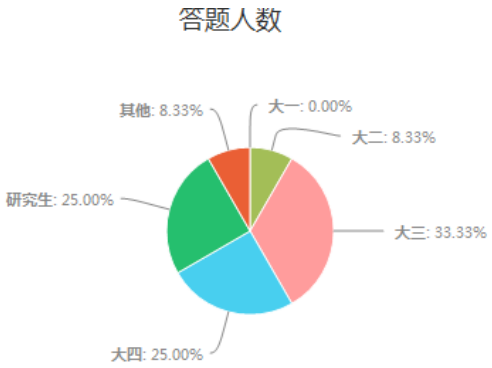
BUCT Survey

We were only able to conduct one survey at BUCT because most of the teaching staff had left for summer vacation however there were still plenty of students. This survey was done so we could gauge interest from BUCT about other teaching methods and changes to the campus. The survey was constructed and conducted in such a way as the identity of the participant would not be revealed to the IQP team and no uniquely identifying information could be collected from the answers. To create the student survey we requested information about how much they knew about flipped classrooms, their major and their status as a student. This was done to help identify different groups within the BUCT population.

It was very difficult to conduct the survey because there was no big mass email alias that we could send the survey to because such things do not exist in the university. Because of the lack of a mass email alias we were given two feasible options to send the survey to the student body. These two options were to actively go around the BUCT campus and try to get students to answer our surveys and to send out a Wechat survey to individuals our Chinese partners knew. The surveys also had to be written in Chinese so that the students could be able to answer the survey. We tried the first option this for two days focusing our efforts around the period with the most traffic around lunch time both before and after but we were not successful. During our attempt we did notice a range of reactions to our attempt; some maybe thought the surveys were flyers and would just take them and walk away, we got no responses from these people. Many more however did not even pay attention and pretended we were not there and would just walk by. After two days of this we knew this would not be a very efficient way to answer our surveys.

Therefore we decided to peruse the second option as it was advised by one of our Chinese partners. The other way we could get student responses was to send the survey through an attached link. This link would take them to an online survey. This new survey was planned to be distributed through Wechat (a very popular app used in china to message). Our Chinese partner headed this online survey. Once she finished this new survey she sent it to all her friends/contacts on Wechat. After this we waited over a week to accumulate responses. The number of respondent's we got was less than twenty. Although this is not a lot of students it was much more than what we could have gotten through the other method.

Result

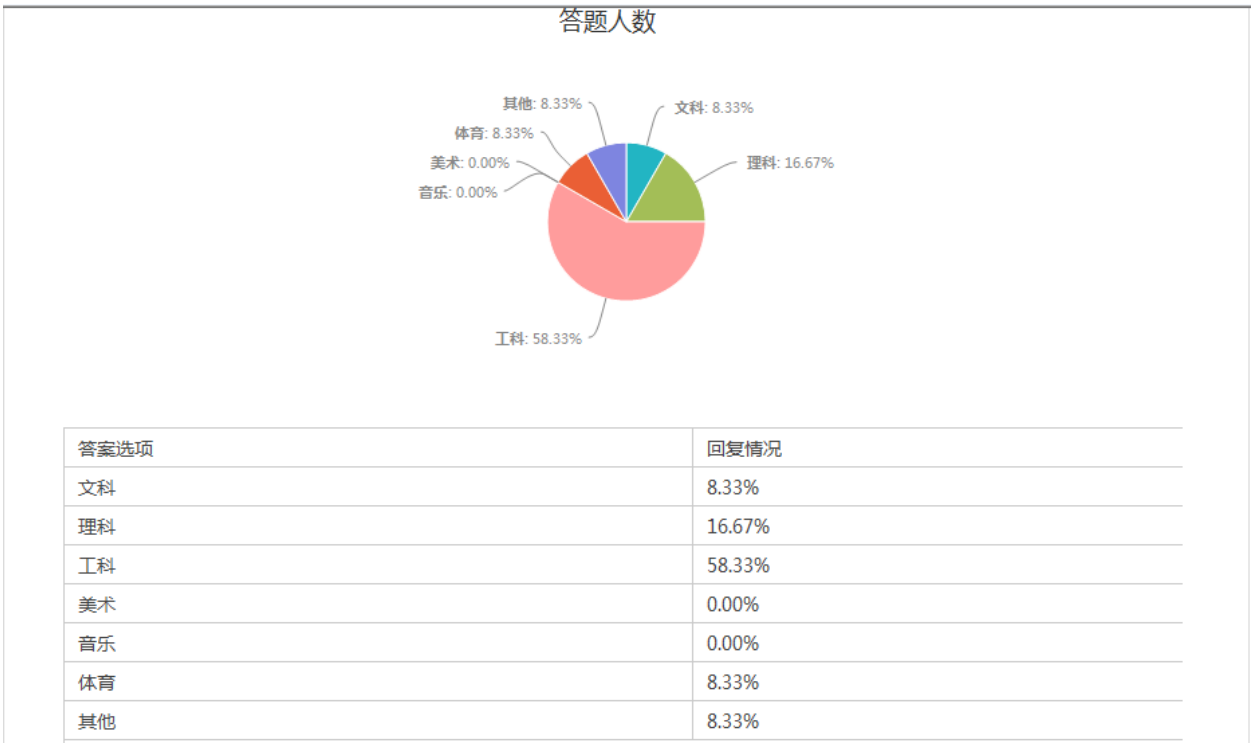


答案选项	回复情况
大一	0.00%
大二	8.33%
大三	33.33%
大四	25.00%
研究生	25.00%
其他	8.33%

Figure 42 BUCT Student Status

Question 1: What is current class level?

We had 0% respondents from the freshman class, we had 8.33% of sophomores answer the survey, 33.33% were juniors, 25% were seniors, and 25% were graduate students. From this we can say that the majority of people are upper classmen and from this we can say that the group surveyed is experienced in the way BUCT operates.

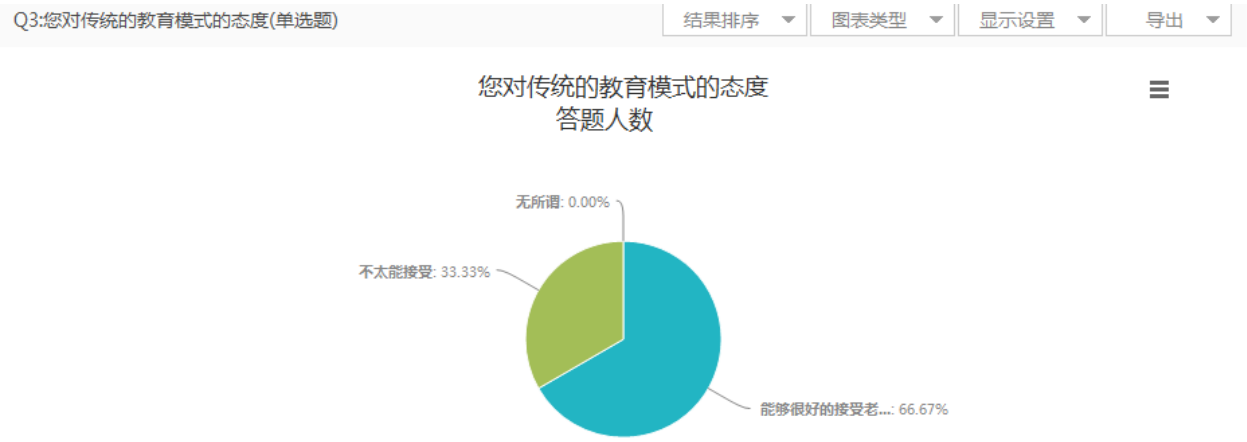


答案选项	回复情况
文科	8.33%
理科	16.67%
工科	58.33%
美术	0.00%
音乐	0.00%
体育	8.33%
其他	8.33%

Figure 43 BUCT Student Major

Question 2: What is your major?

Language Arts about 8.33%, math majors are consisted of 16.67%, science majors consisted of 58.33%, engineering majors 58.33% and there were 0 correspondents who answered who are performing arts, music, language and other. This was expected as it is representative of what this school teaching focuses on. However this distribution shows us we will not be able to represent majors outside of science and engineering reliably.

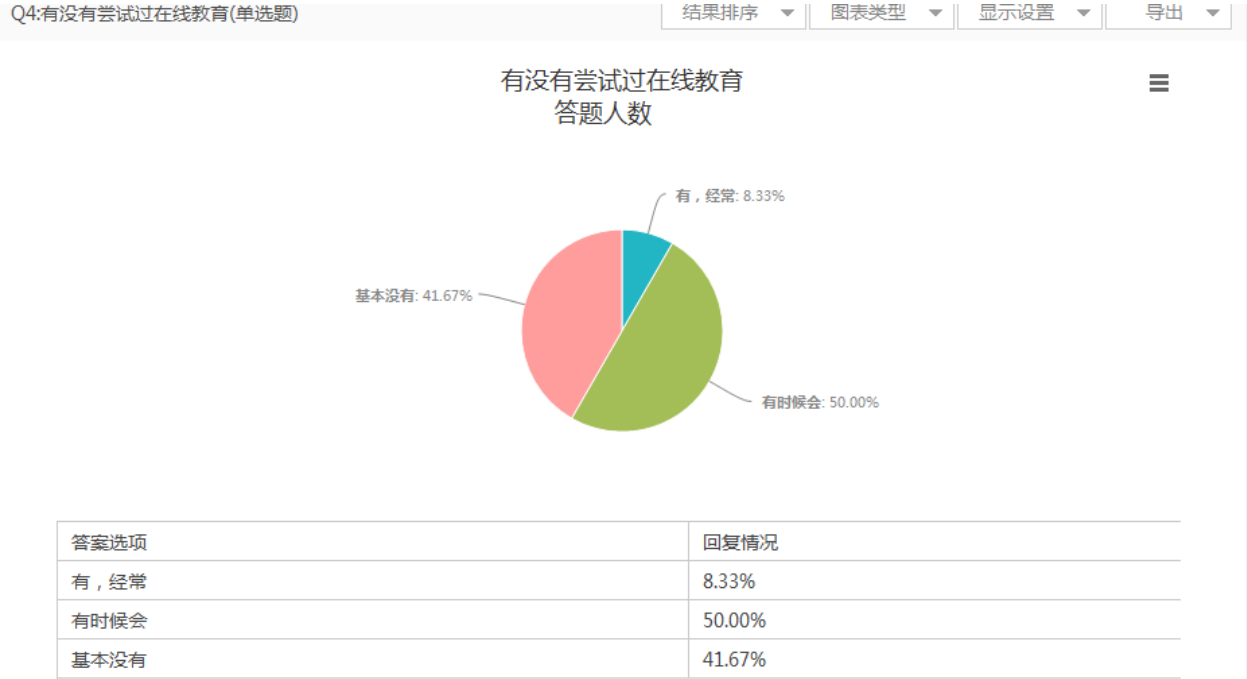


答案选项	回复情况
能够很好的接受老师教授的知识	66.67%
不太能接受	33.33%
无所谓	0.00%

Figure 44 BUCT Student Evaluation of Class

Question 3: What do you think of the traditional class lecture?

66.67% said they enjoy it and 33.33% said they did not like it. This amount of responses saying that they did not like the traditional lecture classes is significant. It shows that there is room for improvement in the traditional lectures.



答案选项	回复情况
有，经常	8.33%
有时候会	50.00%
基本没有	41.67%

Figure 45 BUCT Student Use of Online Class

Question 4: Asked if they had tried online classes?

8.33% use it frequently, 50% said that they use it sometimes, and 41.67% said no. This is a good distribution and show that the online classroom is being used and it is significant part of student learning. However due to the wording BUCT cannot be seen as the cause for this significant use of online classes.

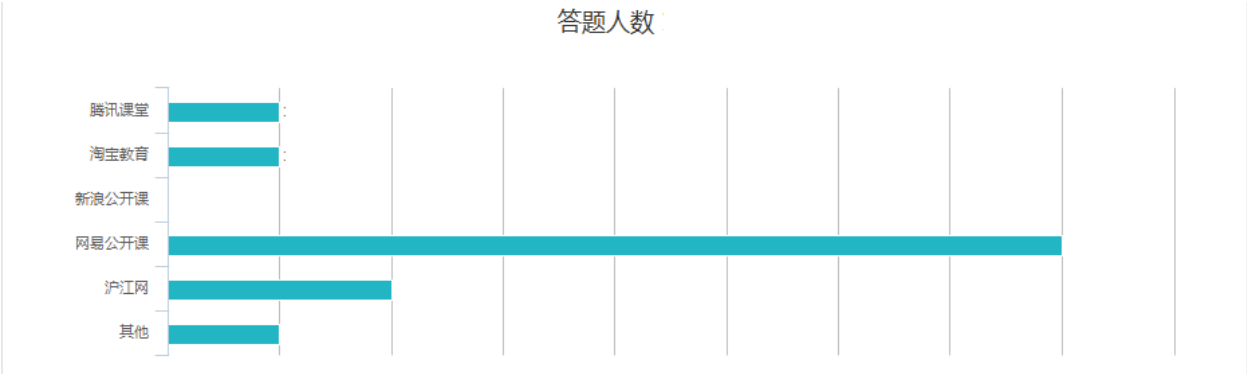
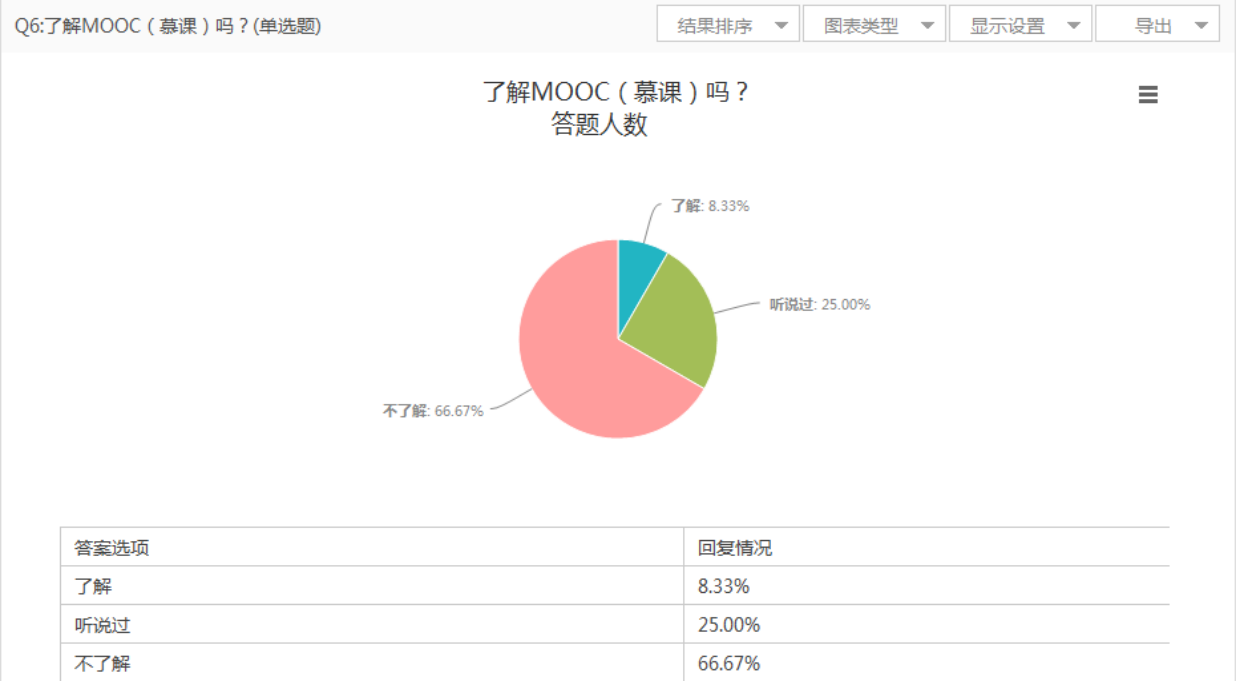


Figure 46 BUCT Student Use of Educational Websites

Question 5: Which websites do you use for education?

The websites that the students use for education and resources are Tecent classes 1%, Taobao classes 1% , Sina classes 0%, Easy net is used by 8% of the students making it the most used, Huhiang is only used by 2% , and other people use other education system is 1% but they did not state what kind they use.

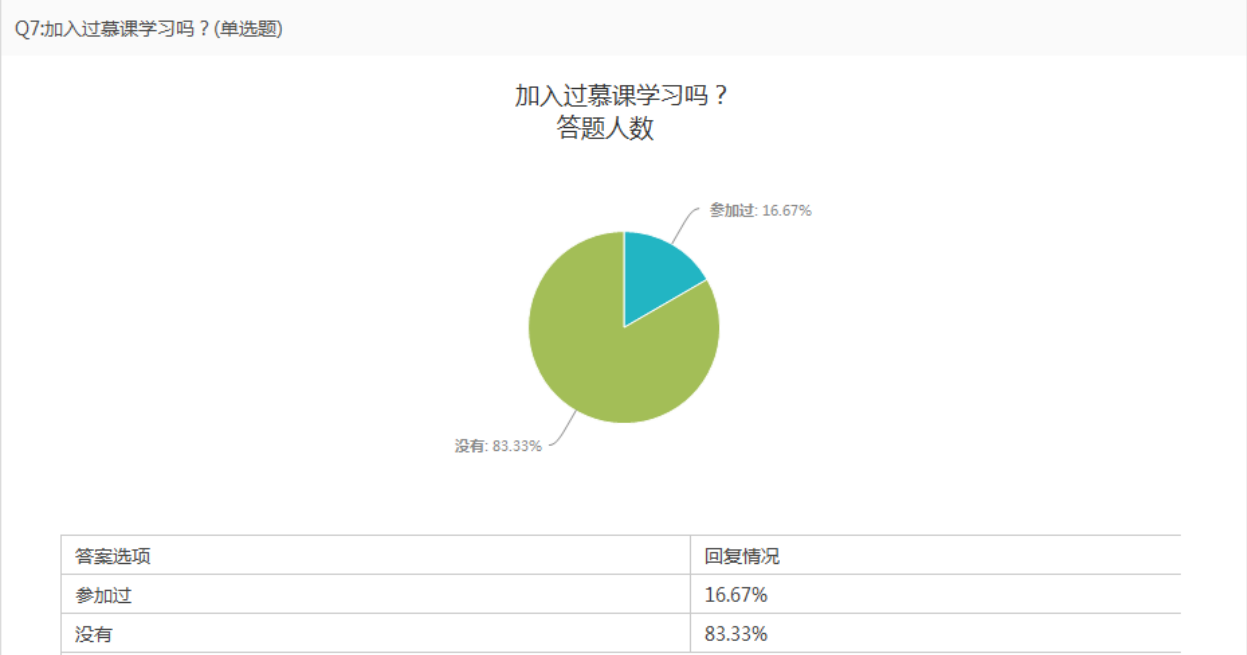


答案选项	回复情况
了解	8.33%
听说过	25.00%
不了解	66.67%

Figure 47 Student Use of Massive Open Online Course

Question 6: Do you know MOOC? [MOOC: Massive Open Online Course]

We asked them if they knew what MOOC was 8.33% said yes, 25% said they have heard of it, and 66.67% said they have never heard of it or ever seen it. This shows that a majority are unaware of a significant teaching change and the new focus on online classes. This tells us that the population would need to be educated on these new teaching techniques.

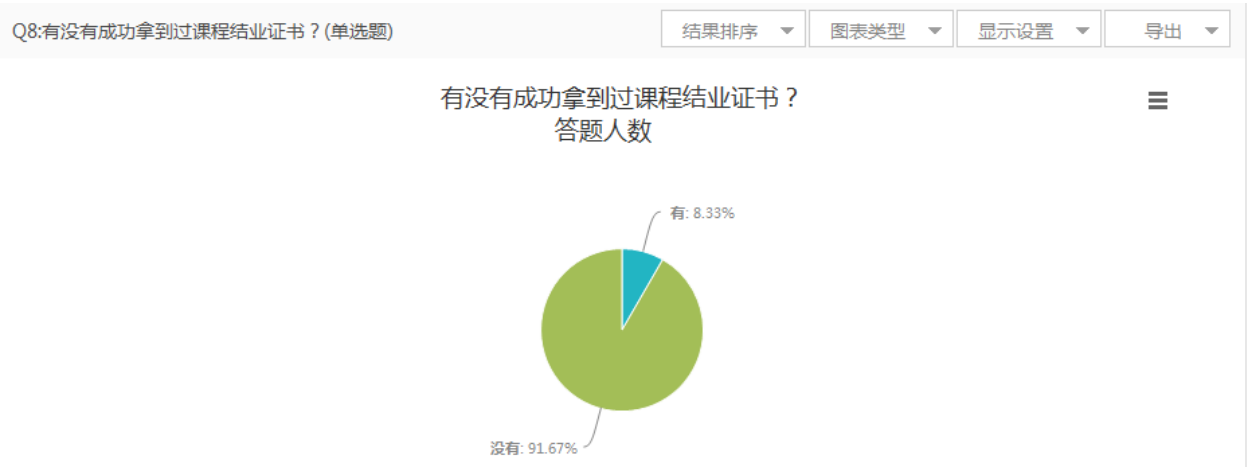


答案选项	回复情况
参加过	16.67%
没有	83.33%

Figure 48 BUCT Student Use of MOOC

Question 7: Have you taken any MOOC classes?

We asked them if they had taken any MOOC classes and 16.67% said yes and 83.33% said no.

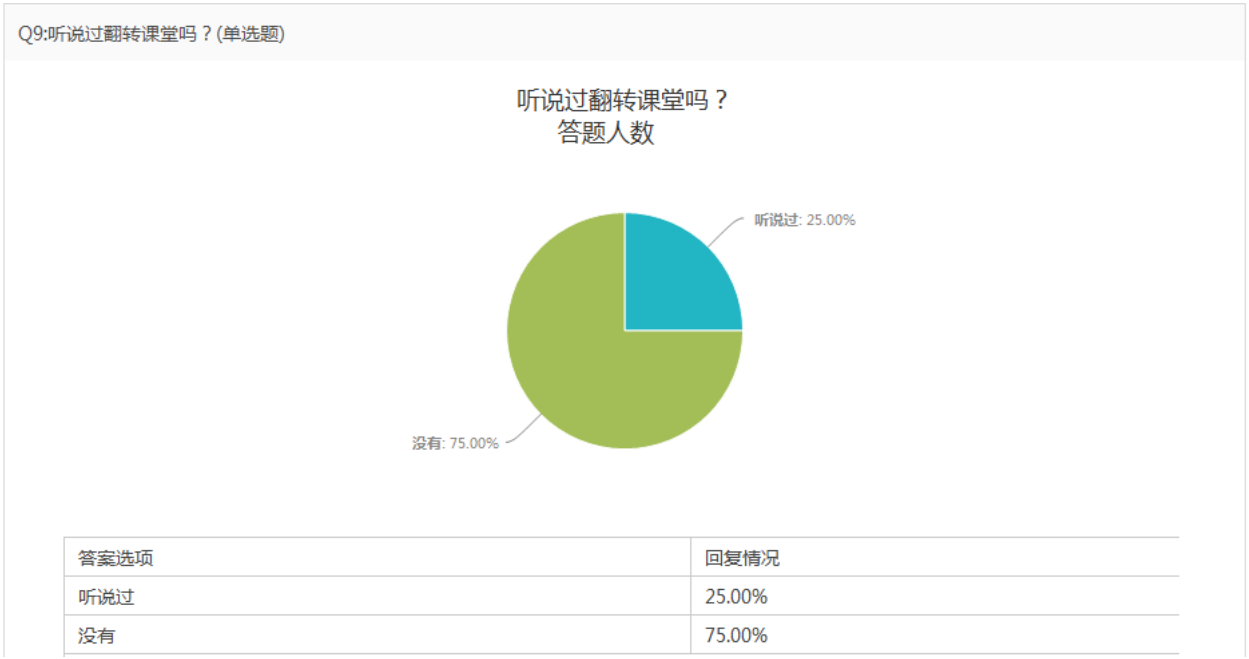


答案选项	回复情况
有	8.33%
没有	91.67%

Figure 49 BUCT Student MOOC Completion

Question 8: Do you have any Certificates? [Finished and passes a class in MOOC]

Of the respondents we had 8.33% said they did and 91.67% said no. Although the number is not large it dies show that there are students in BUCT that have successfully completed courses through MOOC.



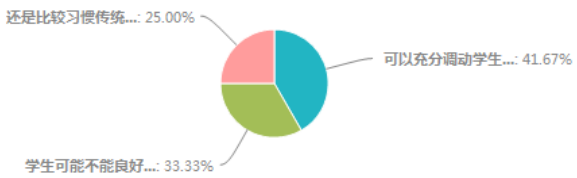
答案选项	回复情况
听说过	25.00%
没有	75.00%

Figure 50 BUCT Student Knowledgeof Flipped Classrooms

Question 9: Have you ever heard of flipped classrooms?

25% said yes but 75% said no. The amount that said no is a huge percentage of those surveyed and strengthens our original thoughts about BUCT students. This shows that most of the population is not educated about flipped classrooms and hints to the need of new education about teaching at BUCT.

翻转课堂要求学生在课下观看视频学习基础知识点，课上教师与学生就基础知识进行延伸，互动交流。这样的学习模
答题人数



答案选项	回复情况
可以充分调动学生积极性，愿意尝试。	41.67%
学生可能不能良好地掌握课下时间，预计课上的互动效果比较差	33.33%
还是比较习惯传统的上课方式	25.00%

Figure 51 BUCT Student Intrest Evaluation

Question 10: Flip classrooms means that students learn material out of class in videos and in class time is used to interact. We asked the correspondents if they would like to participate in something like this.

41.67% said yes and 33.33% said they would not be interested in it. A number of 25% would prefer the traditional classroom. This shows that although there is significant interest in flipped classroom teaching at BUCT it is not universally wanted across the student body. This is expected to be correlated to the amount of students who have heard of flipped classrooms.

Figure 52 BUCT Student Preferred Teaching Method

Question 11: Which class model do you prefer in university curriculum?

This question was open response / write in. Some answers that were given were; so wanted to combine practice and class content, a class consisted of asking questions, a class where communication between teacher and students is highly encouraged, help undergraduates graduate from the BUCT university, many want a class that will help them retain text book knowledge so he can use it for the final test, a class centered around MOOC, a flipped classroom. Many students said they did not know or didn't care. The most interesting response we got was that many people were interested in using innovated technology but still keep traditional format of teaching. From this variety of responses and the fact that many did not submit a proper response it is hard to determine if there is any trend that can be followed from this question. However because of the lack of a trend we can also say that there is a desire for something new within the population surveyed.

BUCT Survey Conclusion

After the results we got from the survey we were able to assume that many BUCT students are not really educated on different types of teaching approaches and are not really interested in changing

this. This is because many did not even know what a flipped classroom was. It is as if they are only used to traditional curriculum and are afraid to try new different teaching approaches. This is a huge problem to the institution because how can they improve their curriculum if they are afraid to try different things.

Recommendations

After understanding what the BUCT team wanted and what they have completed we understand that they have a database created on myeclipse. What this database could do so far is log in the student with their username and password. It also has some type of links where the student can click but what they are trying to do now is learn how to input information into the database. This seems to be a big difficulty in understanding how to upload any type of content into the system. When we discussed with them we showed them other options available to us at WPI and one of the things they really liked was our Blackboard (myWPI) setup.

Once we saw the great difficulty and frustration the Chinese partners were going through to learn how to upload content we decided to look into other viable options. We thought instead of them having to create a database, they can purchase any type of learning management system (LMS). The two learning managements we researched into were blackboard and Canvas by Instructure. Teachers and students would just have to learn how to use it and learn how to upload information. When we started to consider these recommendations to the BUCT Teams we looked into research and made sure that both LMS systems were accessible in China. What this means is that it is not a banned website. When we looked into this our results were that both LMS systems were available for use. From here we decided to contact both LMS systems and gain knowledge in prices and what would be needed in order for BUCT to implement any type of LMS systems.

After discussing with them it seemed as if they were interested in looking into any type of learning management systems. This is because the one partner who was mainly working on the code can no longer participate in the project since he has other obligations to complete other projects that he is currently working on for his major. Another consideration we took into account was that it would be too much coding for the other group partner to do, by herself. Since they seemed all on board with getting a LMS system for china we decided to contact Blackboard and Canvas.

Blackboard

Once we contacted US Blackboard there was several communications between the distributor and us. Asking questions in regards to what we were looking for as an institution. Some questions that were discussed were the following, is it a banned website in China , does BUCT have enough students/professors that can access the website without any problems, were we looking into giving it a trial and run with the BUCT students/professors to see if they like the format and availability of it , would they need a training course both for students and professors, what kind of Blackboard technologies would you want incorporated within the system, what budget has WPI/BUCT created. After discussing with them with what we wanted they explained to us that they have their own region, BB China division that will be able to help us step by step.

When discussing with the Blackboard supplier we decided to test out all the questions that were asked of us. We had our own BUCT partners log into our own WPI Blackboard system and see if it they ran into any problems, they did not then we proceeded to ask Professor Xia to log into WPI and he was able to do it from his laptop and desktop computer and the only problem that was faced was that the internet connection was a bit slow but other than that we did not face any problems. It is evidently not a banned website in China. They would need a training course for both students and professors but

learning how to use Blackboard will not take that long to learn our BUCT partners already understood how to use it after navigating through it for a couple of minutes. The type of Blackboard technologies we would like to see incorporated into their black board system at BUCT would be equivalent to the resources available at WPI such as echo 360/ class capture, turn in technologies, and the availability of all current course they are taking for the semester. From here we knew that myWPI would be the best recommendation to both project teams at BUCT.

Since they have their own region it makes it easier for Blackboard to have access to the host available at BUCT in order to download it and modify it to however they wish. After speaking to the BB China region they gave us two options to pursue. One of the options was that we purchase a whole Blackboard system or the second option was that we look into WPI hosting BUCT classes on their own myWPI black board system. We have yet not decided on an option for them to pursue because BUCT has not given us an estimated budget to give to Blackboard.

This is very essential because BUCT not having the available technology installing black board would help them to do that. This can be a huge leap for them in that they will introduce such programs as echo 360 and class capture and turn in technologies. That would solve the solutions to both of the projects at BUCT. It will give the web expansion team a whole system to work on and the participation technology project it will give them access to turn in technology so it will introduce a lot of technology to their campus to help them start implementing flipped classrooms into their curriculum. The next few steps that we are waiting for is for an approval from Blackboard. Amongst waiting approval from black board we will see a list of technology they would need to purchase apart from the whole Blackboard system. From there we would get an idea of what BUCT should aim for as there budget.

A barrier that we found and are facing with the BB China division contact is that they want to speak to the project sponsor or someone at BUCT that can be the main contractor. This is because of a

respect expectation in Chinese business where if you contact a business about something they want to and will often only speak to a manager rather than a staff. This is important because we expressed that were working on the project rather than administrating the project this caused confusion as they will no longer speak with us and rather demand to speak to an administrator despite our explanation that we were both. We were unable to get a hold of anyone who could sort this issue out despite contacting our sponsors, the administration and our project advisors. They further did not want to give us specific information on costs or what would be the next steps. Currently we cannot get in contact with someone who could help from our BUCT sponsor mostly because it is now summer vacation on campus and they has gone home for the summer and are out of contact with the university.

Canvas

Another learning management system that was found late into our investigation of online platforms for BUCT was Canvas. Canvas is a learning management system by Instructure that is a much newer competitor to Blackboard. It uses Ruby on Rails for the web application framework and PostgreSQL for the database. It incorporates JQuery, HTML5, and CSS3 to provide its modern user interface that gives it a sleek appearance. It has the ability to host entire classes online being able to upload and store files, complete grading, assignments and more. We have contacted Canvas and they have given us a trial version for us to use and have been in contact with us on a daily basis for the last week of the project. The system is very promising and easy to use in our experience but we have not been able to get pricing for the system.

Final Results

As of final results we got an estimated price range looking at other adopted technologies. The black board system never gave us an estimated or exact price. They did not give us a direct price because they said it depended on what kind of technologies BUCT would like, how many users would

have access to the system, would they want to self-host the program and just pay for the license. There were many different aspects that would change the estimated price range, because the short amount of time BUCT was not able to give us all the answers to the questions we needed to finalize a price for black board products. In regards to Canvas by Instructure we were able to get in contact with them and access what the LMS system would look like. Do to the amount of time we were not able to get a final pricing from them as well. After this we decided to create an estimated price. This price is looking anywhere from 200,000 to 700,000 which is very expensive price range for them. After speaking to BUCT about this price range they did not seem so concerned about the price. The next few steps which we are handing over to BUCT is them discussing with black board and Canvas in order for them to let the LMS systems know exactly what they want to see incorporated into their system as well as how many users they want to be able to host. After that BUCT will be under a certain time frame to purchase any of the two LMS. They said it usually ranges anywhere from a time frame of one year to two years it can be short as half a year but that is usually when the school is in a hurry to adopt a black board system. After we have discussed with BUCT they said they want the job to be done correctly so they have set up an estimated time of two years to adopt the full system into their curriculum this includes installing into classrooms all the needed technology they need, teaching the staff and students how to use it, and they said they are now trying to find a group of students/faculty that will be willing to monitor the system and learn how to use all the technology that comes with it. Something very similar to the ATC they have a technology help desk but all they are in charge of is renting out laptops and helping students put money on their meal cards. They were considering teaching the staff that works there or another feasible option we gave them was to hire computer science majors or anyone that will be willing to invest time and go through the training to learn all the new technology that comes with black board.

Project Conclusion

This pilot project into investigating Flipped classrooms at home and abroad has been a very enlightening experience. WPI has been extremely helpful and forward thinking with regards to the project and the involvement of blended learning in the curriculum respectively. The knowledge about assets and teaching methods gained from the staff and school resources has been invaluable to this project. WPI is well prepared to handle the changing teaching environment with abundant technology and resources to assist professors. However WPI continues to utilize the lecture teaching method for its convenience rather than blended learning and we doubt this will change without intervention from the administration despite the resources made available to the teaching staff.

BUCT has made efforts to investigate flipped classrooms but has encountered many problems that they have yet overcome. Although the project initiatives within BUCT have shown promise as exploratory research into classroom participation and improved online resources they do not have the interest from the administration necessary to make changes to the institution. The resources and support available at BUCT will need a lot of work to support any blended learning in the curriculum. Some of the problems worth noting are that the teaching environment is not conducive to an interactive classroom, the students do not wish for a new way of learning, the internet is problematic in its availability and speed, the teaching staff does not wish to utilize a new method of teaching, classrooms are not outfitted adequately to bring technology to them and the capital required to make the investment to bring in a new system for teaching and updating the classrooms does not exist at this time. With these issues in mind we strongly recommend investing in an update to the web portal that aims to make the system more useful to teachers and students.

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