

APT-GT Project: Design and Development of an E-learning System

by

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ABSTRACT

Over the years, the availability and sophistication of e-learning tools has developed rapidly. Compared with the traditional education, the E-learning platform saves workforce and financial resources, and people no longer need to go to the classroom for learning. Based on the prevalence of mobile devices and easy access to the Internet in our lives, our work and our learning styles have been changed. Time, space, and location conditions no longer restrict teaching and learning. Knowledge acquisition channels become flexible and diverse. We built a Web-based tool named The Automatic Phonetic Transcription Grading Tool (APT-GT) that enhanced the user experience for both teaching and learning [6].

APT-GT is a Web-based language learning system used by the Communication Disorders department in the College of Liberal Arts, Auburn University. This system was designed to support students with their language ability.

With the help of the APT project, students practice the ability to perform communications transcription and enter this information and characters using the International Phonetic Alphabet (IPA) keyboard. Moreover, they immediately receive assessment of their exercises instantly from the system. For multilingual learners, APT offers a variety of phonetic transcriptions for various keyboards.

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CHAPTER 1. INTRODUCTION

The digital revolution and smartphone boom have triggered tremendous changes our daily lives. One new promising technology is Web-based learning; it can happen at any time and any place with the help of mobile devices or personal PC [1]. The mobile computing device used by Web-based learning must be able to efficiently present the learning content and provide two-way communication between the teacher and the learner [2].

Based on digital learning, Web-based learning brings new feelings of accomplishment to learners and provide support for anywhere and anytime through an effective combination of mobile, Internet and computing technology. Web-based learning is considered as a future learning mode or an indispensable learning mode for future learning [1].

Web-based learning is developed by digital learning and is an extension of digital learning. It is different from general learning [4]. Michael Wenger, an e-learning expert at Sun Microsystems, put forward his unique insights on Web-based learning. He believes that Web-based learning is nothing new because printing textbooks in traditional learning can also support learners. Learning anytime, anywhere, we can say that textbooks have long been a tool to support Web-based learning, and Web-based learning has always been on our side [15]. In addition to all the features of digital learning, Web-based learning has unique features that learners are no longer restricted to classroom and books and are free to learn about different purposes and different ways anytime, anywhere.

The learning environment is mobile, and teachers, researchers, technicians, and students are all mobile. From the perspective of its realization, the technical foundation for Web-based learning is mobile computing technology and internet technology - mobile interconnection technology [1].

The automatic grading tool aims at improving the students' level of feedback and optimized

teacher's time. Several studies have reported the development of software tools that support this process. The grading tool should support the accuracy, consistency, and security of the grading mechanism and conduct time comparison analysis. The necessity for this tool is that we enlarge enterprise system (i.e. Canvas), but it does not provide tools to support the automatic grading system that will support phonetic transcription. With this automatic grading tool for phonetic transcription not being currently available, we needed to begin the design process by exploring the model with communications professionals. Then based on our interactions with this group, we created a model for automated phonetic transcription and the automatic feedback needed to support this effort and provide immediate user feedback.

APT-GT is an application that provides students with convenient e-learning and mobile learning experience and also offers easy-to-use student management for teachers. The project aims to help teachers in the education department manage their lectures, practices, and exams. The current canvas system cannot meet the specific requirements of our clients. Therefore, we designed and implemented a unique system based on their requirements.

CHAPTER 2. LITERATURE REVIEW

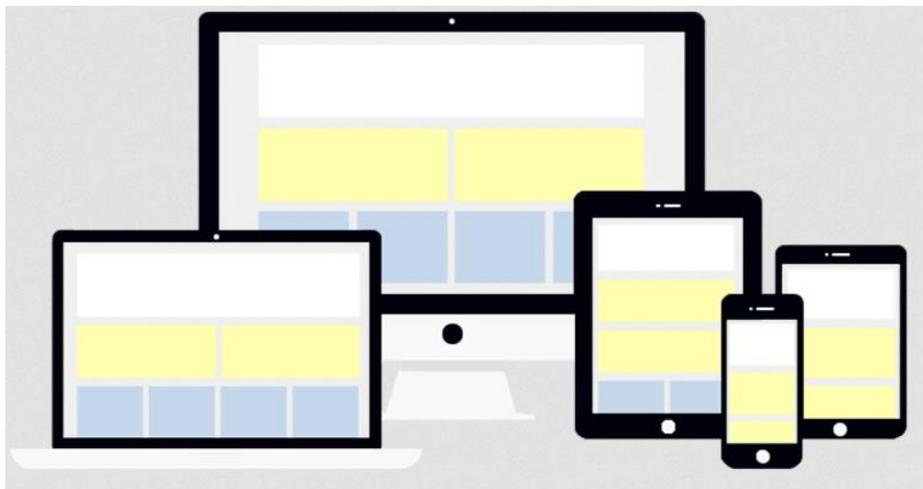
2.1. Responsive Web Design in User Interfaces

The rapid development of the Internet has promoted the diversified design and development of web pages and Internet supported tools. The Internet has changed the way to work, live and play. With the continuous updating and development of mobile devices, people can easily get any information without desktop computers. More information is spread through the web, and web design is the core of the web application interface. The popularity of large-screen devices and the rapid development of small-screen mobile devices have led to differences in the screen size and resolution of various devices. Initially, traditional web pages had a fixed pattern for large-screen devices and were not adaptive to support new small mobile device screens. With the usage of mobiles being much higher than in the past, we must consider the design of the application to support desktop and mobile devices. Support must be available for multiple types of resolution, multiple sizes of devices and this creates the need for a development philosophy to support this new method of providing content (i.e. Responsive Web Design).

2.1.1 What is Responsive Web Design?

Responsive Web Design integrates the three core technologies of existing streaming layouts, flexible pictures, and media queries. This term can also be referred to as flow design, waterfall flow layout, flexible layout, and so on. The focus of responsive design is to provide a universal user experience for different devices and to design different images, texts, and other content through core technologies to adapt to different devices. The way of display, this development of web design will be an innovation and a challenge. Responsive web pages are

adjusted and laid out according to the user's behavior and environment and it can respond to different screen sizes, directions, device resolutions, or system platforms. Webpage contents and functions are provided according to different devices. In this case, the same website will have different page layouts between mobile phones and tablet computers. This will not only increase the number of website visits but also bring a good user experience. Responsive web design breaks the traditional design ideas and enables the same website to switch between web pages on smartphones, tablet computers, or desktop computers. In other words, the website can



automatically respond to the user's device parameters without having to design and develop for each new product.

Figure 1: Responsive layout [8]

2.1.2 Reason to use Responsive Web-design

Responsive web design can efficiently display different web page layouts between smartphones and desktop computers [3].

A wide variety of user-end devices, such as the iPhone, iPad, Kindle. These devices have some differences in screen size and resolution, and these devices are upgraded continuously, new screen size, resolution, device functions are being developed constantly. Therefore, more

horizontal screen, vertical screen, special-shaped screen and other sizes come out. The development of these new devices has caused fixed-page web pages to be updated continuously, which not only increases the cost of web site design but also can only be designed for some specific devices and discards other users who use older devices. The speed of the update can never keep up with the pace of equipment upgrades, which apparently cannot meet the user's needs. Responsive webpage solves the problem of cross-device terminals for traditional websites. It can automatically recognize the user's device parameters, quickly adjust the picture size and switch to the corresponding resolution.

The compatibility between different operating systems, iOS, Android, Windows 10 is necessary. These systems need to solve the problem of browser compatibility, the use of mobile browsers keep increasing, but the use of Internet Explorer is declining. Websites with fixed-width models are complicated to be compatible with browsers, and responsive design can provide the best browsing experience for users based on their browsers.

The browser window size changes also influence the user experience. Most websites consider that the browser maximizes the display effect of the window and ignores the flexible space of the screen itself. For example, if the browser window is restored or reduced, then the fixed-mode website layout cannot be fully displayed. In the use of mobile devices such as iPhones and iPads, the instantaneous switching between the horizontal and vertical screens has become a real demand, and fixed-width web page layouts cannot be able to adapt a variety of device size changes. Responsive web design uses streaming layout and other methods for multiple devices and presenting an ideal visual effect.

2.2 Background of E-learning

Mobile-based E-learning research has become a research hotspot, enabling people to

exchange information, share resources, collaborate on technology, and learning around the world.

E-Learning is the evolution of the development of distance education.

2.2.1 The History of E-Learning

The concept of E-Learning was first proposed by the United States. The traditional education will no longer be able to meet the demands of students in the 21st century.

In the 1990s, the E-Learning emerged. With the rapid development of digital technology, network technology, multimedia processing technology, and artificial intelligence technology, society has entered the digital age. Information theory has been introduced into education science, which has brought new breakthroughs in educational theory research. Lifelong education has become one of the educational needs of the information society. Network, which is not limited by time and space and can be shared interactively, has become a favorite educational tool [12]. People began to conduct preliminary research on the virtual teaching environment, the application of video teaching systems, and network cooperative learning. Computers and networks became a new way of learning.

By the end of the 1990s, with the popularity of computer, other hardware devices and the rapid development of the Internet and software, and the continuous enrichment of digital content laid the foundation for the concept of E-Learning [2]. At this stage, the digital learning conditions, facilities, and the environment have been greatly improved in the United States. Digital resources have become increasingly wealthy, and teachers' digital teaching capabilities and students' digital learning capabilities have significantly improved. Other countries also recognize the importance of the development of E-Learning. As a result, E-Learning has risen worldwide, rapidly expanding from North America and Europe to the world. This is the initial stage of the development of E-

Learning. At this stage, the application of E-Learning focuses on the use of the Internet and other technologies to replicate teacher-led traditional method of teaching. However, it does not take full advantage of the potential capability of computers and networks. Only use E-Learning technology to provide more interaction and experience during the learning process.

Since 2003, E-Learning theory has begun to pay attention to the guidance of social learning theory [2]. This stage of E-Learning emphasizes the active learning of learners to participate in social learning, flexible learning content and ubiquitous learning environment. This is where E-Learning matters.

The research on E-Learning has been increasing year by year. The research is moving in an in-depth direction. At the same time, the research area is also becoming wider and wider every year. Even if it develops to the present day, E-Learning may be just in its first Stage. We look forward to a broader future for E-Learning.

2.2.2 The development of E-learning

With the development of social science and technology, the globalization of information, and the development of education, the emergence of E-learning has gradually gained people's favor [2]. Compared to the traditional learning model, E-learning refers to the method of disseminating content and learning quickly through the application of information technology and Internet technology. Compared with the education methods of traditional education institutions, E-learning is characterized by high efficiency, convenience (breaking time and space restrictions), low threshold, and rich teaching resources. Based on these characteristics and the help of the development of Internet technology, the E-learning platform has gradually emerged and gained favor in the primary market [2].

Regarding E-learning platform, it saves human resources and financial resources. People

no longer need to go to a specific classroom for knowledge. The development of E-learning creates new ways of life, work, and learning. Teaching, and learning no longer limited by time, space, and location conditions, and ways of knowledge acquisition become flexible and diverse.

However, the current E-learning platform has not entirely replaced the traditional teaching model, mainly because of its lack of interactivity. In the traditional classroom classes, students could ask questions at any time, but most of the E-learning system is teaching by videos. We can only browse text or video but cannot promptly raise questions and resolve it at the same time. Between teachers and students or students themselves, there are no ways to communicate through the Internet. Although computers can be used to statistically analyze students' question, it still lacks practicality compared to traditional classrooms.

2.2.3 The advantage of E-Learning

1. Students are active

In the E-Learning environment, the position of teachers and students has changed dramatically compared to traditional teaching. E-Learning emphasizes student-centeredness. In the process of teaching, students are the subject of cognition and active acquirers of knowledge; teachers assist students in acquiring knowledge and being the builders of the learning environment. E-Learning gives students opportunities to innovate and giving full play to their creative abilities. At the same time, provide students with an environment to practice what they learned through the E-Learning. With the help of E-Learning, students can form new knowledge and form solutions effectively.

2. Teaching flexibility

The class time for the traditional method of teaching usually is 40-45 minutes. In a

limited period, the teacher imparts the content of the class to the students according to the teaching schedule. The process of 'teaching' and 'learning' is synchronized. Once students have missed a certain part of their knowledge, they can only ask their classmates or their teachers later. The classroom scene is irreproducible.

E-Learning teaching time is flexible. Teaching content can be presented to students through computers and other multimedia devices. Therefore, students can independently control the class time. Students can choose to take a class synchronously with the teacher's teaching process. With the E-Learning teaching process, students control their learning process according to their learning conditions.

E-Learning breaks the Geographical restrictions. With the constant development of modern information technology, the location of teaching could become more extensive [2].

Compared to the traditional method of teaching, E-Learning is more flexible regarding time and location.

3. Diversified teaching forms

In the traditional teaching process, teaching content is mainly presented in the form of teacher's board or PPT, and these two forms are relatively simple. According to the definition of E-Learning, E-Learning conducts activities of learning and teaching through the Internet or other digital content [11]. Therefore, teaching content in the E-Learning environment has a variety of presentation methods, such as online video, multimedia applications, sound files, e-mails, web hard drives, cloud.

4. Rich teaching resources

Traditional education mainly uses textbooks as the primary teaching reference, the

teaching resources are relatively simple. With the support of the Internet, multimedia devices and computers, E-Learning has much more teaching resources. Through these teaching resources, E-Learning can set up a productive teaching environment to improve students' enthusiasm for learning and help students build knowledge more rationally.

2.3 E-Learning applications

The product positioning of the E-learning application is to build an online teaching tool that is compatible with mobile devices and devices. The implementation through the browser is a perfect choice to establish a cross-platform E-learning platform, because the browser is compatible with different devices and operating systems. System code is placed on the server. The front end only needs to send requests to the server. After receiving feedback from the server, the E-learning system runs on a cross-platform browser. So the system can be used on the PC and mobile systems. For users, they can have a better experience on different platforms. For E-learning content providers, they can focus more on the preparation of teaching content, regardless of differences in the front-end. The cross-platform E-learning simplifies the difficulty of user access to the system, enabling users to join the E-learning system anytime anywhere. The E-learning system overcomes time and geographical constraints so that teachers are more dedicated to teaching and students in remote areas can also get the latest teaching resources.

2.3.1 System Structure of an E-learning application

In the development of the current distributed network application, there have been two different implementations. One of them is traditional application system, i.e., Client/Server (C/S) structure. There is also a Browser/server (B/S) architecture that is often used in browser applications.

The system architecture of C/S is usually for software systems. To reduce the communication consumption of the system, the client end and the server end are assigned tasks at the same time. Also, the user must use the client end to manage the operation.

The client is mainly responsible for the user's program and business operations. Managing data information, sharing data, and maintaining the system data is the server's work. The C/S architecture is easy to set up and easy to use. However, it is difficult to upgrade the system program, and program maintenance is troublesome.

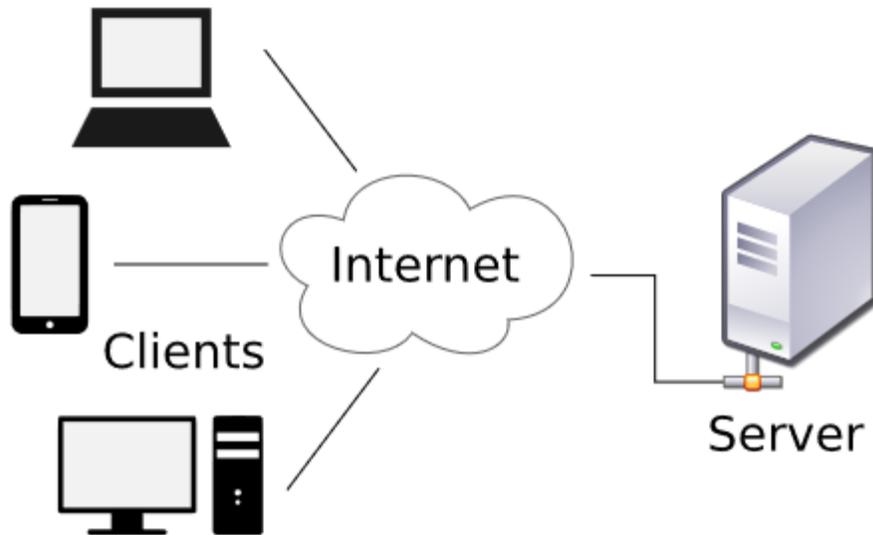


Figure 2: Client/Server architecture [9]

The system architecture B/S is popular because of the rise of Internet technology. In the B/S structure, the front-end user only needs to have a browser that can access the Internet and then access the system through the network. In the client end, there is no need to develop programs. The front-end applications are almost save and running on the server end. This feature makes the client end relatively light, and there is no program load. In the system update or maintenance process, we only need to update on the server side. The overall system update is easy to maintain. We can change thousands of front-end by changing one single program on the server end.

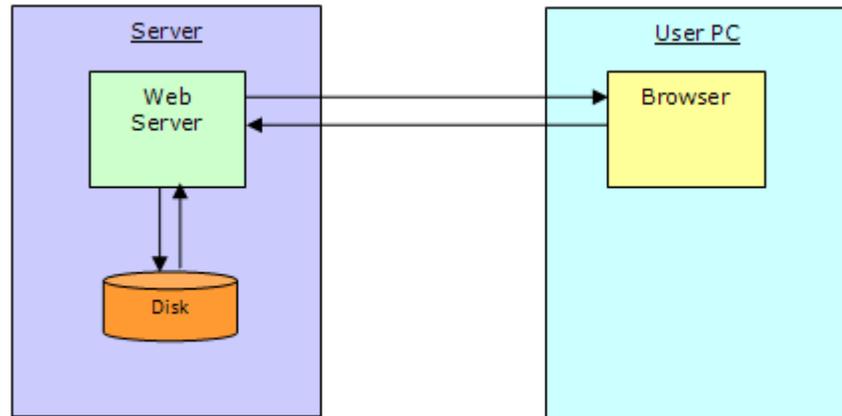


Figure 3: Browser/Server architecture [10]

Being free from time and place restrictions is the most significant advantage of the B/S system model, and it is more flexible when dealing with real-time events. At the same time, it is convenient to maintain the system. For the E-learning system, the purpose is to achieve remote synchronization of education. The E-learning system users are geographically distributed, so the system uses the B/S structure.

CHAPTER 3. Method

The APT-GT is an interactive learning system provides a connection between students and teachers of the course linguistics. The system provides class notes and course materials such as videos, and it also has the function to provide assignments. In each assignment, the teacher creates an exam or pre-test related to the video for the students. Then after the students take the exam or submit an assignment, the teacher can correct and score the exam online. The system also has the communication function by using the 'comments' after login. The teacher can also manage lessons after they log in. Within the 'current lessons' tab, the teacher can upload and manage lesson files, manage users, and manage exams as well as pre-tests. The lesson files are in the video format and the questions added to the exams are audio format.

In the main scene of the student view, the first step is to register and then students log into the system. The students' register for the course they want to take. They can only take the class after the course registration request is approved by the teacher. After the request is approved by the teacher, they have the permission to review the course material, exams and pre-tests related to the course. After students finish the necessary lesson and activities, they begin with the pre-test and then complete an exam. The questions are audio files of a words' pronunciation. Students use the International Phonetic Alphabet (IPA) keyboard to transcribe the work and type in their answer. The automatic grading algorithm compares the student's answers to the correct answers, which are supplied by the teachers and then the students are given their results. The result will show the Difference Ratio between the student's answer and the correct answer. The algorithm also analyzes all the results of students for each exam/ practice test.

The APT-GT v 1.0 has been developed to incorporate all these features. The system is a web application, which allows teachers to provide course material online, which facilitates material availability to students at all times. It meets the advantage of E-learning system - overcomes time and geographical constraints, so that teachers are more dedicated to teaching and students can also get the latest teaching resources anytime and anywhere.

3.1. Existing Solutions

The APT-GT version 1.0 was functionally complete. The system provides teacher and student with the interface to manage courses, files, exams. There are several different roles of users.

1. Admin: The Admin role is responsible for user management. Admin role access the APT-GT for authorizing new registered users, assigning their roles (student or teacher) and

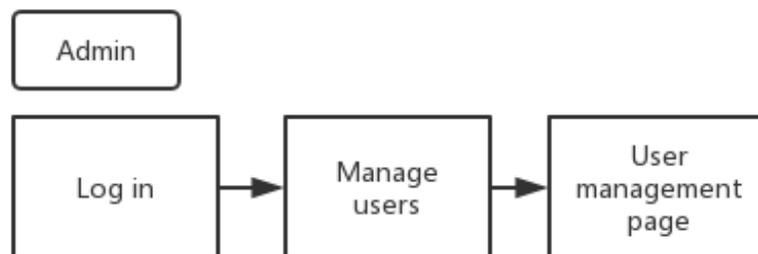


Figure 4: Operation logic for Admin role

delete/disable users if necessary. The operation logic shows in figure 4.

2. Teacher: The Teacher role accesses the APT-GT and manage the course related files, exams, and pre-tests. Teacher has the right to authorize a Student to a specific course after the Student registers for the course. Students can also check the analysis result, which is

calculated by the automatic grade algorithm after each exam. The operation logic shows in figure 5.

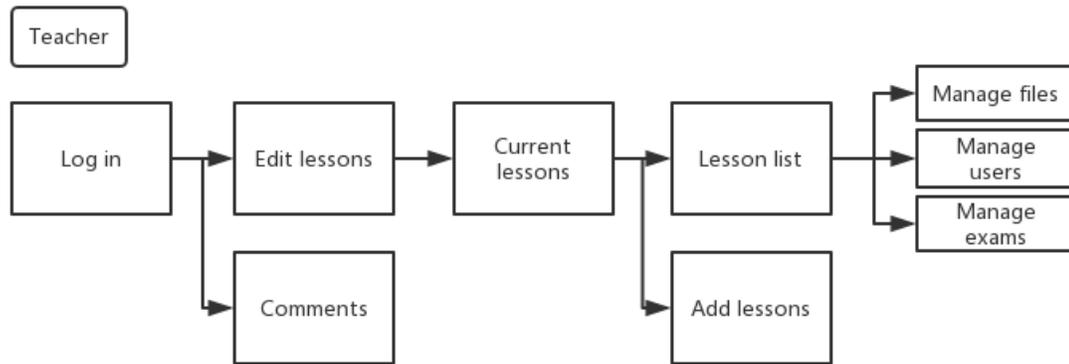


Figure 5: Operation logic for the Teacher role

3. Teaching assistant: Responsible for managing course-related files. Teaching assistants are assigned by Teacher, upgrade from Student.
4. Student: Responsible for consuming content uploaded by Teacher or Teaching assistant and taking practices and exams. Students are managed by teachers, their registration to a course is also approved by the teacher, only after which the student access the course

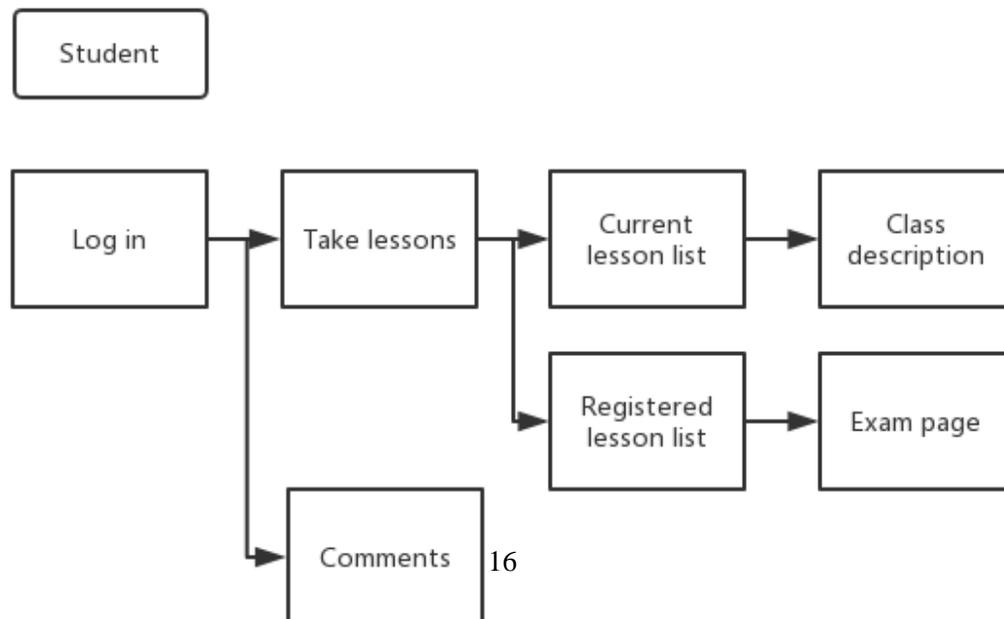


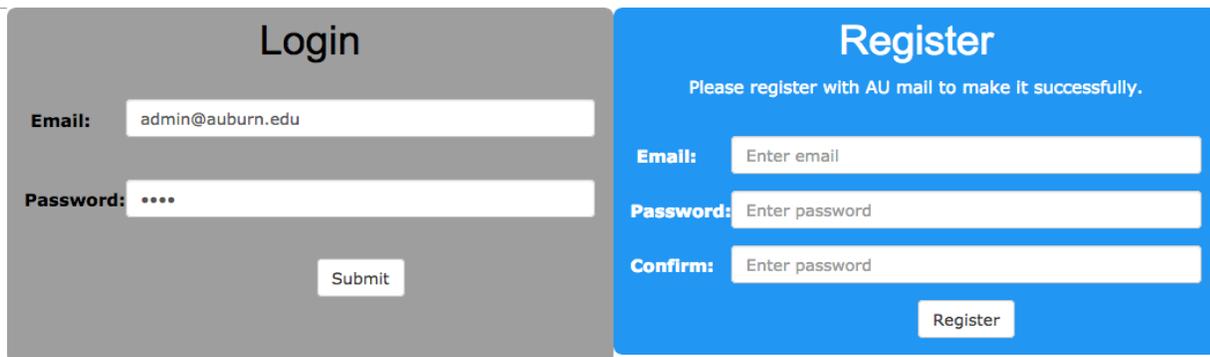
Figure 6: Operation logic for the Student role

material, practice tests and exams. The operation logic shows in figure 6.

The APT-GT has another unique feature, the International Phonetic Alphabet (IPA) keyboard. Students use this keyboard to type in answer to the video questions in the exam. The IPA based on the Latin letters and designed by the International Phonetic Association. The IPA provides a standardization of spoken language sounds.

3.2. Current system & Problems

The APT-GT language learning system is designed to serve the students and teachers in the linguistic courses, which are in the Communication Disorders Department in the College of



The image shows two side-by-side form panels. The left panel is titled 'Login' and has a grey background. It contains an 'Email:' field with the text 'admin@auburn.edu', a 'Password:' field with four dots, and a 'Submit' button. The right panel is titled 'Register' and has a blue background. It contains a message 'Please register with AU mail to make it successfully.', an 'Email:' field with the placeholder 'Enter email', a 'Password:' field with the placeholder 'Enter password', a 'Confirm:' field with the placeholder 'Enter password', and a 'Register' button.

Please use Google Chrome browser.

Figure 7: User Log in Page

Liberal Arts, Auburn University. The system is functional, but still has problems.

The login page in the APT-GT version 1.0 showed in figure 7. The page is functional, but the UI still needs to be optimized. The Login and Register functionality can be improved and utilize the same area to improve ease-to-use and provide a clean style for the UI.

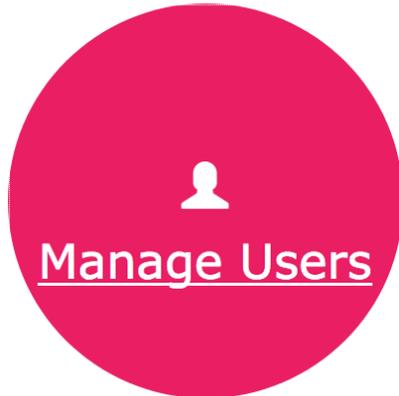


Figure 8: Main Page of Admin Role

The Admin role is an account for administrators who have the authority to upgrade any user roles shown in figure 8. Standard user accounts need to be upgraded by Admin to use their character abilities.

User Management

User	Email	Role	Update to Teacher	Update to Student	Delete
teacher	teacher@auburn.edu	Teacher			
student	student@auburn.edu	Student			
student1	student1@auburn.edu	Student			
student2	student2@auburn.edu	Student			
student3	student3@auburn.edu	Student			
student4	student4@auburn.edu	Student			
user1	user1@123.com	Teacher			
user2	user2@123.com	Student			

Figure 9: User Management Page for Admin Role

The screenshot shows a user interface for a teacher. At the top, there is a dark navigation bar with 'ALT' on the left, a 'Return Main Page' button, and user information 'hello, teacher' with a 'Logout' button. Below this is the main content area titled 'Current Lessons'. It includes two sorting options: 'Order by created time' and 'Order by alphabetical'. A table lists two lessons: 'lesson1' and 'another', both at level 1, assigned to 'teacher', with an 'x' in the 'Action' column. Below the table is a 'Choose the level:' dropdown menu set to '1'. There are two input fields: 'Lesson Name' with the placeholder 'Enter Lesson Name' and 'Lesson Description' with the placeholder 'Enter Lesson Description'. A green circular button with a white plus sign is centered below the form fields.

Figure 10: Current Lessons Page for Teacher Role

The Teacher Role is responsible for managing students' accounts and updates all the details about courses. After Teacher log in, the first page is the Current Lessons page (figure 9), teachers can add lessons and manage the lesson's details by clicking on a specific lesson. The user operation logic should be easy-to-use for the Lesson page as this page will be the first page presented to the user. During initial participatory design sessions, we gathered initial requirements from the users. After several meetings with the customers, we gathered requirements definitions, preferred teaching style, and suggested usage styles and we have found that the Teacher role for the system is a very detailed set of operations. We have captured all of this in detailed requirements and design documentation.

From our requirements analysis, the Student Role is also a very detailed set of operations.

The screenshot shows a web interface for a student. The header is dark with 'ALT' on the left, a pink 'Return Main Page' button, and 'Hello, student' with a 'Logout' button on the right. The main content area has two tables.

Current Lessons

Lesson	Level	Advisor
level one class No. 1	1	user1
level two class No. 2100	2	user1
lesson1	1	teacher
another	1	teacher
lesson 1	1	azt
fgdg	1	teacher11
English1	1	teacher11
Test Lesson	1	mal_teacher
sdbcb	1	teacher1
Lesson 1	1	teacher1

Registered Lessons

Lesson	Role
level one class No. 1	student
lesson1	student

Figure 11: Current Lessons Page for Student Role

Lesson:lesson1

Current Exams

Exam	Due Date	Created by	Action
exam1	Wed Jan 31 22:58:00 CST 2018	teacher	Check result

Figure 12: Current Exams Page for Student Role

The system as defined in this iteration will support the student in logging in, registering for lessons, reviewing lesson materials and taking exams to reflect on what they have learned from the lesson materials. All of the Current Lessons and Registered lessons are available and displayed in one page to provide easy access for the student. If there are many courses, the student will need to scroll down the page to find the courses they want to take.

Users access the exam function, after they select the registered lesson, the page showed in figure12. We need to simplify the user operation logic to reduce complexity and provide an easier method to navigate the system in the next version.

3.3. Hypotheses

To develop a system with a better user experience, the operation logic, user interface, and the usable functions could be designed better.

Based on the ease of use, user interface, operation logic, efficiency, the overall user experience of the newly designed application will be evaluated.

Hypotheses 1: Satisfaction

The final design will have a high user satisfaction.

Hypotheses 2: Ease of use

The final design will be easy to use.

Hypotheses 3: Efficiency

The final design will be more efficiency to use.

Hypotheses 4: Effective feedback

The final design will provide more effective feedback and a clear operation logic for users.

CHAPTER 4. SYSTEM DESIGN

4.1. Requirements Update

After discussed several times with our clients Dr. Marisha Speights Atkins and Dr. Dallin Bailey from the Department of Communication Disorders in the College of Liberal Arts, Auburn University, the system still needs to be modified to accommodate more users in the future and to provide a better user experience [5].

4.2. Functional Requirements

1. The application should have expanded function so that teachers can copy course and materials such as videos, pre-tests, exams, and students' information are not included. If there is the same course in another semester, teachers should be able to copy the course into another semester.
2. In the previous version, all the available courses are on the same page so that the page could be hard to navigate. Users cannot find the course they want when there are too many courses that they have to scroll down. So, in the new update, we decided to separate the courses into different semesters.
3. In the transcription page, there should be a confirmation that answer was saved or resaved.
4. In the transcription page, users could edit the answer with the cursor.
5. It should have a progress bar below the answer input. The progress bar is an area that shows items that have been completed and which items have been skipped.

4.3. Design Requirements

1. Once the teacher adds a new course or copies an existing course, the operation logic should be simplified to one click to modify the course details such as name, description, start

date, semester.

2. In order to reduce the complexity of user operation logic, try to show all the critical information on the same page. So, users do not have to click a certain return button and find the information they want after.
3. In the assignment splash page, there should be an introduction about the recordings.
4. In the assignment splash page, there should be a button to go directly to transcription.

4.4. New Operation Logic

To satisfy the Functional requirements and the Design requirements, the team design the

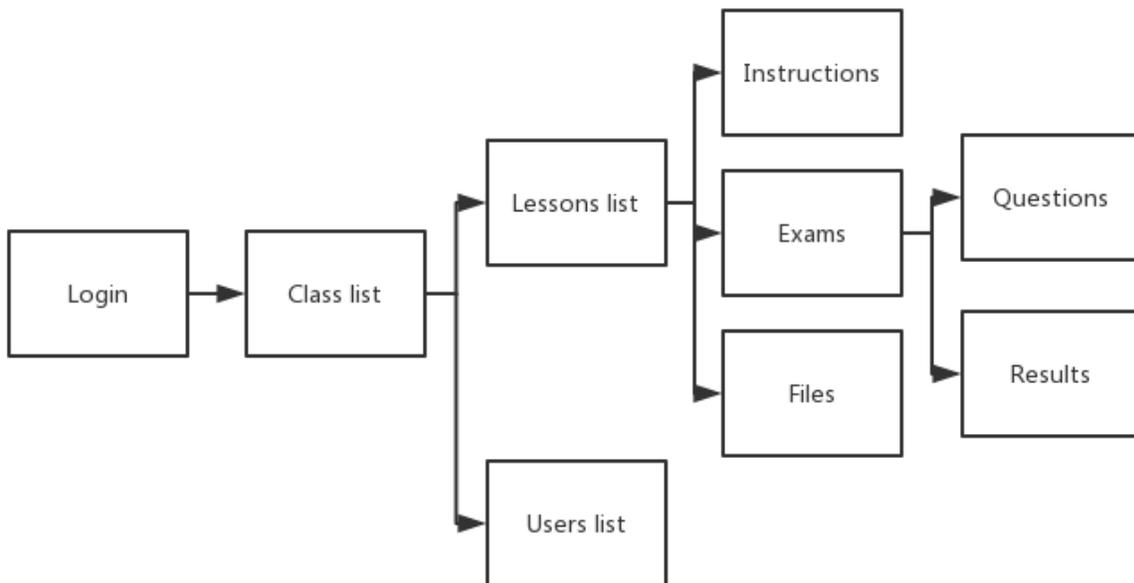


Figure 13: New Operation Logic for Teacher Role

new Flow Chart for the Teacher Role showed in figure 13.

The new Flow Chart has a straightforward logic that shows all the critical information on

a single page. After user Login, they receive an integrated Class listing page. Users will find all the classes available currently. Moreover, after choosing the class, a Lessons' list and Users' List shown (Only show for Teacher Role) next to the Class list. Both the Lists show in the same sidebar of the current webpage. Users could access the function add, copy, delete, modify the class in the Class list. Users add, modify, delete lessons in the Lessons list. For the Teacher Role, they add, modify, delete students in the Users list. There could be a 'settings' button aside each list for the functions above.

Users access the Instructions, Exams, Files and other lesson's details after they choose the certain class and lesson. The Questions and Results will show after user choose to access the Exams.

4.5. Wireframe

After the new operation logic is finished, a Wireframe was created to illustrate the next



Figure 14: Login Wireframe

planned iteration of the development process.

The Login Wireframe is illustrated in figure 14. Consider the simplicity of interface design and ease of use; there is only a single window used for the login page and by combining the “sign in” and “sign up” windows in the old version, simplicity for the interface has been improved.

Figure 15 shows the main wireframe of the system. For the simplicity of the user operation logic, all the necessary elements are shown on the same page. There are no ‘return’ buttons in the window so the user can access any function in the system directory. The classes list and the submenu lessons list, students list are on the left side of the page. They are in the same sidebar.

Users can jump to any other classes after finishing the work on the one present, just clicking the sidebar without any return operation needed.

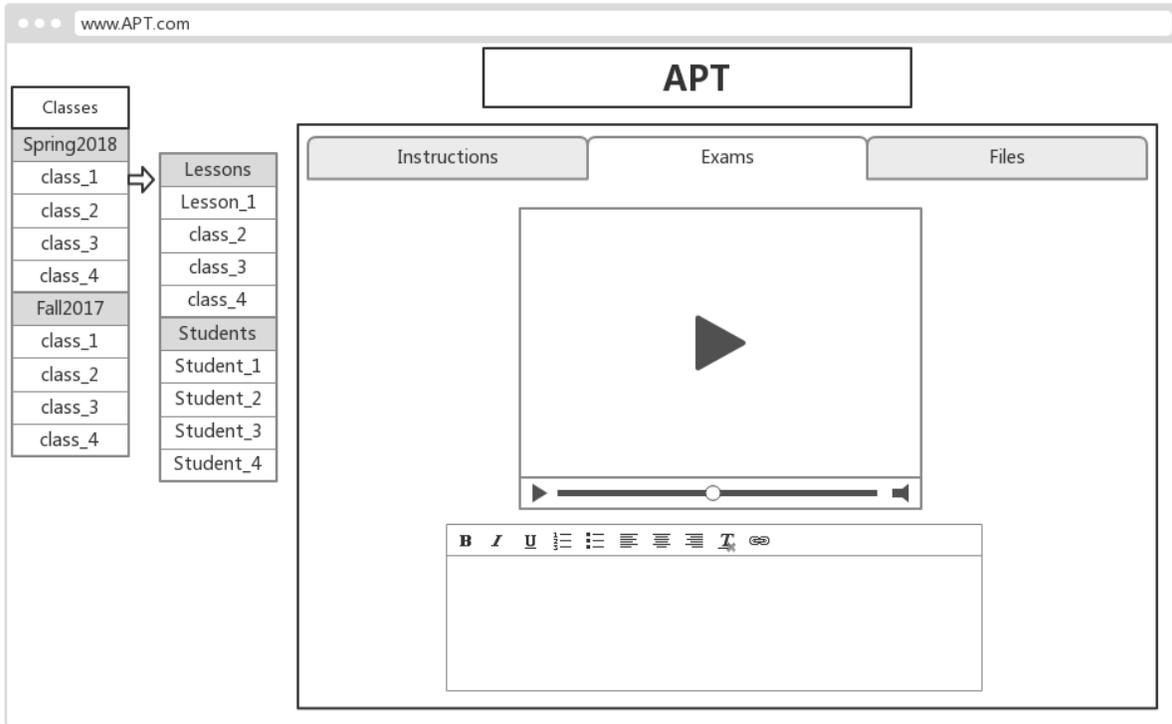


Figure 15: Wire Frame

4.6. Prototype

The prototype will be the foundation of the final system. The workload of the design process will be more linear with the help of prototype. The prototype illustrated how the user would interact with the system and communicate the initial product idea. The prototype has to reflect what the user expects to see on each page and the elements' relative priority on the page.

The prototype is designed by using the Axure software, which is a professional, fast prototyping tool. Axure enables the front-end engineers to quickly create wireframes, flowcharts, prototypes, and specification documents for application or websites. As a professional prototyping tool, it can quickly and efficiently create prototypes, and support multi-person collaborative design and version control management.

For better user experience, the standard Auburn theme was used for the prototype. Figure 16 shows the prototype of the login page.

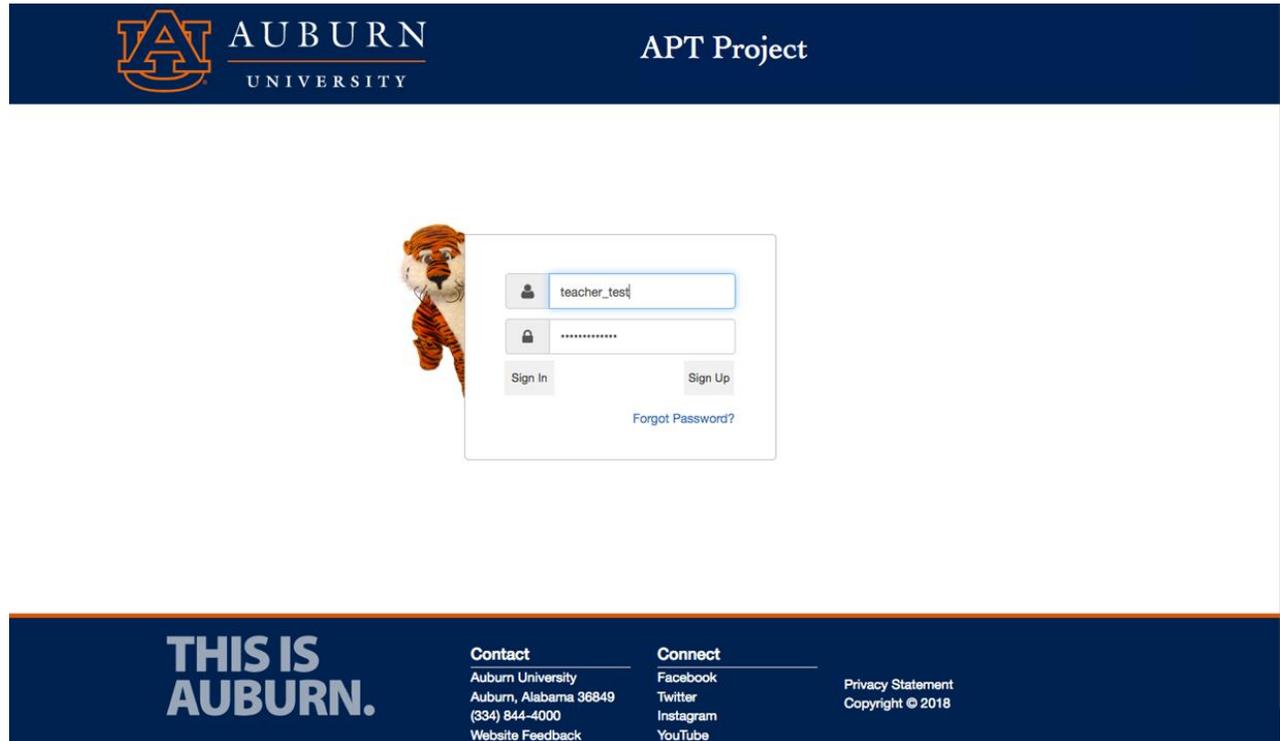


Figure 16: Prototype of Login Page

Figure 17 shows the prototype of the Add Classes page. The scenario is, after clicking the setting button on the right of a specific class, add class page shows in the central area. Following the functional requirement, the teacher user copies course materials such as videos, pre-tests, exams into another one by choosing the right class' information in the drop-down menu. If there is no need for this function, the default option is None.

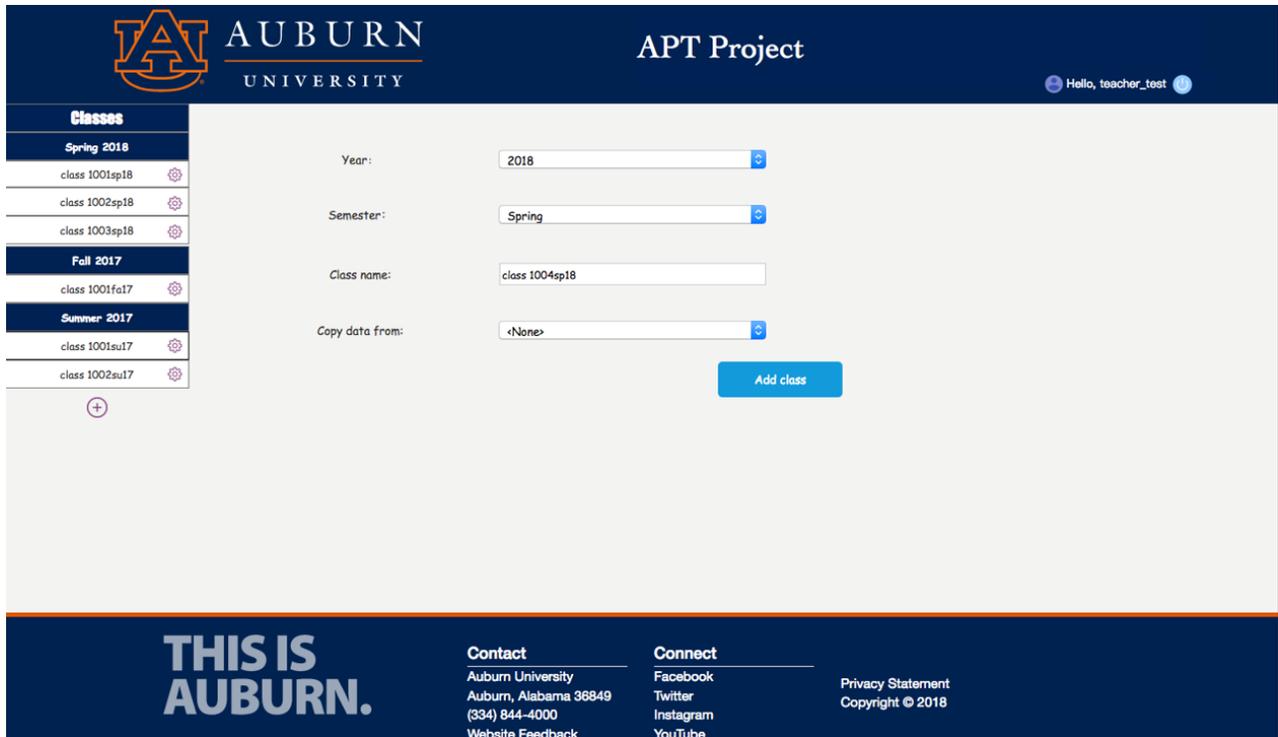


Figure 17: Prototype of Add Class Page

Figure 18 shows the prototype of class's details editing page, users edit the current class's detail by clicking the setting button on the right of the class. Users also delete the class on this page.

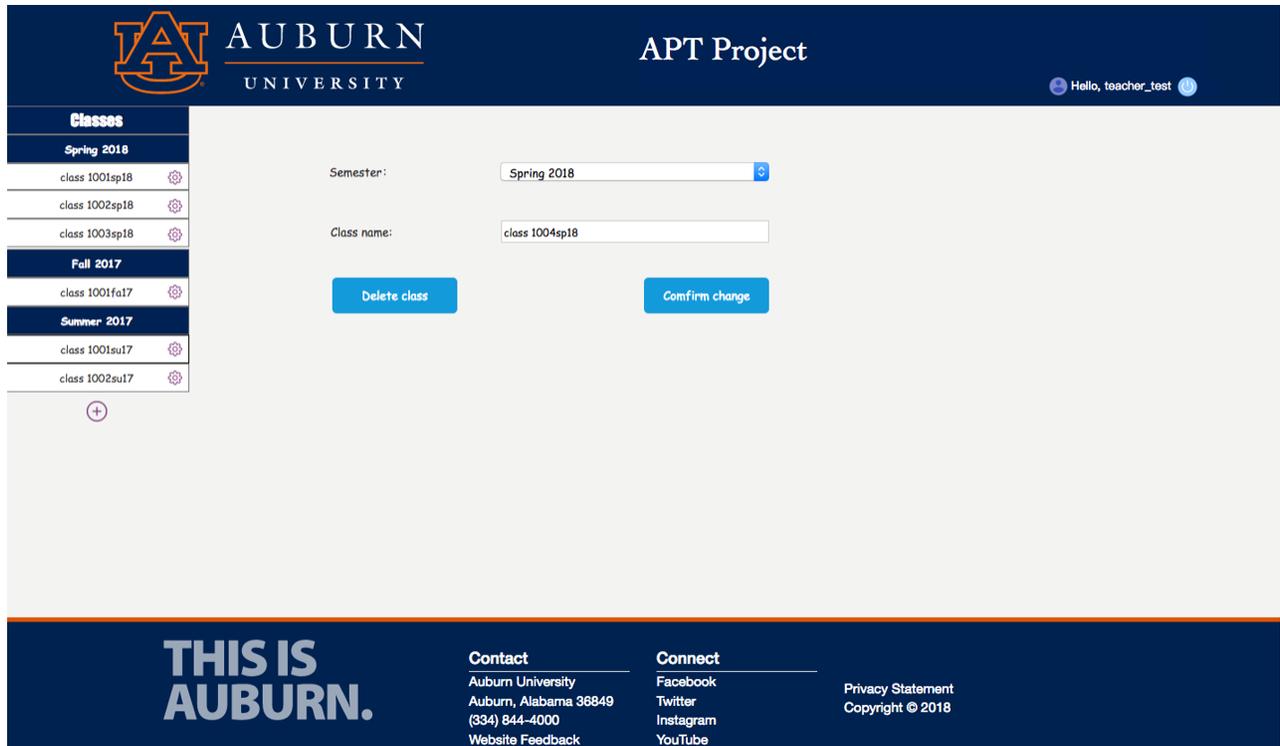


Figure 19: Prototype of Lessons Page

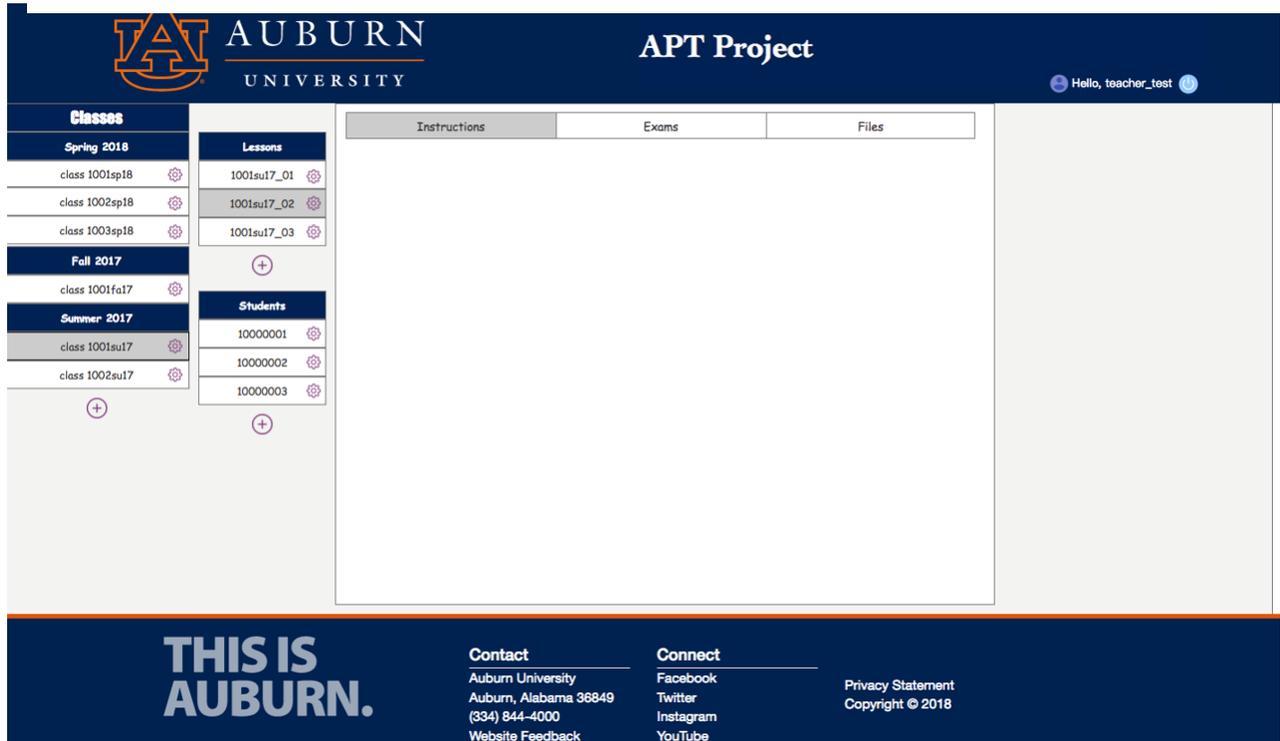


Figure 18: Prototype of Class's Details Editing Page

Figure 19 shows the prototype of the Lessons page. Users could access the lessons after

they choose the class. For teachers, there is a students' list under the lessons list. Teachers can edit the lesson details by clicking the setting button on the right side. Teachers can also edit the lesson

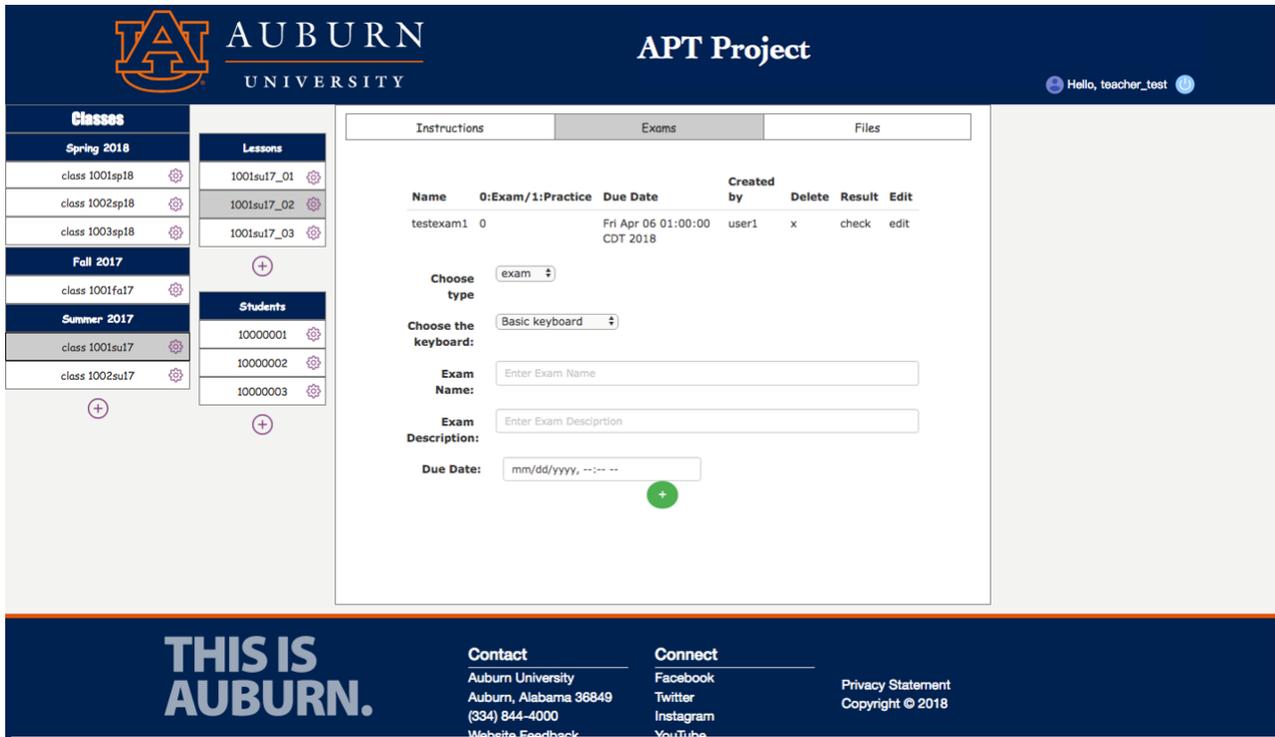


Figure 20: Prototype of Exams Page

details such as the lesson's name or delete the lesson.

The exams page shown in figure 20, the Exam page layout of the version 1.0 was created to support teachers in editing the details about exams. The details of existing exams showed in the head area including name, exam type, due date, created by, delete status, result, and edit these details at the end of this line. Teachers can also add exams by clicking the button on the bottom after they entered the information above.

The files page shown in figure 21, this page contains all the files including question videos, practice tests, and other files related to the lesson. Teachers delete the file by clicking the on the right of the line and add a file by clicking the button on the bottom after choosing the

location of the file above.

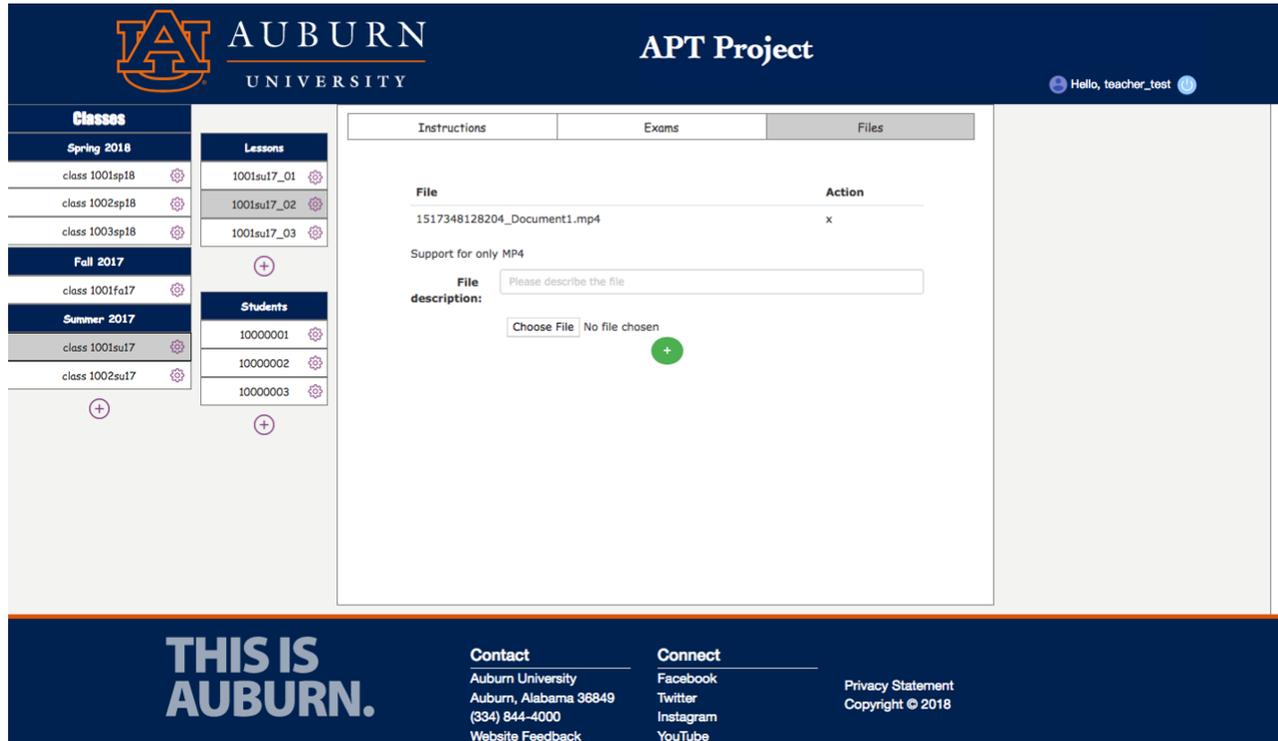


Figure 21: Prototype of Files Page

4.7 The integrated version of Prototype

During the first 2,3 weeks of the developing process, the team conducted two different version of prototypes. When the team confirmed with our clients Dr. Marisha Speights Atkins and Dr. Dallin Bailey, they wanted both the great features from the two versions, the research team decided to integrate the two versions.

Figure 22 shows the Teacher's main page of prototype version 2. It has the same feature that contains a sidebar with semesters. Figure 23 shows the assignment page of the prototype version 2 and figure 24 shows the assignment page of prototype version 2.

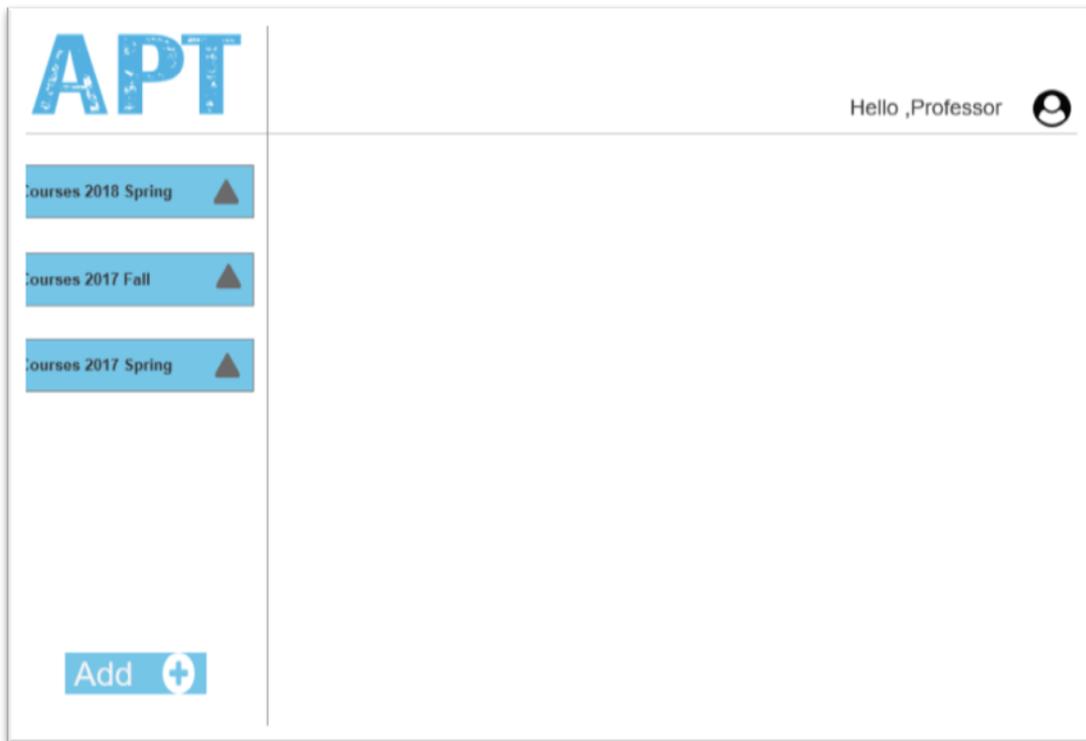


Figure 22: Main Page for Teacher, version2

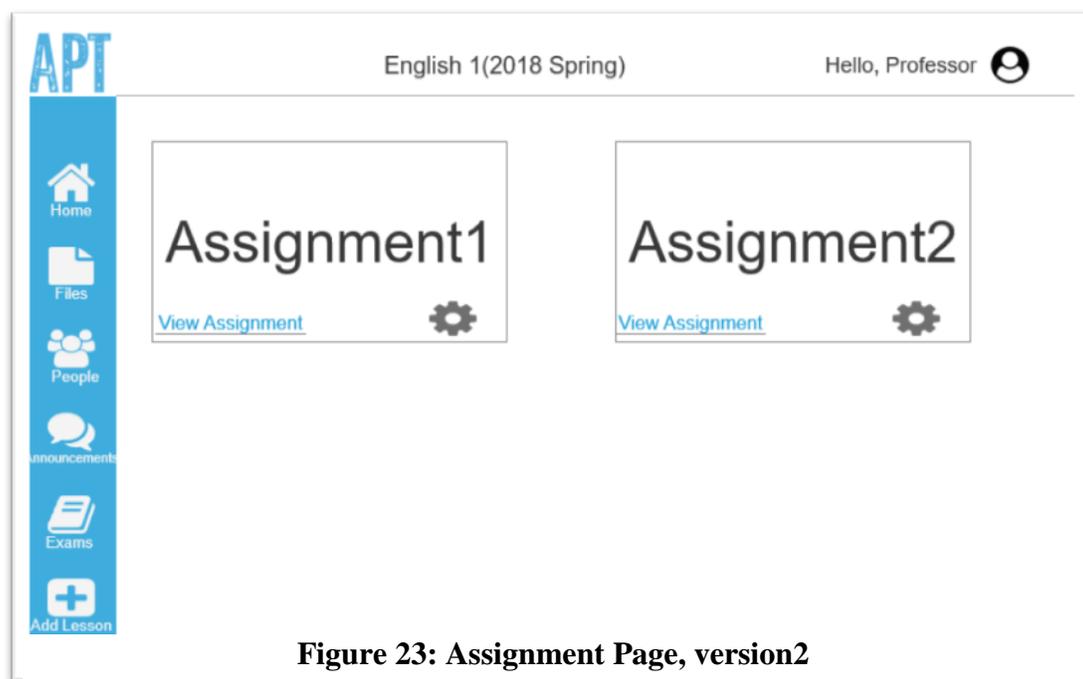


Figure 23: Assignment Page, version2

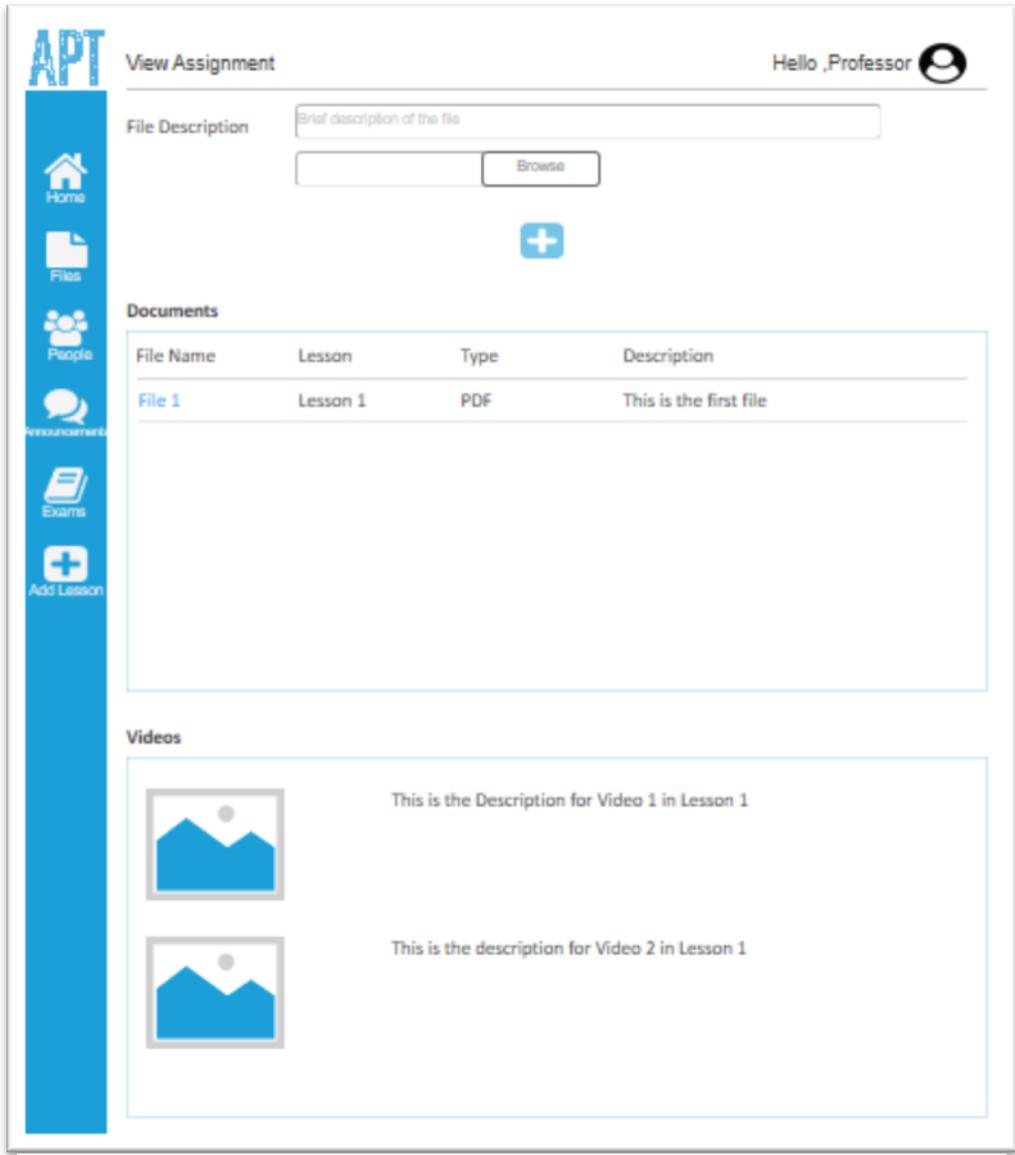


Figure 24: Assignment Page, version 2

CHAPTER 5. Implementation

5.1. Project Schedule

The Apt-GT user interface design team was allotted eight weeks to work on the version 2.0 with the new client's requirements. The first week we worked on the design of the new function. First one is the function that teachers can copy course and materials without students' information and separate the classes into different semesters. For the second week, the team designed the conceptual model for future designing. Moreover, the next week the team developed two prototypes with different styles and confirmed with the clients. There were both great features that our clients wanted so we integrated the two prototypes into one version. The next four weeks, according to the final prototype, were utilized to develop the responsive components of the user interface and confirmed the system with our clients at the same time. In the last week, the team worked on the project paper and presentation.

5.2 Tools and Technologies

The technologies for front-end pages such as HTML, CSS, JavaScript are used for developing the APT-GT.

The HTML is a hypertext markup language. Hypertext means the language could contain more than just texts, but also pictures, links, music, and even applications. In essence, HTML is the same from the language used in our daily communication. The difference is that natural language is used for human-to-human communication and HTML is used for communication between humans and browsers. To make the browser display the cool effects we expect, we use HTML to tell the

browser where to put a control. As for what this control looks like, what is the specific function, we need the help of CSS and JavaScript respectively.

CSS stands for cascading style sheets, a computer language used to represent file styles such as HTML or XML.

JavaScript is a direct translation scripting language that is used to implement complex dynamic functions for web pages.

5.3 Scenarios

Scenario 1-User Sign In/Register:

Once User X opens the system, the first page is the sign in page, where X enters the username and password. If X forgets the password, he/she can click on “forgot your password?” button to change the password.

If user X is a new user, he/she can click on “New User? Create an account”, from which X will be redirected to the register page. Where he/she can create a new account. But can't do any further action until being approved by the admin user.

Scenario 2-Account Setting:

User X can modify his/her account sitting by clicking on the profile picture on the top right corner of any page. he/she will be redirected to the account setting page, where X can edit his/her information like name, email address, phone number, and possibly change their account password. User X can also change the profile picture and upload his/her own. Finally, user X can press the “Save” button to save changes, from which will be directed to the homepage.

Scenario 3-Admin Role:

An Admin User X can sign into the ALT system using his/her credentials. Once X signs

in, he/she will be directed to the home page from which user management can be done.

As follows:

- X can approve newly registered users by assigning them a student/teacher role.
- X can disable a user (student/teacher/new user) to deny further access to the ATL system.
- X also can change the roles of existing teacher to students and vice-versa.

Scenario 4-Teacher's main page:

Once teacher X logs in, he/she will be directed to their home page, which is the Lessons page, from which:

- X can view all the existing lessons and their descriptions
- X can press on "Create Lesson" to create a new lesson
- X can click on "Manage Users" to manage users
- User X can also search for a particular lesson using the search field.
- X can delete a lesson by clicking on the "trash icon" on the top right of each lesson.
- X can edit lessons related to the lesson by clicking on the "Edit Lesson" button on the bottom left of each lesson
- X can also go to the tests related to a particular lesson, by clicking the "Tests" button on the bottom right of each lesson

Scenario 5-Teacher's lesson page:

One X clicks on a particular lesson, he/she will be directed to the lesson's page, from which X can view files of the lesson y, X can update a file by clicking the "Update" buttons that correspond to that particular file, he/she can also delete a file by pressing the "Remove" button that corresponds to that file.

Finally, X can use the side menu from any tab of a particular lesson to go to any other related tab like homepage, exams page, manage users page, and manage videos page.

Scenario 6- Teacher’s Create lesson page:

Once user X click on “Create lesson” in the home page, he/she will be directed to the Create lesson page, where he/she can create a new lesson, by specifying the difficulty level, lesson name, and description, finally add files to the lesson where he/she can add multiple files by pressing the “plus” icon on the left on the file upload file, to add field, finally X can click on the “Create Lesson” and the lesson will be created.

Scenario 7- Teacher’s Manage files page:

Within a particular lesson, if user X, clicks on the “Manage videos” from the sidebar, he/she will be directed to the manage files page, from which:

- Where X can view existing files and their creation date
- X can delete a particular file by clicking the “delete” button that corresponds to that file.
- X can add new videos, by uploading a file and its description, he/she can also multiple files by clicking the “plus” button next to the upload field.

Scenario 8- Teacher’s Test page

From the Tests main page of a particular lesson from which:

- User X can click on the “Previous Exams” button to go to exams page
- User X can click on the “Previous Practices” to go the practices page.
- User X can create a new Test, by filling the information needed in the “Create New test” form, like test type, keyboard type, exam title, description and due date. Finally, user X can add the test by clicking the “Add Test” button, which save the test to the tests lists

depend on its type (Practice/Exam).

Scenario 9-Teacher's Announcements page:

- Teacher X Enters the announcement page and decides to make an announcement.
- X types in the announcement and clicks on send.
- All the students are notified of the announcement on their respective pages.

Scenario 10- Student Role:

When a user logs in as a student, he can access the following functionalities:

- Student X registers an account
- X logs into his account using his credentials
- X reads announcements from the teacher and responds if needed
- X goes to lessons page and picks a lesson
- X watches videos for lesson
- X takes related practice tests
- Once the teacher has posted an exam X answers questions in the exam
- X reviews his scores

5.4 Implementation Process

This section describes how the APT-GT v2.0 web application was developed. The team used Scrum as the software development process, so the whole process is divided into different sprints. With Scrum, products can have a series of fixed-length iterations called Sprints, providing the team with a framework for regularly distributing software. Milestones (the end of the Sprint) will frequently occur, which will make team members feel that there is real progress in each cycle, and everyone is valued and motivated. Short iterations also increase the effectiveness of evaluation

and quick feedback based on the testing.

Scrum process can flexibly adapt the frequently request changes in demand. By using Scrum, the prototypes can be developed quickly and present to customers. At the same time, Scrum gets the suggestions and quickly get action in the next sprint.

The development process is divided into 4 sprints. Moreover, after reviewing all the sprints, the implementation details of the software language and tools were discussed.

5.4.1 (a) Sprint 1

Sprint 1 began after the decision was made to improve APT-GT application in terms of usability and functionality. The new functional and design requirements were collected, and UI details were developed based on the extended functionality.

(b)User Interface

The user interface design team created a wire frame based on the conceptual model. The wire frame contains the main function page of the APT-GT. After discussing implementation, the design team decided to come up with a prototype. This prototype interface design will be reviewed during Sprint 2. Since the web application had not been fully developed, the testing committee created a test plan document containing the possible test cases.

5.4.2 (a) Sprint 2

At the beginning of Sprint 2, the initial user interface design was approved, and more resources for the designers to examine while developing were provided.

(b)User Interface

During Sprint 2, the interface team started working on the detailed UI design. The requirements for easy navigation, better aesthetic appeal, ease of changing the course description we took into consideration. As a part of the new design, APT-GT logo was designed. Among the

several variants, the most appropriate one was chosen. Since the images were created in Sprint 1, the team developed a fully-interactive prototype was presented at the end of Sprint 2 and the feedback was documented.

5.4.3 (a) Sprint 3

By the end of Sprint 3, the team had completed a high-fidelity APT-GT prototype. After getting the approval, the team decided to start the development of the web application.

(b)User Interface

The user interface design committee decided that the best way to improve on the version 1 was to develop a responsive web application. Thus, APT-GT would be accessible to those on smartphones. The first component to develop was the side-bar template that would be reusable on all pages for ease of navigation. Simultaneously, the new functionality was being developed, which

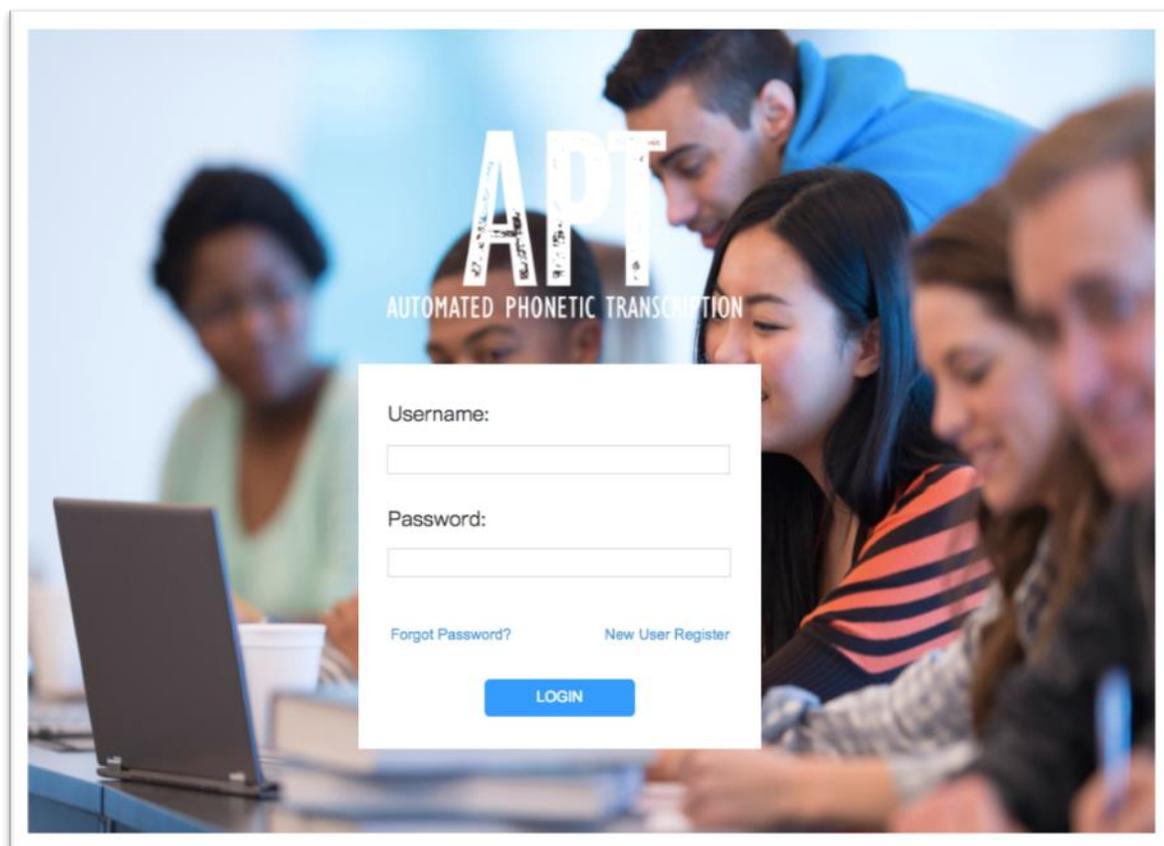


Figure 25: New version of Login page with logo

could be later integrated to the responsive front-end.

The changes that were made to the front-end after the feedback was to change APT to APT-Grading Tool. It was also decided that the course dashboard will be changed to an Assignment dashboard to help the student avoid an extra step to access the course material, practice tests & exams.

5.4.4 (a) Sprint 4

The focus of Sprint 4 was to ensure all of the customer's requirements were met the APT-GT v 2.0 and the new version was tested for all functionality.

(b)User Interface

The final change that was made was to make the login page more appealing and with a clean one-page design for the project homepage. The latest version of the login page has been integrated with the other functionality. The user interface is fully developed and will be integrated with the API.

5.5 Evaluation and Usability

5.5.1 Evaluation

The project evaluation should meet the project's hypothesis identified at the beginning of the project and satisfy the user's operational needs under various scenarios. The system was usability tested with a set of users to ensure that the program has a good degree of completion, increased functionality, good ease-of-use and a satisfactory level of usability.

5.5.2 Usability Testing

During the design and testing phase we completed many weeks utilizing the Scrum framework and the team completed the system design and development to a level of client's satisfaction. We collected evaluation of the system by using the Survey Monkey online tool. The team created a series of pre-survey and post-survey of the current system and recorded the results. The questionnaires are our main user evaluation approach, and these questionnaires are sufficient to evaluate the user acceptance of the system.

The Evaluation starts with the pre-survey. Selected users take the questionnaires. After users complete the pre-survey, the team offer a specific scenario for them to work on. And then the users take the post-survey.

The pre-survey and post-survey are listed in the 5.5.3 and 5.5.4.

5.5.3 Pre-Survey Results

The pre-survey questions are:

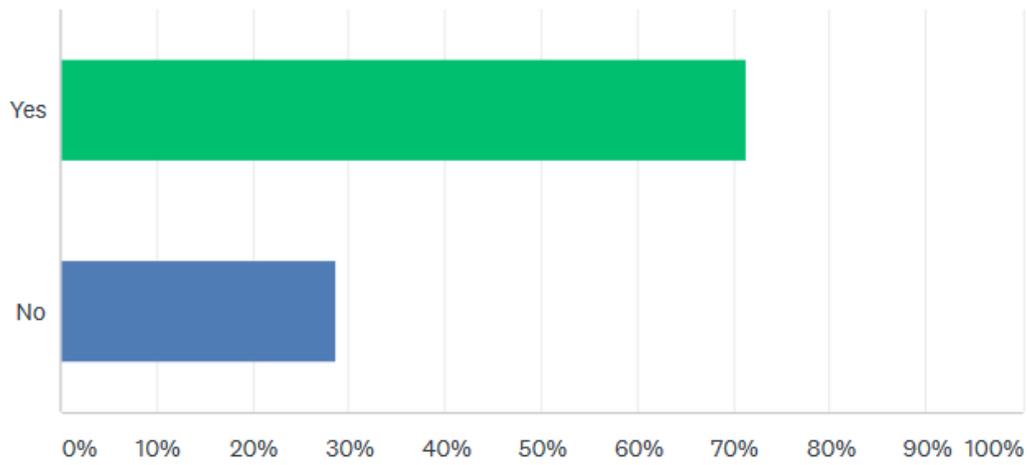


Figure 26: Online Education website

1. Have you used an online education website?

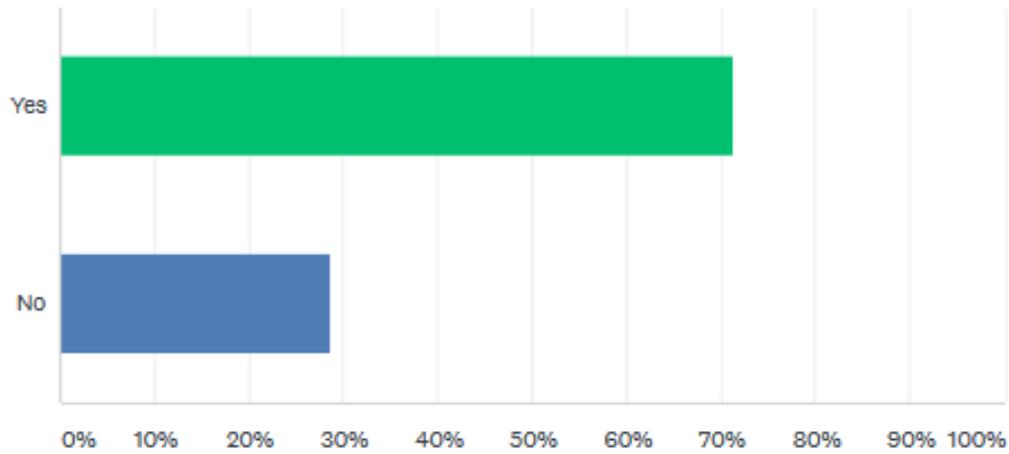


Figure 27: Related knowledge

2. Do you have any knowledge or training about Communication Disorders?
3. Do you know about User Interface Design? Have you been working on it?

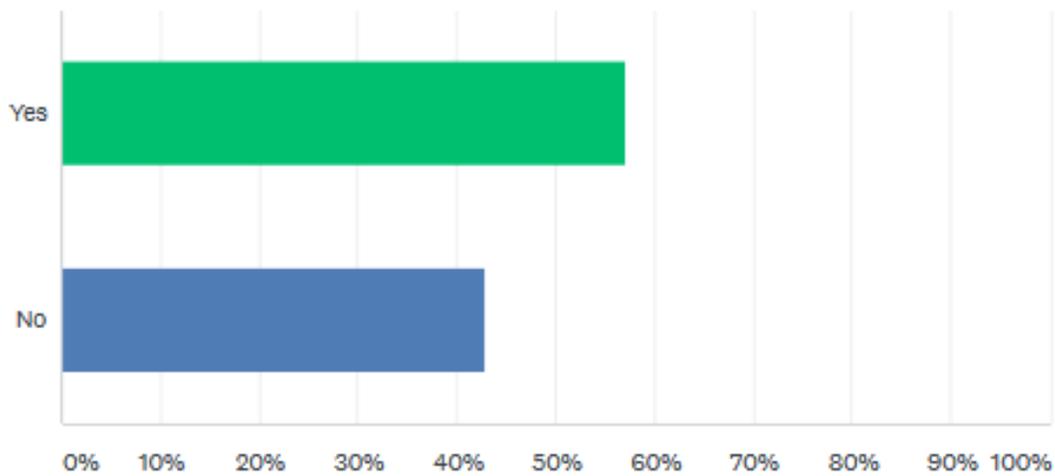
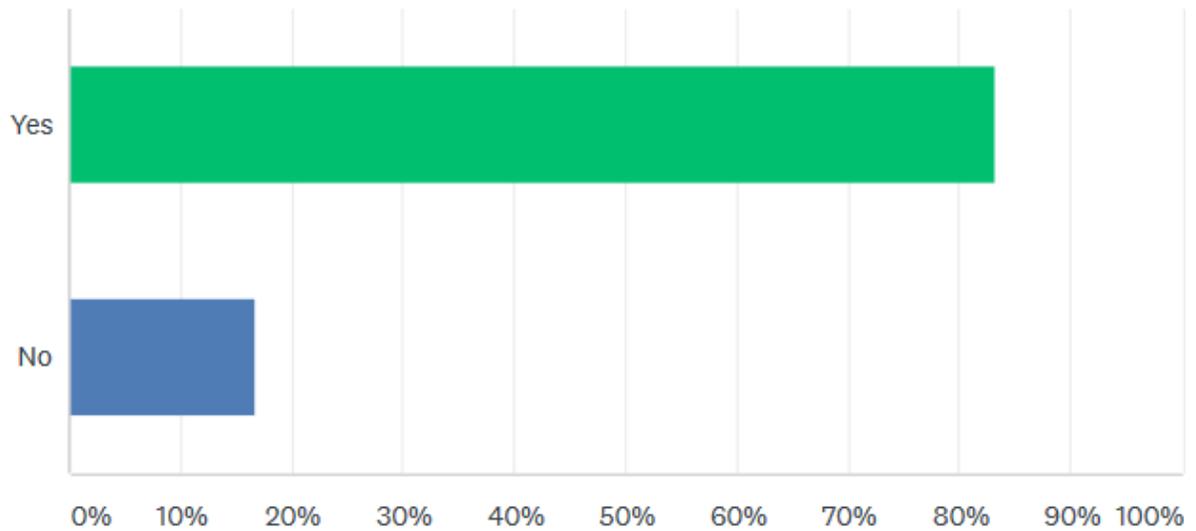
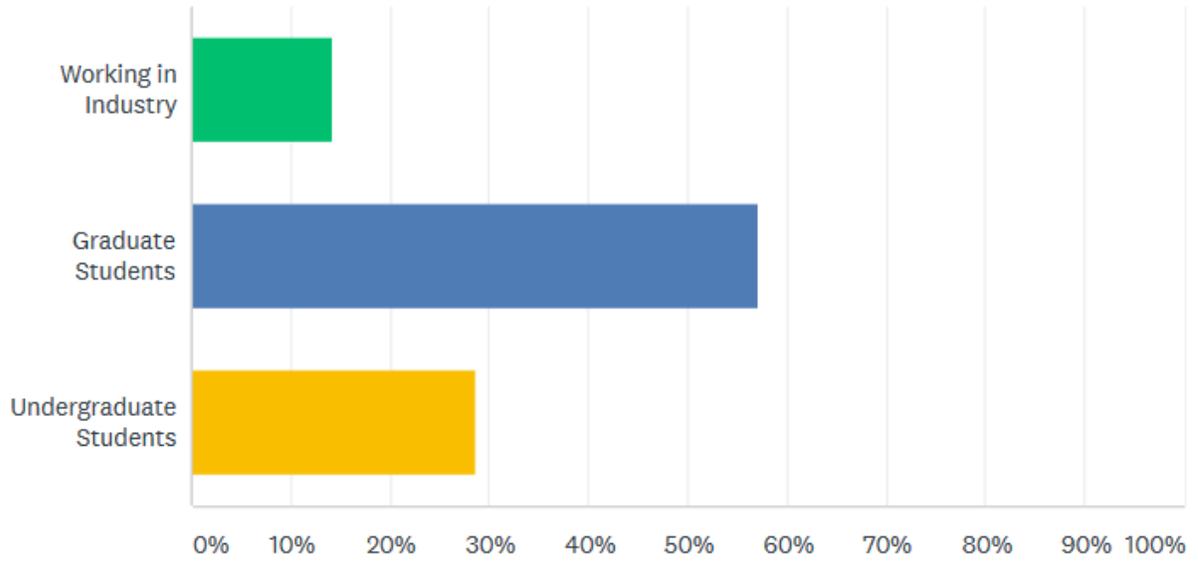


Figure 28: User Interface Design experiences

4. What is your current position?



5. Do you want to use online education website for your study?

5. What web browser do you usually use? Select all that apply.

6. Have you ever take an exam online?

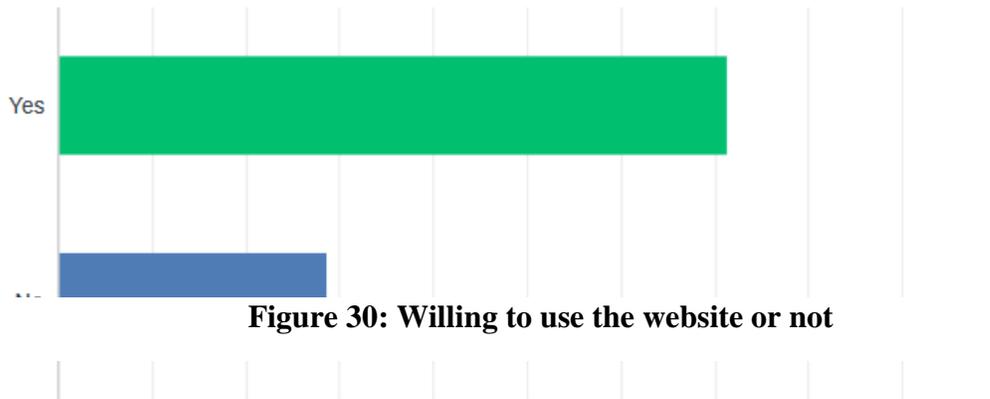


Figure 30: Willing to use the website or not

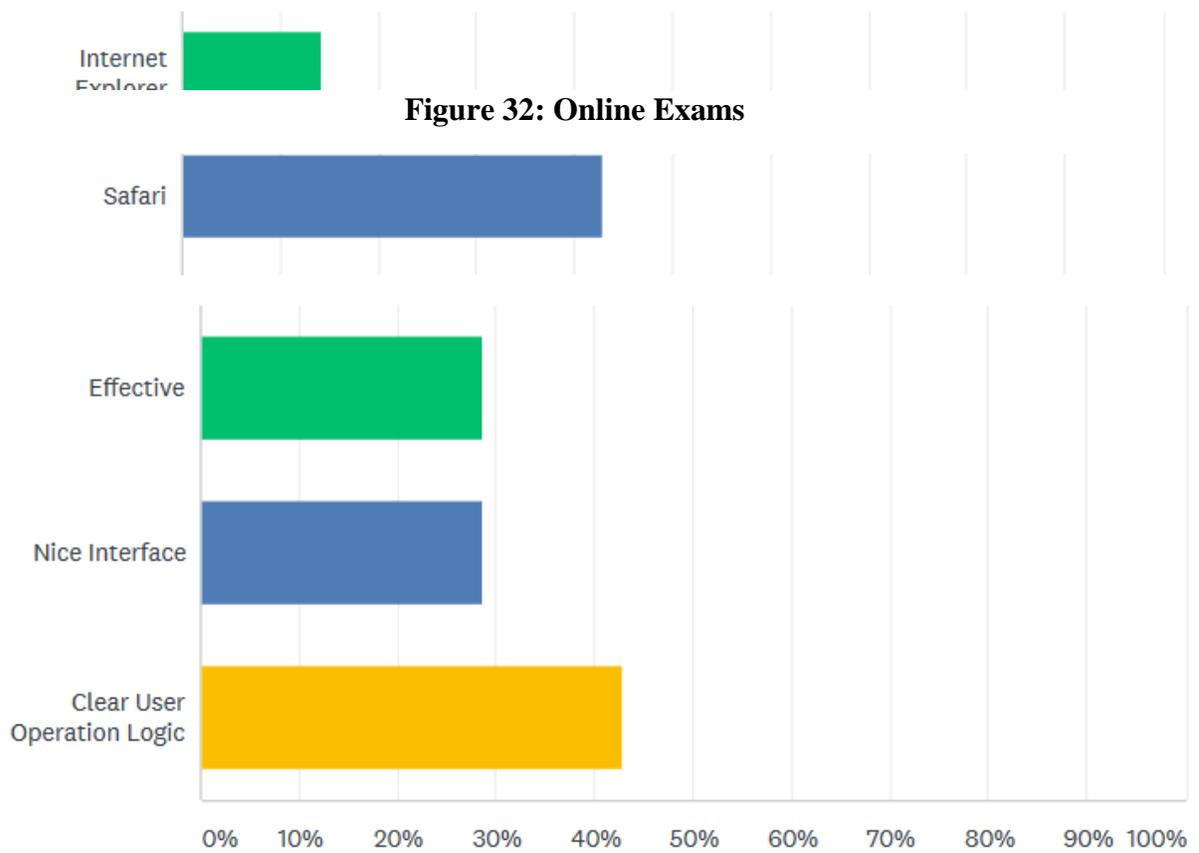


Figure 32: Online Exams

7. What is the most critical feature of an online learning system?

Figure 33: Most important feature

5.5.4 Post-survey Result

The post-survey related to **Satisfaction** are:

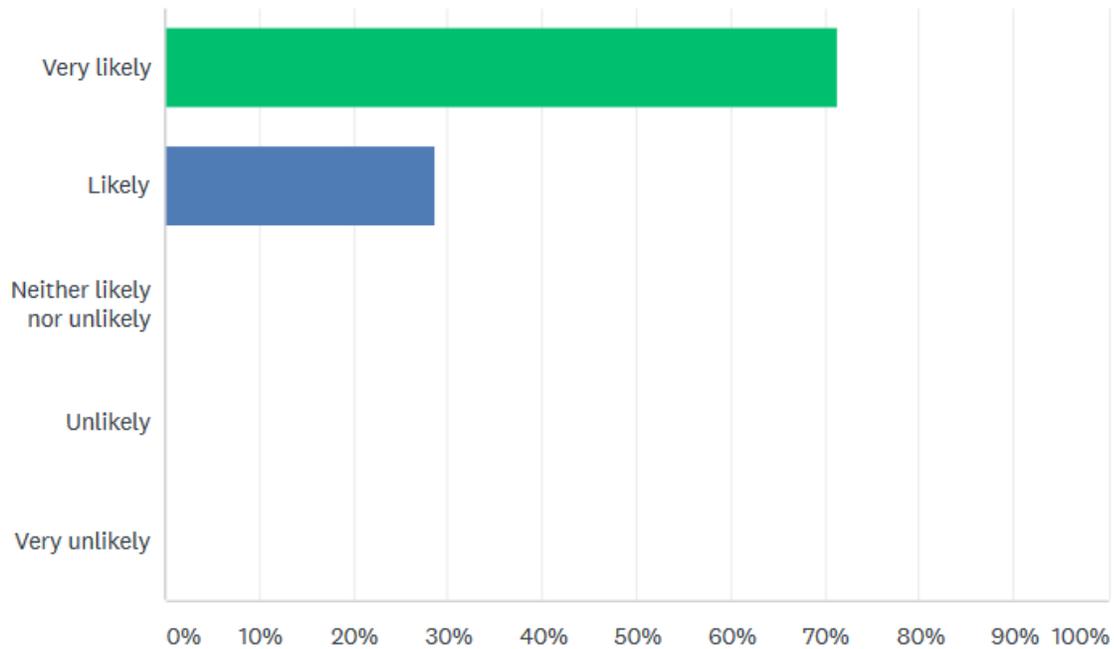


Figure 34: Satisfaction survey 1

1. Do you like the design of the web application?
2. The user interface is good compared to the version 1.0

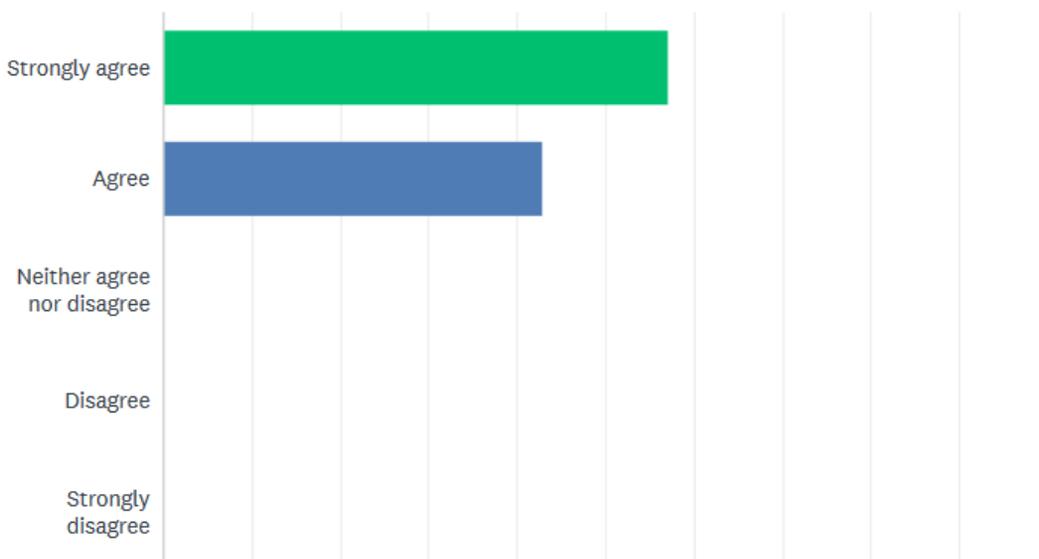


Figure 35: Satisfaction survey 2

The post-survey related to **Ease of Use** are:

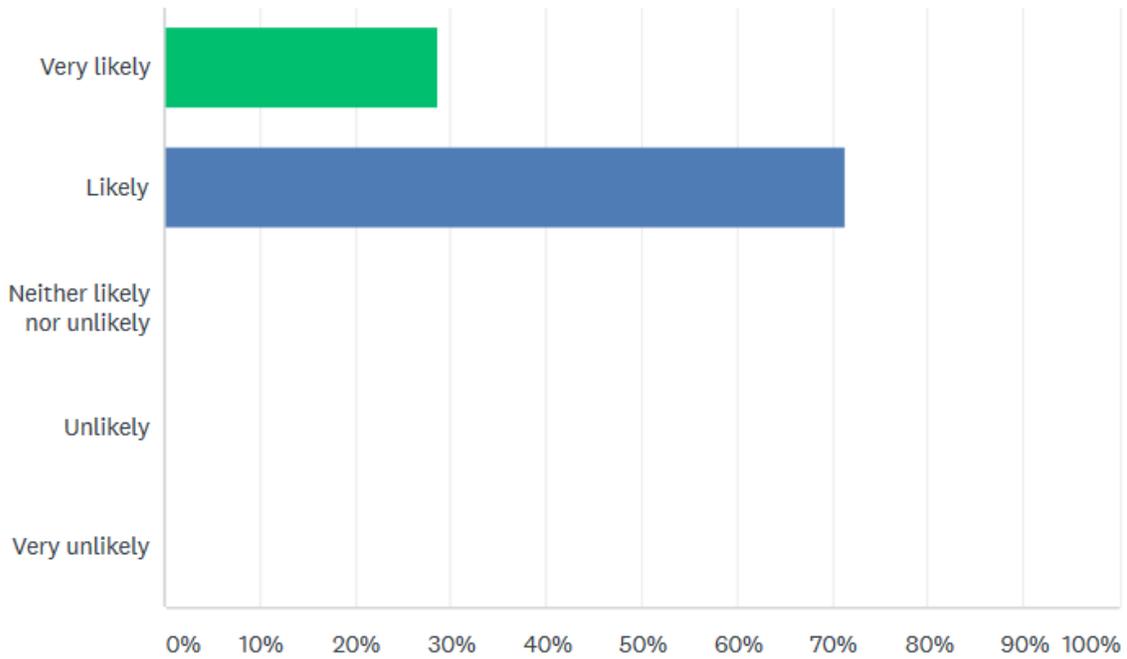


Figure 36: Ease of Use Survey 1

3. Compared to the version1.0, the final design is easier to use.

4. The color scheme of the web application is attractive.

The post-survey related to **Efficiency and Effective Feedback** are:

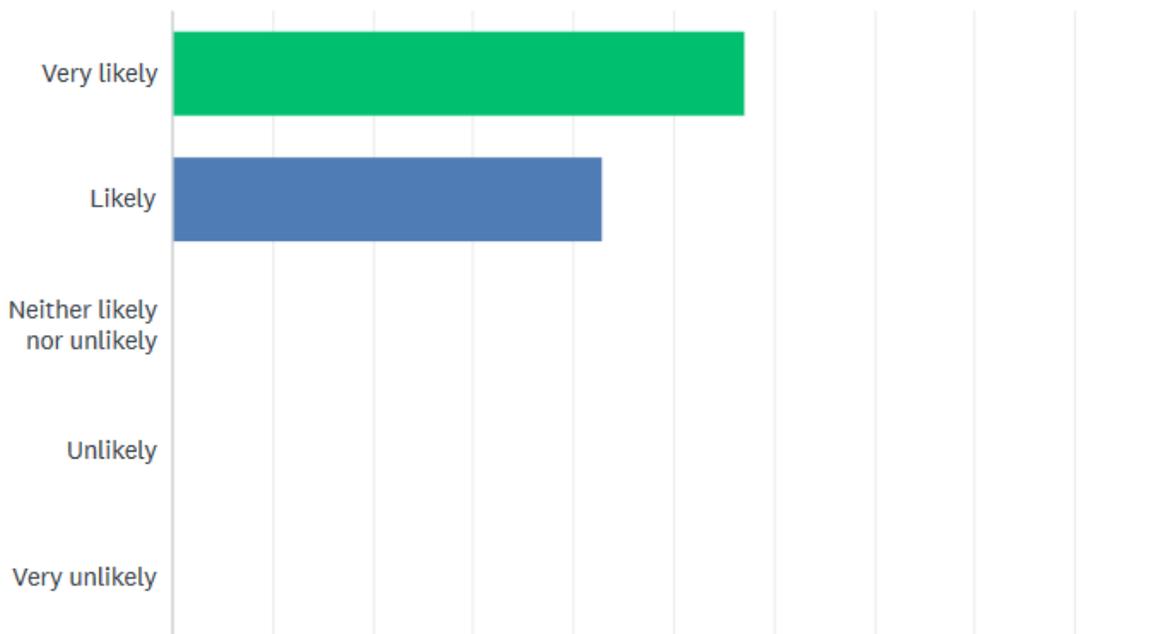


Figure 37: Ease of Use Survey 1

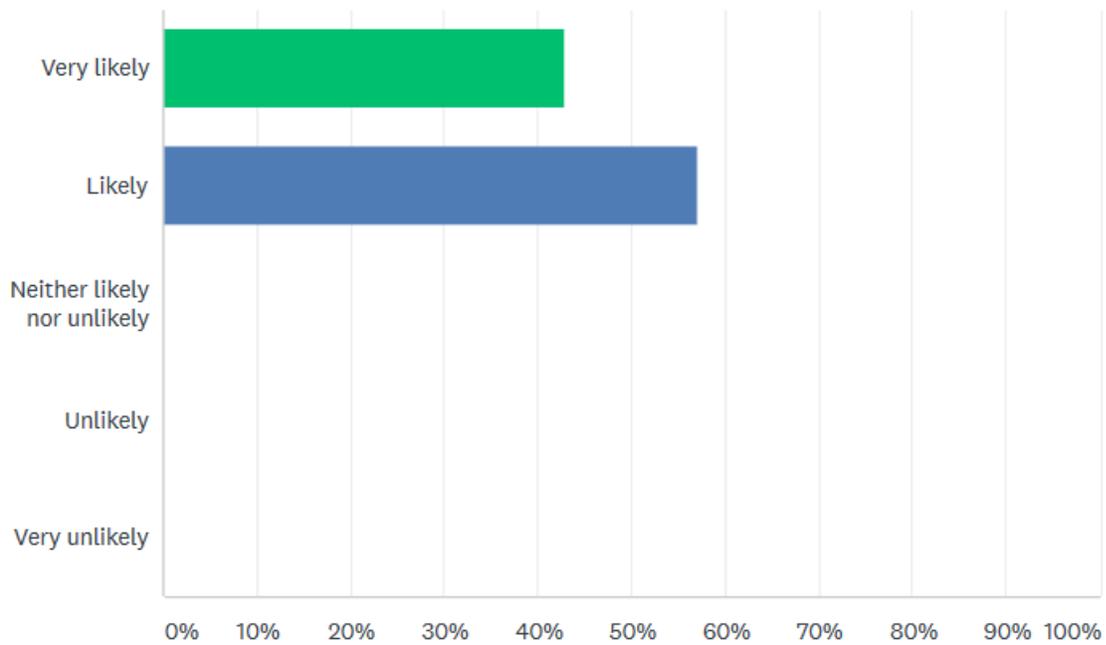


Figure 38: Efficiency and Effective Feedback Survey 1

5. The fonts used in the application are easy to read.

6. Compared to the version 1.0, do you think the user operation logic is more effective?

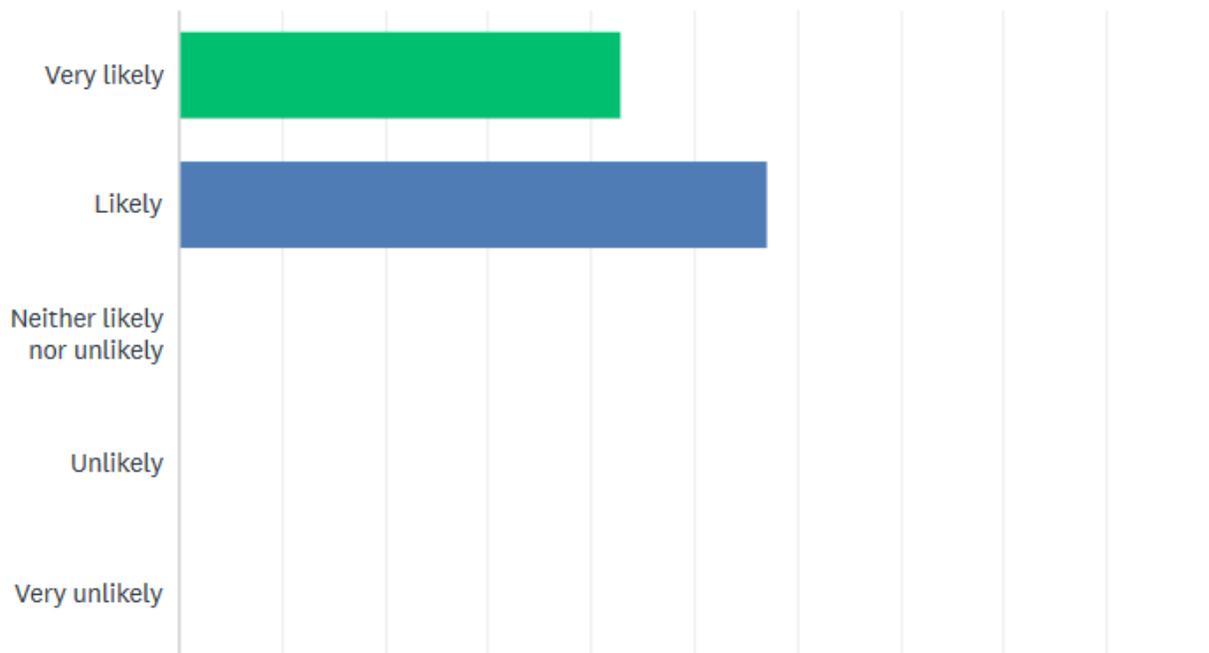


Figure 39: Efficiency and Effective Feedback Survey 2

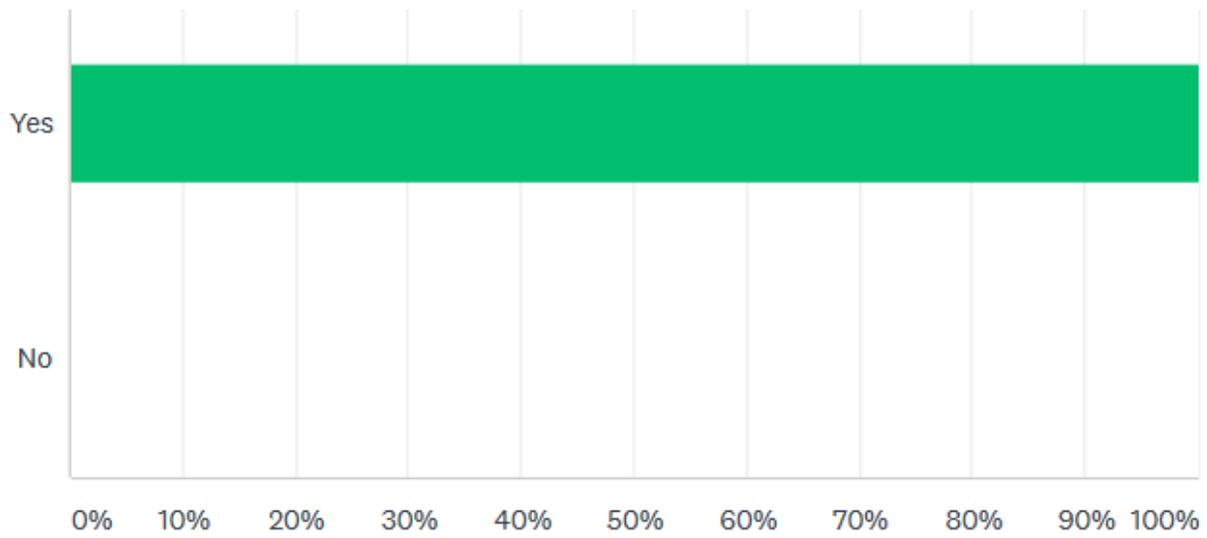


Figure 40: Post-survey

7. Do you want to recommend this project to your friends?

5.5.5 Results analysis

The survey participants were asked a few pre-questions before the study to determine the participating group characteristics. The survey shows that 70% of the participants had used online education website and 70% of them knows about the training of Communication and Disorder. In the participants, 12% are working in industry, 57% are graduate students and 31% are undergraduate students so half of them knows about and have been working on UI design. Survey shows that 82% of the participants want to use the online education website to study and the most the popular browser is the Google Chrome (56%). The survey shows that the most important feature of an online education application is the application has a clear operation logic and 70% of the participants take online exams before.

The navigation, accesses of various functionality and the ease of navigation were determined by the efficiency and effort that a participant had to perform or complete some tasks associated with the role that they access the website through.

Overall, most of the participants agreed with the hypothesis:

1. The final design could satisfy the users
2. The final design is easy to use.
3. The final design is more efficiency to use.
4. The final design could have a more effective feedback and a clear operation logic for users.

CHAPTER 6. CONCLUSIONS AND FUTURE WORK

APT-GT is an application that provides students with efficient learning experiences and also offers easy-to-use student management functions for teachers. The project aims to help teachers in the education department manage their lectures, practices, and exams. The current version did not meet the specific requirements of our clients. Therefore, we re-designed and upgraded the system based on their requirements.

During the developing process, the team discussed about the new requirements and updated and clarified the operation logic (i.e. separate the classes into semesters). The team created the wireframe based on the new requirements and then the system prototype was developed. The team met with the clients every week to ensure that the design and development process was on track. The team have completed all the development tasks within the time-frame specified.

The web application provides a better interface design, user operation logic and a better over experience for users. The result of the pre-survey and post-survey support the conclusions. In the future, through our iterative design and implement process, we will provide more functionality to make the APT-GT better suited to support the needs of the teachers as well as the students. The APT-GT should also be made available as mobile application in both iOS and Android platforms, in the near future.

BIBLIOGRAPHY

1. Jin, W., & Zhirui, D. (2017). Research on Mobile Learning Model of College English Based on WeChat Platform. *Eurasia Journal of Mathematics, Science & Technology Education*, 13(8), 5847-5853.
2. Li, S., Jin, Q., Jiang, X., Park, J.H. (Eds.) (2014). *Frontier and Future Development of Information Technology in Medicine and Education*. Springer Nature. Available from <https://www.springer.com/us/book/9789400776173>
3. Eric Overfield, Rita Zhang, Oscar Medina, Kanwal Khipple. (2013). *Pro SharePoint 2013 Branding and Responsive Web Development*. Springer Nature. Available from <https://www.anress.com/us/book/9781430250289>
4. Wang, G, and Y Gao. *The design and implementation of mobile learning platform based on WLAN*, *Computer Intelligent Computing and Education Technology*, 2014.
5. Weber, Alan S., Hamlaoui, Sihem (Eds.). (2018) *E-Learning in the Middle East and North Africa (MENA) Region*. Springer Nature. Available from <https://www.springer.com/us/book/9783319689982>
6. Zhou, W., Nicholson, P., Corbitt, B., Fong, J. (Eds.). (2003). *Advances in Web-Based Learning – ICWL2003*. Springer Nature. Available from <https://www.springer.com/us/book/9783540407720>
7. Galitz, W. O. (2007). *The essential guide to user interface design: an introduction to GUI design principles and techniques*. John Wiley & Sons.
8. Responsive design is called responsive "design" but not responsive "technology"
http://vlambda.com/wz_xaFXfnpJo5.html
9. Client–server model, Wikipedia https://en.wikipedia.org/wiki/Client%E2%80%93server_model
10. Web Servers and Web Browsers Configuration Architecture,
https://support.proiv.com/V8_Help/openclientadmin/web_servers_and_web_browsers_configuration_architecture.htm
11. How E-learning Market Growth in upcoming years., M2 Presswire, March 19 2018.
12. Chang, C. C., & Hsiao, K. C. (2010, September). An e-learning system for information management education based on web services. In *Computational Aspects of Social Networks (CASoN), 2010 International Conference on* (pp. 221-224). IEEE.
13. Georgetown University’s Center on Education and the Workforce, 2010.
14. Usability, Wikipedia, [Online]. Available: <https://en.wikipedia.org/wiki/Usability>.

15. Li, Q., Lau, R. W., Wah, B. W., Ashman, H., Leung, E. W., Li, F., & Lee, V. (2009). Guest editors' introduction: Emerging internet technologies for e-learning. *IEEE Internet Computing*, 13(4), 11-17.
16. Introduction to User-Centered Design, [Online]. Available: <http://www.usabilityfirst.com/about-usability/introduction-to-user-centered-design/>.