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SMART LECTURE: EXTENSIBLE AND SCALABLE LEARNING APPLICATION USING WEB TECHNOLOGY

Master's Thesis

ILYAS CHENOUF

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Thesis Advisor: ASSIST. PROF. DR. TAMER UÇAR

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ABSTRACT

SMART LECTURE: EXTENSIBLE ANDSCALABLE LEARNING APPLICATION USING WEB SERVICE TECHNOLOGY

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Every solution discovery is driven by the existence of a problem or a void, and as much as we have had online learning or classroom, there has been a void yet to be satisfied. Online learning has been there but no luck; it is a fair share of technical problems. We will discuss how to solve it by using web services and keep the same feeling as the classroom experience; most are solved by the Smart Lecture learning system, that capable of giving a lecture and provides the student with the ability to ask questions by the speech to get real-time answers and feedback with the ability to express the understanding at the same time.

Keywords: Classroom, Online Learning, Web Services, Real-time.

ÖZET

AKILLI SINIF: WEB SERVİS TEKNOLOJİSİ KULLANAN GENİŞLETİLEBİLİR VE ÖLÇEKLENEBİLİR BİR ÖĞRENME UYGULAMASI

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Her çözüm bir problemin veya bir boşluğun keşfedilmesinden ortaya çıkar. Çevrimiçi öğrenme ve çevrimiçi sınıflarımız olduğundan beri doldurulamamış bir boşluk bulunmaktadır. Çevrimiçi öğrenme uzun zamandır var olan bir sistem olmasına rağmen günümüz ihtiyaçlarına cevap verememekte, kendini yenilememektedir. Bu tez çalışmasında çevrimiçi öğrenme ile ilgili çeşitli sorunların web servisler kullanarak nasıl çözüleceğine, sınıf deneyimine çok yakın bir duygu hissettirerek öğrencilere ders vermeyi ve gerçek zamanlı bir şekilde konuşarak soru sorup cevaplar almayı, geri bildirim vermeyi ve anladığını ifade etme yeteneğine sahip olmayı sağlayan Akıllı Sınıf öğrenme sistemine yer verilecektir.

Anahtar Kelimeler: Sınıf, Çevrimiçi Öğrenme, Web Servisler, Gerçek-zamanlı

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ABBREVIATIONS

ACID	:	Atomicity, Consistency, Isolation, Durability
API	:	Application Programming Interface
CSS	:	Cascading Style Sheets
HTML	:	Hypertext Markup Language
HTTPS	:	Hypertext Transfer Protocol Secure
IoT	:	Internet of Things
MVC	:	Model–view–controller

1. INTRODUCTION

The world has faced the biggest changes in the last century that came with the pandemic's unfolding. All countries and regions realized the need to adapt to these changes. One of the methods is to enforce lockdowns, cutting down the activities that need gathering the people, including universities, schools, and all kinds of education. The lockdowns caused the general public to find alternative ways to continue working, studying, and even commerce. And most people went to the same alternative, which is using the web service in their daily life. The utilization of Web services has risen exponentially when compared to pre-lockdown levels. Video-conferencing services like Zoom, for example, have seen a significant increase in usage from both businesses and for personal use.

The virus-imposed lockdowns across the globe have resulted in the subsequent exponential rise in the use of web services with huge utilization in user behavior and patterns. It is interesting to note that these changes have come about rapidly, the employees start adapting to new rules of the work, like shifting the office work to the house and create new working arrangements, and even student did not escape from these changes. And with very little time, all people adjusted to these new implementations. While in some parts of the world, the pandemic has shown signs of receding and stabilizing, it continues to mutate in other countries, causing governments to react by imposing new stringent lockdown measures upon their citizens. Health consultants stay progressively cautious of the possibility of pandemic reemerging, and that lockdown and curfew norms should be relaxed rigorously and slowly with social distancing protocols at the core of the new traditional. In this context, experts anticipate the continued use of web services in the foreseeable future, as global citizens adjust to the new reality that has been forced upon them during the lockdown.

Despite all this change, many people prefer working in these norms on account of working remotely and they have more time to do another thing in their daily life. And we can note also on the learning' side, the schools and the universities kept continues with remote education, which has advantages and disadvantages for the students. regardless of all the

new advantages and disadvantages that came with these norms, one of the common disadvantages in remote learning and in the classroom is the barriers that exist between the teacher and student. These barriers come from arrogance to learn or shyness. which means does not come from the inability to learn, because some people are shy to show their ignorance of things, denounce the question and falsify reality as understands, just in order to show people that they are not stupid or ignorant, and these reasons that prevent man from understanding and learning and in the latter find themselves in a position controlled by the learner.

Shyness creates a barrier between the teacher and the students and limits understanding. Measuring the level of understanding is done by considering a number of factors. This includes the degree of asking questions, the level to which students agree to important points made by the Teacher, and the level of concentration of students throughout the lecture (Rose et al 2015). Teaching students online is one thing and making sure the Teacher and the student are on the same page is another. Therefore, the research shows how the website can be used by teachers to reduce shyness in students by promoting class participation and close monitoring of student attention throughout the lesson.

In this research, we will talk about a new way of learning using web services technology. The idea of this research is to build a web application to prevent shyness during the classroom or with another meaning during the lecture, where the student can ask questions and express his understanding to the Teacher without any problem. To be effective and efficient, in the Smart Lecture, the Teacher will upload his lecture and his contents, and then he will add video answers for frequent questions for his lecture. The student will watch the lecture, and he can ask questions during the watching, he will get the answer by video if not the system saves his question to the teacher, besides that the Smart Lecture collects in real-time feedback from the student involved during the lecture, about the teachers, about contents, and the level of understanding. This feedback is important for the teachers as it helps them understand the level of understanding for the students and improves innovativeness (Pilgrim et al 2012). Smart lecture development is based on the idea of reducing or removing barriers between the students/student and the Teacher, any vague or ambiguous remarks or statements from the Teacher. To achieve this result, the

Smart Lecture provides the students/students with a platform to address questions to their teachers. The Teacher then uses feedback generated from the website and statistics provided by the website to effectively answer the questions. The students are allowed to express how they understand content from the Teacher by using two buttons in the student/student dashboard. The teacher dashboard has functionality for receiving questions, following the student participation using the statistics, and managing the specific lectures.

1.1 GOAL FOR THE RESEARCH

The most interesting thing about this research is that the success of Smart Lecture is entirely dependent on the ability of students to participate in the classes at will and the operations of the lectures to organize the classes and closely monitor to ensure all students participate in the Smart Lecture.

Student's shyness is the main reason for conducting this research because some computer-related activities are known to be beneficial or advantage one group of an individual while disadvantageous for another.

Student engagement and motivation are key to the success of education. Therefore, we are going to build a web application to help them to ask the question whenever they want, and also, they can express they understand the contents of the lecture to improve the lecture.

1.2 OBJECTIVE

Numerous researchers have discovered approaches to improve the act of teaching. Scientists (Nakahara J et al.) and (Kong, Lam 2005) underline that cell phones assume a fundamental part in learning. We can see the educator utilizes his Smart Phone to bring the show document and control the slideshow, while the understudies can utilize a PC to learn, search, solve exercises, and make projects. A portion of these highlights has been consolidated into a few undertakings. For instance, SMART CLASSROOM (Nenad G et al 2012) gives the ability to the teacher to know the student's reaction and feedback with using IoT; iRoom (Johanson B et al 2002) upholds numerous human-computer interfaces

and mobile phones participate and connecting with existing devices and applications. The motivation behind these advances is to foster students' learning capacities, as entire classes become more appealing to study and subsequently improve understudy results.

Smart Lecture is the up-and-coming age of instructive system that aid understudies acquire focuses and step towards the future of education. For a few, posing a question is impolite within the class or may be testing authority. For others, the possibility of humiliating oneself to understand is a lot to bear in a particularly unoriginal setting. Some dread that they will hold up the class with their own inquiries. Our application enables the students to ask questions and give real-time feedback to the teacher without any barrier. Further, this paper centers around utilizing individual web applications giving a few insights into web services technology for encouraging learning participation. Therefore, shyness alludes to conduct reactions like withdrawal considering social. Shyness can emerge out from fear of contrary assessment and can be joined by passionate trouble like emotional distress; Shyness can prevent wanted support in exercises and professional objectives.

1.3 IMPORTANCE OF THIS RESEARCH

In the entirety of the personal factors, the specialists (Yingmin C et al 2018) found that shyness as a personality trait influenced individuals' learning transformation. Because shyness is a feeling of embarrassment, fear, or discomfort, especially when the person is part of a group, this normally happens with unfamiliar people or in new situations. Therefore, shyness alludes to conduct reactions like withdrawal considering social. Shyness can emerge out of dread of contrary assessment and can be joined by passionate trouble or restraint; Shyness can prevent wanted support in exercises and professional objectives. These outcomes in the person fearing from acting or saying and needing to escape from the negative response, insult, laugh at him or refuse. The shy person may decide to stay away from all social situations and all things considered. However, it is important to prevent this behavior especially during the learning stage, the flowing steps can be followed:

i. It is important to understand what the learners are interested in, this takes a lot, much more than it sounds. Questions relating to this child's differences and how they like this activity to get a fair chance and view of who the instructor is dealing with, especially at the lower ends of education. Larson and Rumsey (2018)) note that sometimes it is very difficult for a parent to identify some of these anomalies in children. It means parents who handle such children have to be very careful about who they admit into the 'normal' classrooms and provide special education.

ii. It is important to mention information technology is essential in helping not only those hidden who have special that should be taken to, but also those that require or need to live in the normal school and filthy environment. It seems to be an issue that most parents and teachers forget when handling children on a daily basis.

iii. It is also important to consider the classroom set up. The instructor is supposed to question and ensure that the set-up that they have supports learning. This begins with configuring the arrangement of the desk to how children interact. The connection between one child to another is very important. It is also during this time that the rules that govern classroom seating are set.

iv. Making digital citizenship a priority is important in enhancing the utilization of digital technology. As noted by Larson add Rumsey (2018), technology remains an important issue in contemporary global education realms, especially during a time when the world is trying to adjust to a num setting that it is not used to.

v. Another important technology-based approach is training learners as early as possible to understand what digital citizenship is. In a more theoretical definition, this concept refers to not only in a member of the online community but also ensuring that the language, whether written or text, is responsible. One has to understand that they can be prosecuted for an action they take om air. In their study, (Larson & Rumsey 2018) determined that the air hostess/customer extends null and void when one get involved in some violence.

vi. Mini-lesson plans are critically important in ensuring that every young learner is not only oriented to the technology but also understand the basics that they should even without the use of digital devices.

vii. The most important move is to understand that teachers and parents work not only to get results but also to try and orient their children to a better understanding of

the world in which they live. These lesson plans will help improve not only the identity of the learners who are helped but also the in structure to understand the extent to which they should keep as a parent (Rose Meyer & Hitchcock 2015).

viii. The power of voice also works miracles in families that require stability. The power of voice uses what can be described as the power of sharing. This has to do with how or to the extent to with one is able to extend their privacy so they can help the children understand the concepts more. This is a multi-comprehensive approach that requires other stakeholders, including parents and teachers.

ix. Democracy is another important aspect that cannot be overlooked when training children to be better citizens. The power and the rationale ability to think and respond really fast to critical issues that may be affecting children. Teaching goes beyond mere instruction-giving to what may be described as 'offering positive change'. This strategy requires a more practical approach and a rather sensitive attack to some of these children when it comes to their privacy (Pilgrim, Bledsoe & Reily 2012). For instance, due to the fact that they are underage, it is not possible to establish the extent to which such changes can affect the overall learning process.

x. Using technology to understand more how an effective learning experience can be achieved in important for many learners across the field. It is not possible to understand and respond to a better learning experience if one fails to identify the approaches in the field of education.

2. LITERATURE REVIEW

In recent years, many studies have focused on the problem of how to improve education that why we can see many schools and universities merge education with recent technology in order to boost up the education. While there has been much research on improving education after when the Teacher finishes his lecture, few researchers have taken improving education during the lecture into consideration. As we can note with university professors, there is a decrease in participation, on the other hand, an increasing number of misunderstandings between the Teacher and Student. At the same time, without interaction, inferior passive learning modes appear.

Several methods work on improving the experience of traditional classroom-based learning using many of the technology. We can propose three successful categories of them.

2.1 INTERNET OF THINGS

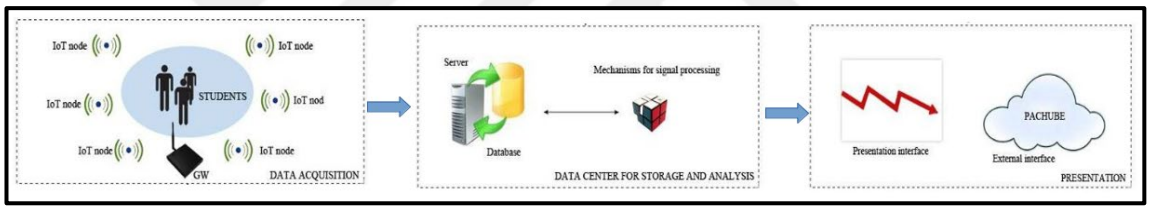
The concept of this research is near our concept research, but they are using IoT in the class. The idea is to consolidate the IoT innovation with social and behavioral analysis, and a normal classroom can be changed into a smart classroom that recognize the voice, discussions, developments, movements, and so forth, to arrive at a decision about the lecture and student. (Nenad G et al. 2012). The researchers have put the sensors in the classroom, and it starts to capture the student's reaction. For example, when someone starts boring, the sensors capture this reaction and send feedback to the Teacher. Then the Teacher can see all feedback in statistics with his laptop. Further, he will know how his lecture is going on, and he may change the method of his explanation to be more interesting.

Table 2.1: All material for IoT technology, and for what they need

Sensor	Parameter	Output
PIR Sensor	Fidgeting	Motion existence
Microphone	Noise	Noise existence
Camera	Fidgeting	Motion level
Sound sensor	Sound level	Sound level

One evident benefit to using this method is that if we can use this technology in our classrooms, teachers can automatically send the feedback by the system to them, and there are no manual actions. Another reason that technology is right for our education; it does not destroy the focus of the student during the lecture.

Figure 2.1: Method of working



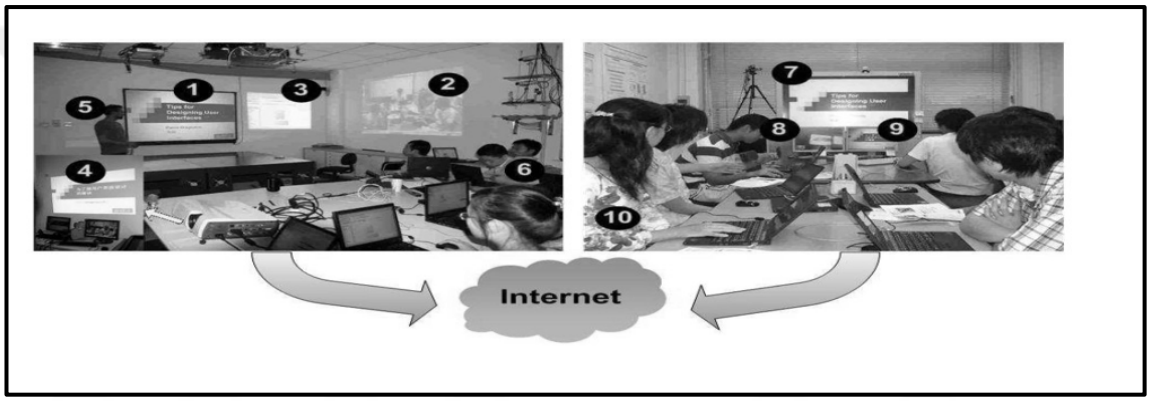
On the other hand, there are obvious disadvantages to the use of IoT in the classroom. Firstly, this technology is expensive because the sensors cost very much., we can use this technology in a specific space, limiting the participant for a lecture. In short, not everyone can use this technology because of the cost or for reasons they cannot make installation whenever or wherever the Teacher wants.

2.2 SMART SPACE

The researchers (Yue S et al 2009). built a channel between classrooms that can translate to any language. When the Teacher enters the class (e.g, in the USA), he will upload his English lecture PPT by the browser. At the point when hen the file is uploaded effectively, it will appear in China and Japan when they can follow PPT slideshows displayed on LCD Screens, and the PPT file will be automatically translated from English into Chinese

and Japanese utilizing the Language grid Web service. The student can ask the Teacher any questions by a chat by their language, and the Teacher can answer whenever he wants. Open Smart Classroom provides a completely unique experience for both the teacher and students to find out in multiple classrooms. As a prototype learning system, it still has some limitations that require to be enhanced, like providing more standard specifications for brand spanking new classrooms to hitch in and improving the aided tools to be more operable and effective.

Figure 2.1: The system of open smart classrooms for two classrooms located in Tsinghua and Kyoto



The main advantage of this method firstly is the ability to make it in a large space; secondly, this method can solve the problem of shyness with the chat, in addition, there is a translator automatically feature for the lecture. Moreover, the way to fill use of the Open Smart Classroom's training environment to reinforce students' understanding within the multicultural class remains an open question, which needs further studying.

Despite these features, there is no feedback to use in statistics during the class in order to improve the lecture. And also, this is another method where you need a budget to install and make the lecture.

2.3 APPLICATION

The Smart Class or E-Class is one method that needs to use external devices, not just a computer or mobile phone. It is like educational content for the students (Anurag Ch et al 2012), that based on using PEN DRIVE that runs on TV through a small multi-media player called e-box straightly on computers. This contains each subject with an actual instructor in a functional classroom. Practicing chapter by part making concentrates as energizing as watching films alongside features such as intelligence map and question-answer in real-time.

Figure 2.3: Types of equipment used in e-learning classrooms

This strategy is a one-stop resource for students that have all requirements of learning and component to help. The usage of this gives some benefit, such as people can get training anytime and anywhere. Moreover, it is simple to clarify the process and syllabus oriented. Plus, it is an exciting audio-video process that assists the students to remember the chapter as compared. But in the end, we still with the same issue with shyness, and the teacher cannot know how to improve his lecture.

3. METHODOLOGY

3.1 ANALYZE STAGE

In the previous, the objectives and targets were introduced and clarified exhaustively. In this part of the research, the methodology to accomplish these objectives and targets will be analyzed. To build this solution, we need to define all requirements, the use case, and data flow diagraming for this application with a model for building in the right way.

3.1.1 Requirement

The requirements were gathered from old researches, that has a relation with Shyness during the classroom and eLearning system, and they were divided in two parts, Functional requirement, and Non Functional requirement, The tables are in Appendix.
In our system we have three kinds of actors:

a. **Teacher**: A user who responsible to create lectures, upload videos, get feedback from student, see statistic about the lecture, and send writing to students.
b. **Student**: A user who responsible to join to the lectures, ask questions by speech, express his understanding about the lecture, and get answers by videos or by writing from teacher.
c. **System**: It is part of backend in application that responsible to recognize questions by speech, give the right videos for the answer, and calculate the understanding statistics of the lectures in real time.

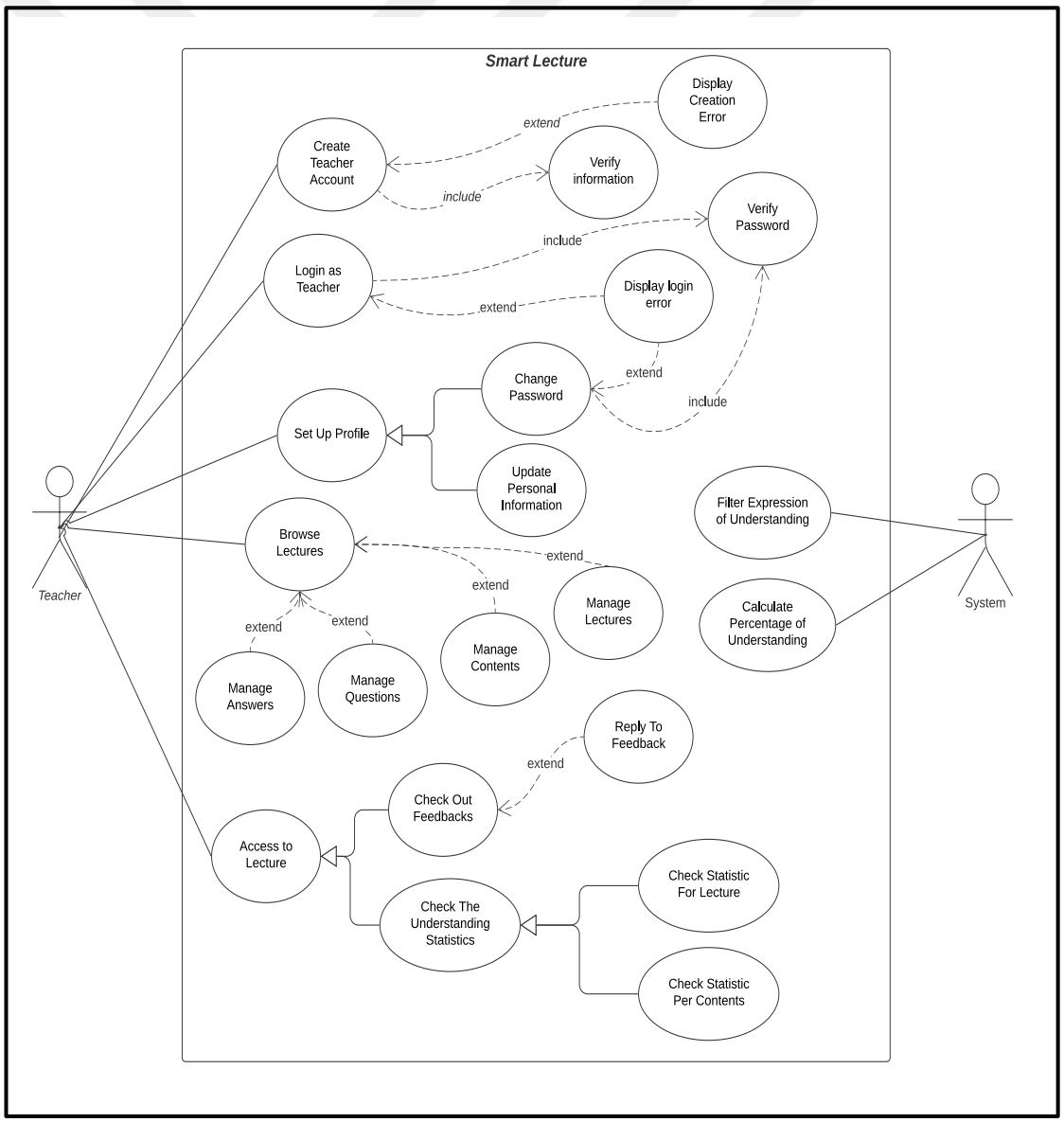
3.1.2 Use Case Diagram

The system needs this diagram to organize all requirements, including internal and external impacts (Dr.S.S.Mule 2015). Therefore, when a system is analyzed to gather its functionalities, the use cases diagram helps identify the actors and prepare all cases exist.

3.1.2.1 Teacher side:

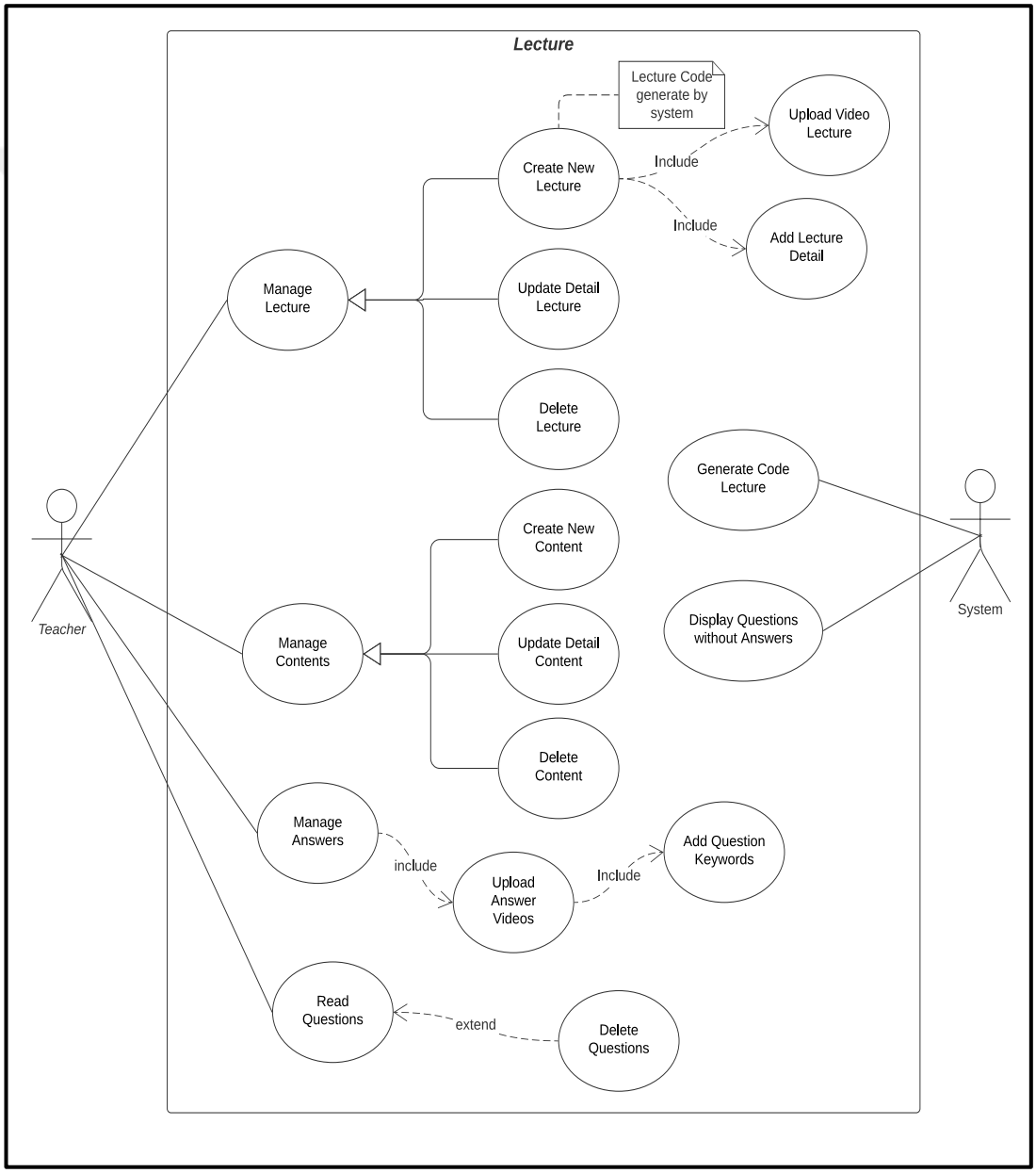
The use cases for teachers were collected based on the requirements, from the authentication phase until present the lecture to the students. The teacher starts to make authentication; Then, he is going to create his lecture by entering the details, contents and upload the video. The system will automatically generate code for the lecture. After, he has to create predict answers for the lecture by uploading videos as an answer, with keywords of the question. At the end, when students attend his lecture, the teacher will start receiving understand expression and feedback for his lecture.

Figure 3.1: Use case diagram for teacher side



During the lecture, the students will ask questions, and some of the questions are without answers. The system will immediately recognize these questions and it is going to display them to the teacher in the list, in order to create answers for these questions, and based on the feedback and understanding expression, the teacher will have a background about of his lecture in order to improve it in the future.

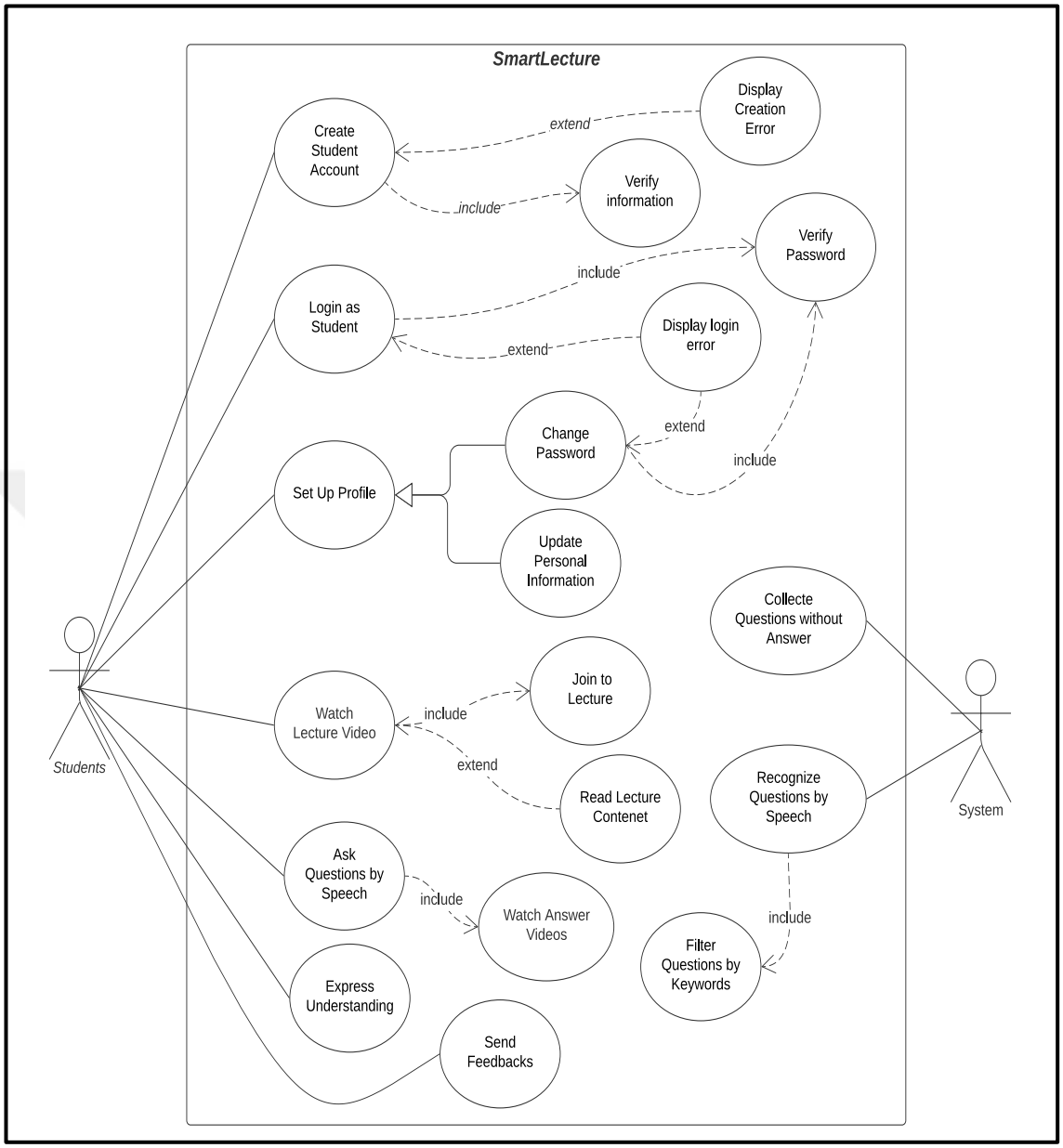
Figure 3.2: Sub-diagram describes the functionalities of Browse Lectures



3.1.2.2 Student side

The use cases for students were collected based on the requirements, from the authentication phase until he can express his understanding to the teacher. The student starts to enter the lecture join code, Then, he starts watching the lecture video, When he has ambiguity during the lecture he can stop the lecture and ask a question by speech in order to get answers at the same time as the video. If there question without an answer he will get a video to explain to him that he will get the answer from the teacher as soon as possible. He has the ability to express his understanding of the content and send his feedback about it.

Figure 3.3: Use case diagram for Student Side



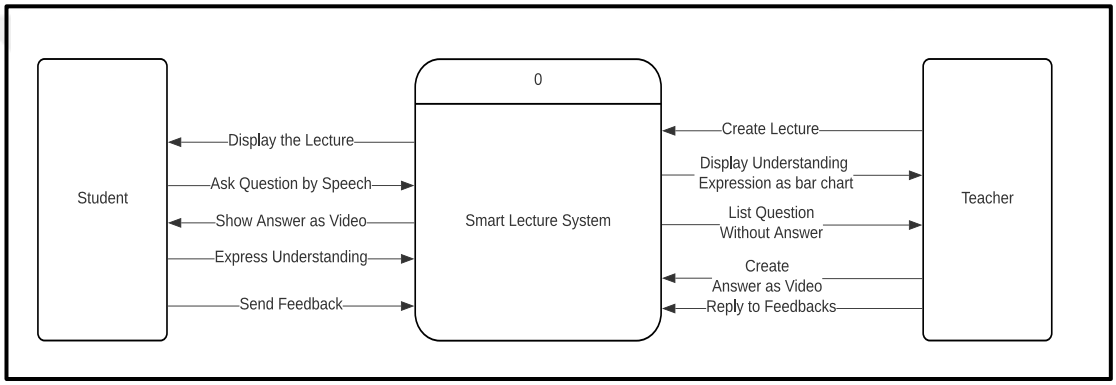
3.1.3: Data Flow Diagram

A DFD diagram can conceptualize the system through every important detail, Modeling the processes on a different level and putting them into the perspective of the system's overall architecture (Li Q Chen YL).

3.1.3.1 Level 0

At this level, the system shows as a single process called Smart Lecture System, which handles Teacher and Student actions based on the requirements. The student has to have a lecture displayer with the ability to ask questions, get answers in real-time, and express his understanding and send feedback. On another side, the teacher has to create the lecture and answer as a video. Also, he should be able to get feedback about his lecture and statistics of understanding with a list of questions without answers.

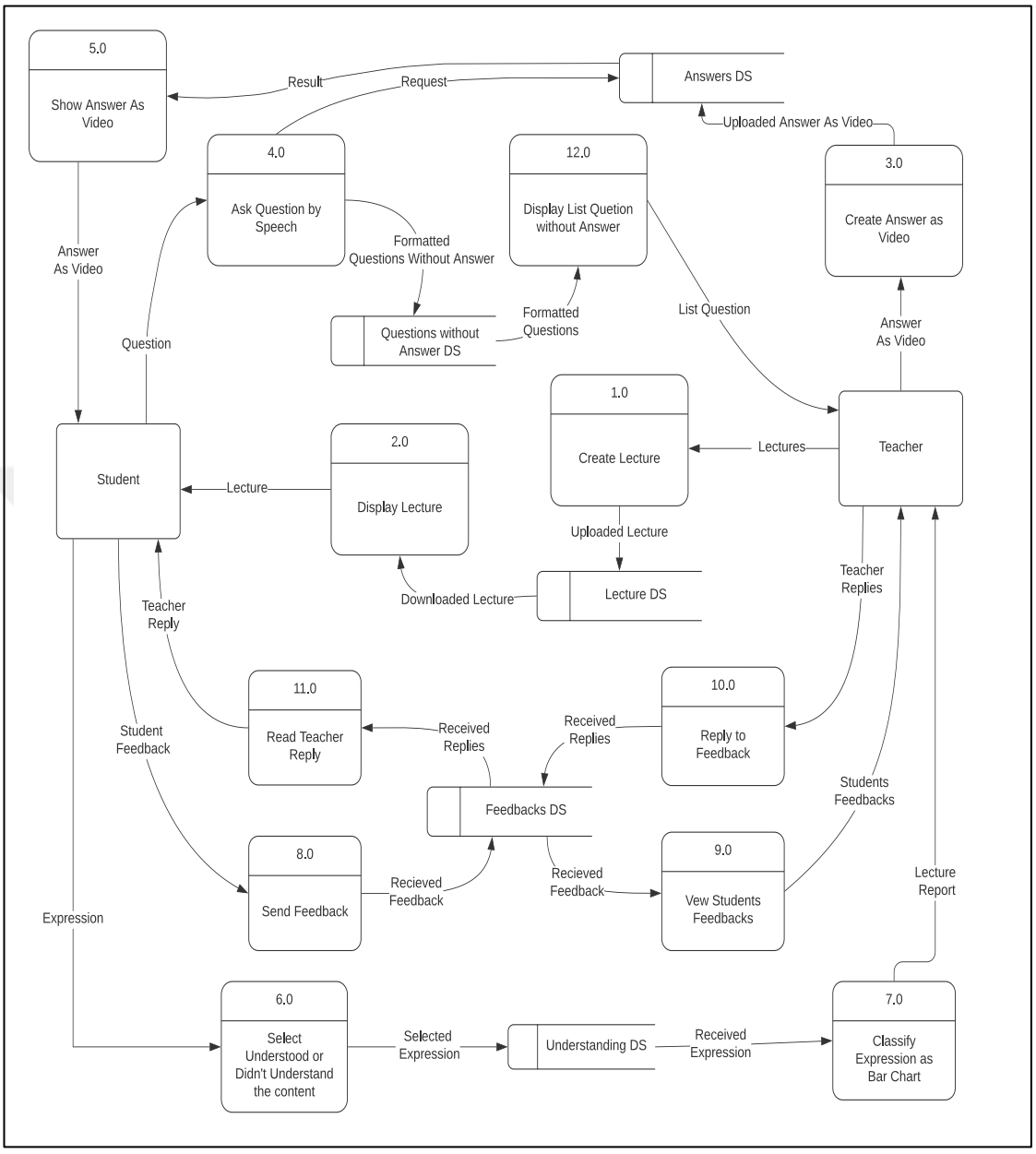
Figure 3.4: Data flow diagram level 0



3.1.3.2 Level 1

The level describes highlight mains function in steps; Where the teacher starts creating the lecture that will store in DS (Data Store), the student can download it from the same DS. During the lecture, when a student starts asking questions, he will get the answers from Answers DS that stored answers as video from the teacher. Else, if there are no answers to his questions, the question will be stored in Questions Without Answers DS in order to display it as a list to the teacher. The student has the ability to select his understand expression of the content and his selected expression will be stored in Understanding DS, where the system can classify it and display it to the teacher as a bar chart. Also, the Student should be capable of sending written feedback to the teacher and which will be stored in Feedback DS where the teacher can receive it and reply to it.

Figure 3.5: Data flow diagram level 1

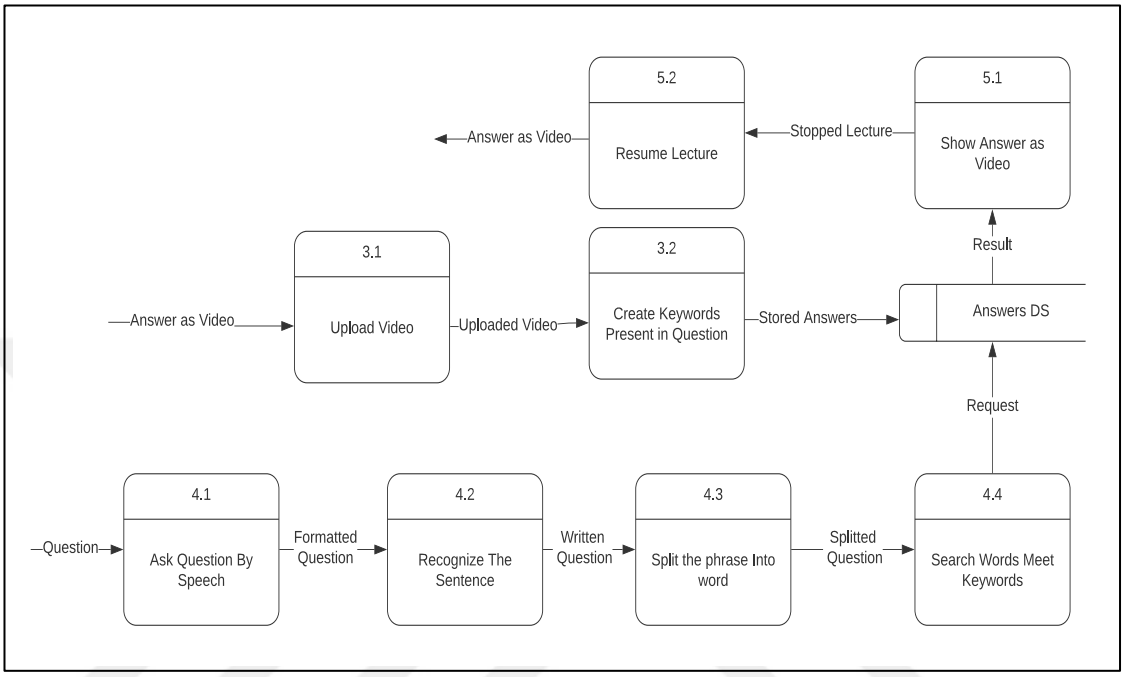


3.1.3.3 Level 2

At this level, the diagram goes deep in process step 2, 4, and 5, where the teacher creates the answer as video, he has to upload the video then create Keywords present in questions, all these details will store in Answers DS. When the student asks a question by speech, the system has to recognize the speech, then split it into words, After, it will start

searching words that meet keywords in Answers DS. When the system finds the right video, the answer will display to the student then the lecture will resume

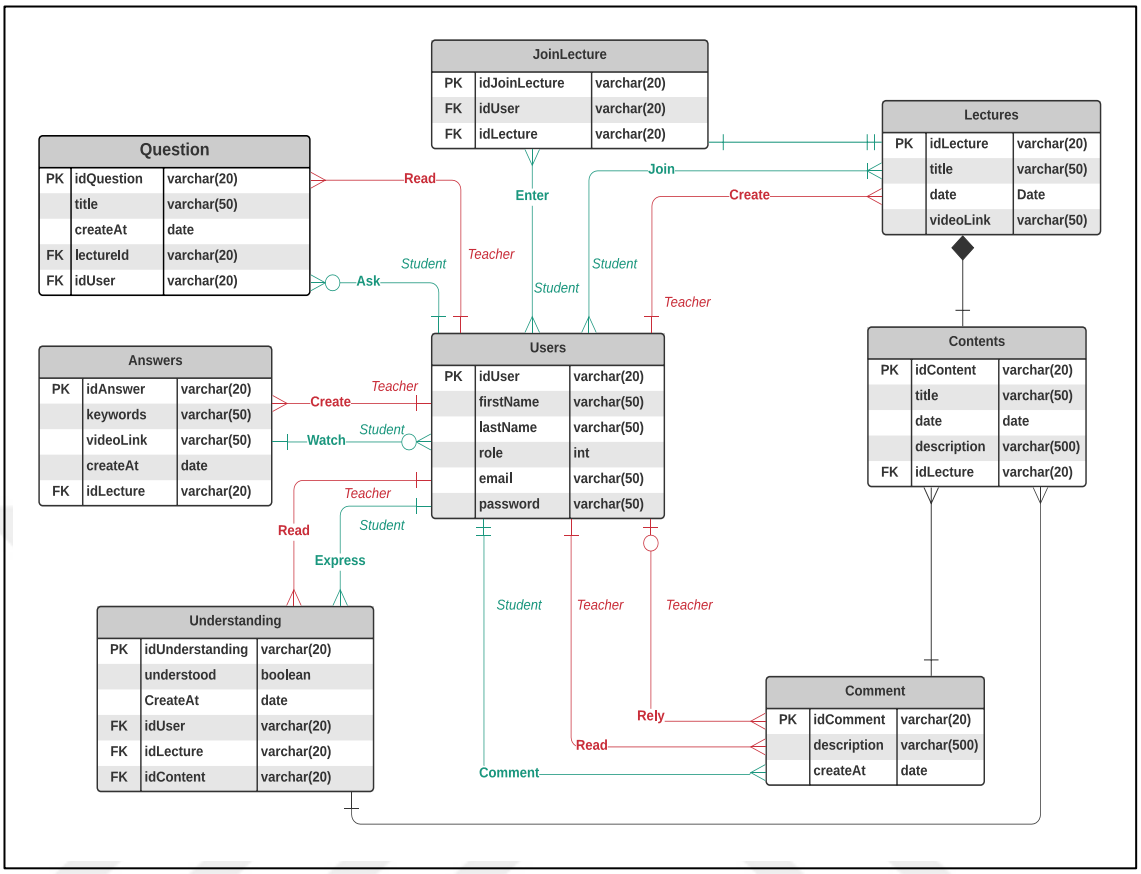
Figure 3.6: Data flow diagram level 2



3.1.3 Entity Relationship Diagram

The ERD is helpful to describe the entities and relations between them in the system based on the requirement. It can also be the architecture for the Database. The system was divided into 8 components; these components will be the same classes in the database system. The user entity contains the attribute "role," with Boolean type, where it should be the Student or Teacher. The Teacher can create lectures, create answers, read statistics of understanding and the comments, and get the questions that without answer. The student can join to the lecture, asks questions by speech, get answers, send written feedback, and expresses his understanding.

Figure 3.7: Entity relationship diagram



3.2 DESIGN STAGE

3.2.1 Activity Diagram

The system needs this model because is one of the important modeling artifacts used in UML, and in order to describe the sequences of activities and to capture the interaction flow actions and its outcomes, since, It focuses on the work performed in the implementation of an operation, and the activities in a utilization case or in an object. The diagram describes the activities of the teacher and student. The diagrams are in Appendix.

3.2.1.1 Teacher

When the teacher accesses the system, he must authenticate as a teacher. Then he will create a new lecture after filling in all details and uploading the video for his lecture. After

that, he has to add the contents of the lecture, like outline and descriptions. In the end, he has to upload answers as videos for frequent questions by adding the keywords that present in the question. During the lecture, he can get feedback about the content in real-time, and he can see the statistics of the lecture as a bar chart.

3.2.1.2 Student

When the student accesses the system, he must authenticate as a student. He will then enter the code for the lecture that he got from the teacher. He will start watching the lecture when he has questions, he clicks on start, and the video will automatically stop for his question in order to recognize his speech; the student can see his question as written form, then, he will click on stop to get an answer after displaying the answer the lecture will resume. While he is watching the lecture, he can express the understanding of the contents or sends feedback.

3.2.2 Sequence Diagram

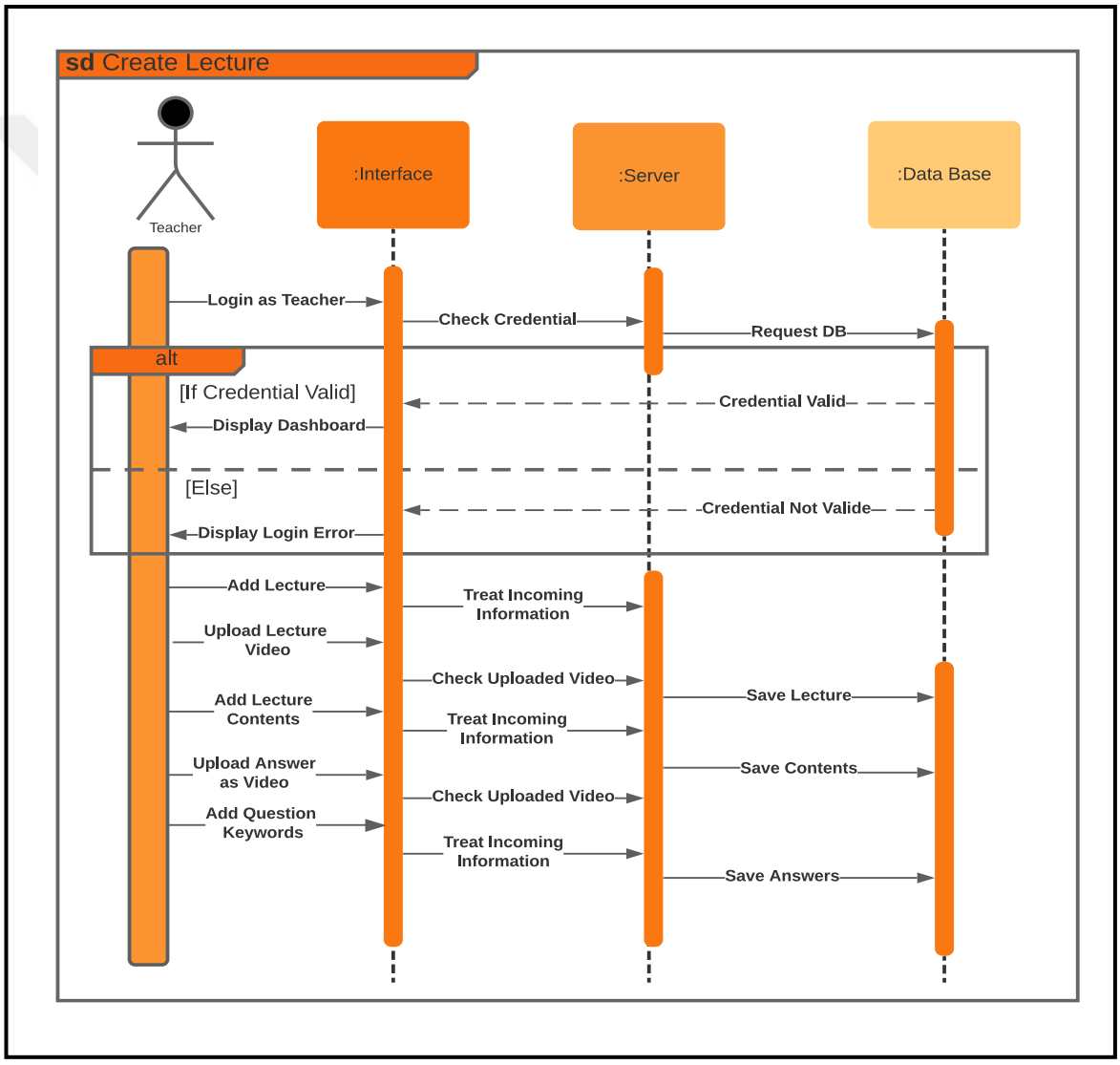
In this part, sequence diagram can go deeply in some activities that present in activity diagram. This helps with understanding the system design in subtleties and intercation between the objects. The diagram describes how does the teacher create a lecture? How can the student join to the lecture? And how does the feedback system work?

3.2.2.1 Create Lecture

The system was divided into actor (Teacher), and three objects (Interface, Server, and Database). The teacher starts login as a teacher, the server will check the incoming credentials to avoid all kind of spam, then it will request from the database to check the credentials, if the credentials are valid the interface of the system will display the dashboard to the teacher, else, will display an error message to repeat login. When the login goes with success, the teacher will add the lecture by inserting the information of the lecture, the server will treat the incoming information for security, then, the teacher starts uploading the video of his lecture, the server again checks the uploaded video if it respects the format and for security reasons, then it will save the lecture in the

database. When the teacher finishes with adding the lecture, he needs to add the contents by inserting the title and description, and the server once will check the incoming information, will save it in the database. In the end, the teacher has to create predictable answers for his lecture by uploading the videos and create keywords that present predictable questions, while the system checks the incoming videos and keywords and then saves them in the database.

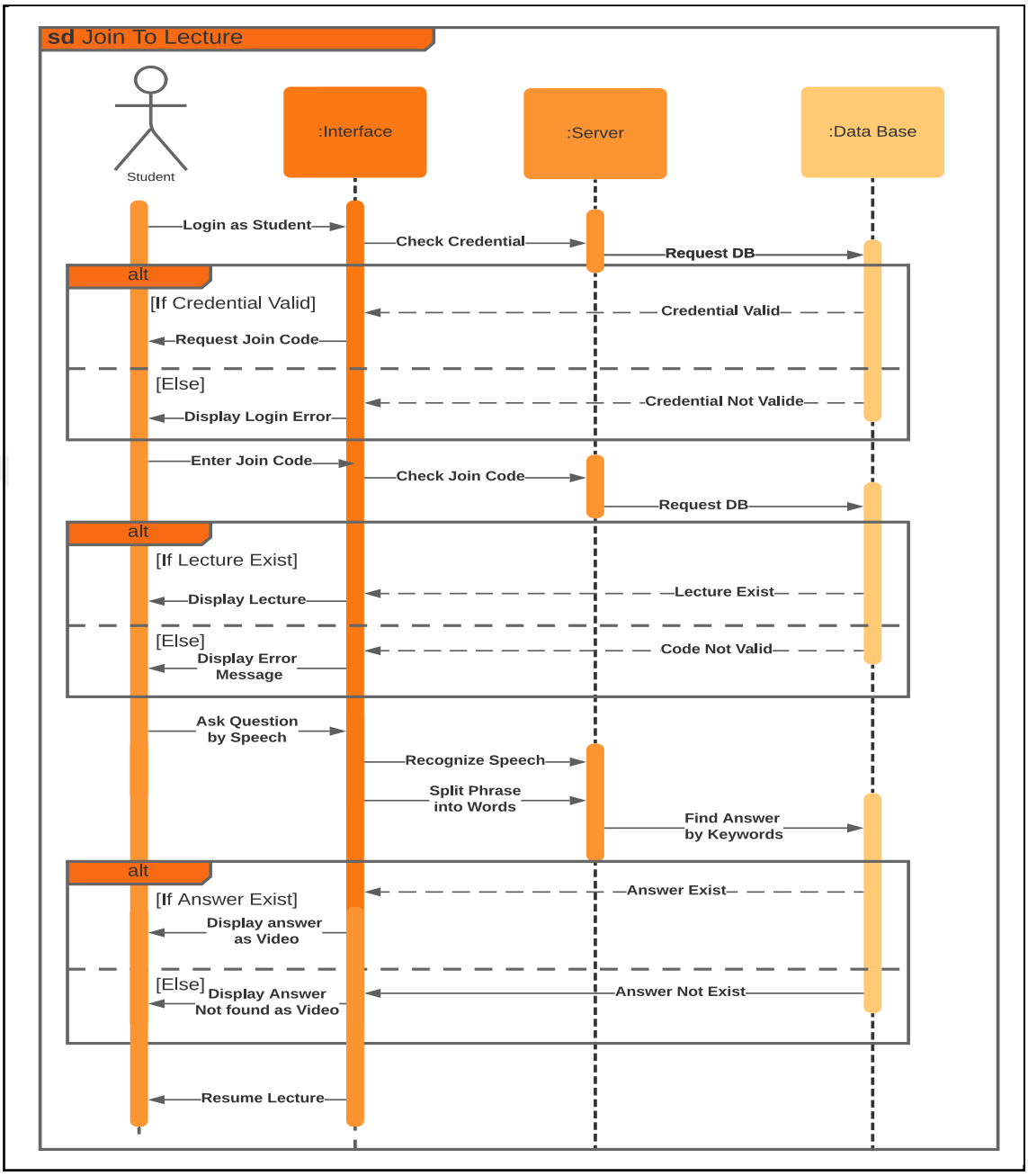
Figure 3.10: Sequence diagram for create lecture.



3.2.2.2 Join to the lecture

The system was divided into actor (Student), and three objects (Interface, Server, and Database). The student starts login as a student, the server will check the incoming credentials to avoid all kind of spam and for security reasons, then it will request from the database to check the credentials, if the credentials are valid the interface of the system will display the page to insert the join code, else, will display an error message to repeat login. When the login goes with success, the student must enter the code in order to join the lecture, by entering the code, the server will check the incoming information and then send a request to the database to check the code. if the code is valid the interface will start displaying the lecture to the student, else, the error message will display. While the student watching the lecture, he can ask questions by speech, the server recognizes the speech, then will split it into words, after will start looking for words that meet keywords that exist in the database, if the server finds the answer, immediately the interface will show answer as video, else, will show answer not found as video. in the end, the student can resume his lecture.

Figure 3.11: Sequence diagram for join to the lecture.

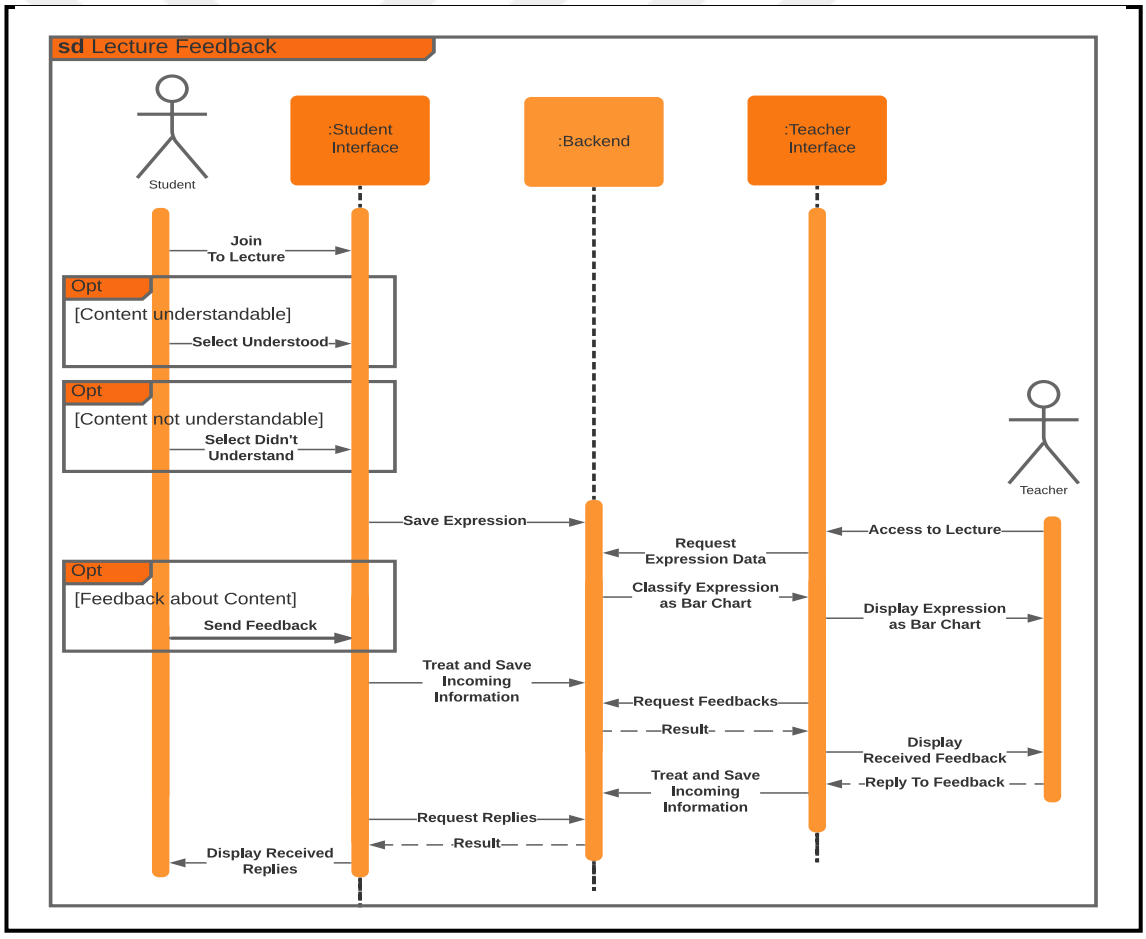


3.2.2.2 Feedback

The system was divided into two actors (Student and Teacher) and three objects (Student Interface, Backend, and Teacher Interface). The student starts to join the lecture; then he has two options to select the expression: he can select "Understood" if the content is understandable to him or select "Not Understood" if the situation is the opposite, and the

backend will save the expression. The teacher needs access to the lecture, and his interface will request expression data from the backend; this last one will classify the expression and display it to the teacher as a bar chart. The student has the option to send feedback about the content; if he sends the feedback, the backend will treat the incoming information from the security side and save it. On the other side, the teacher interface will request feedback from the backend; this last one will display feedbacks to the teacher in order to reply to it. The backend will treat the incoming information from the teacher and save it. The student interface will request replies from the backend, displaying them to the student.

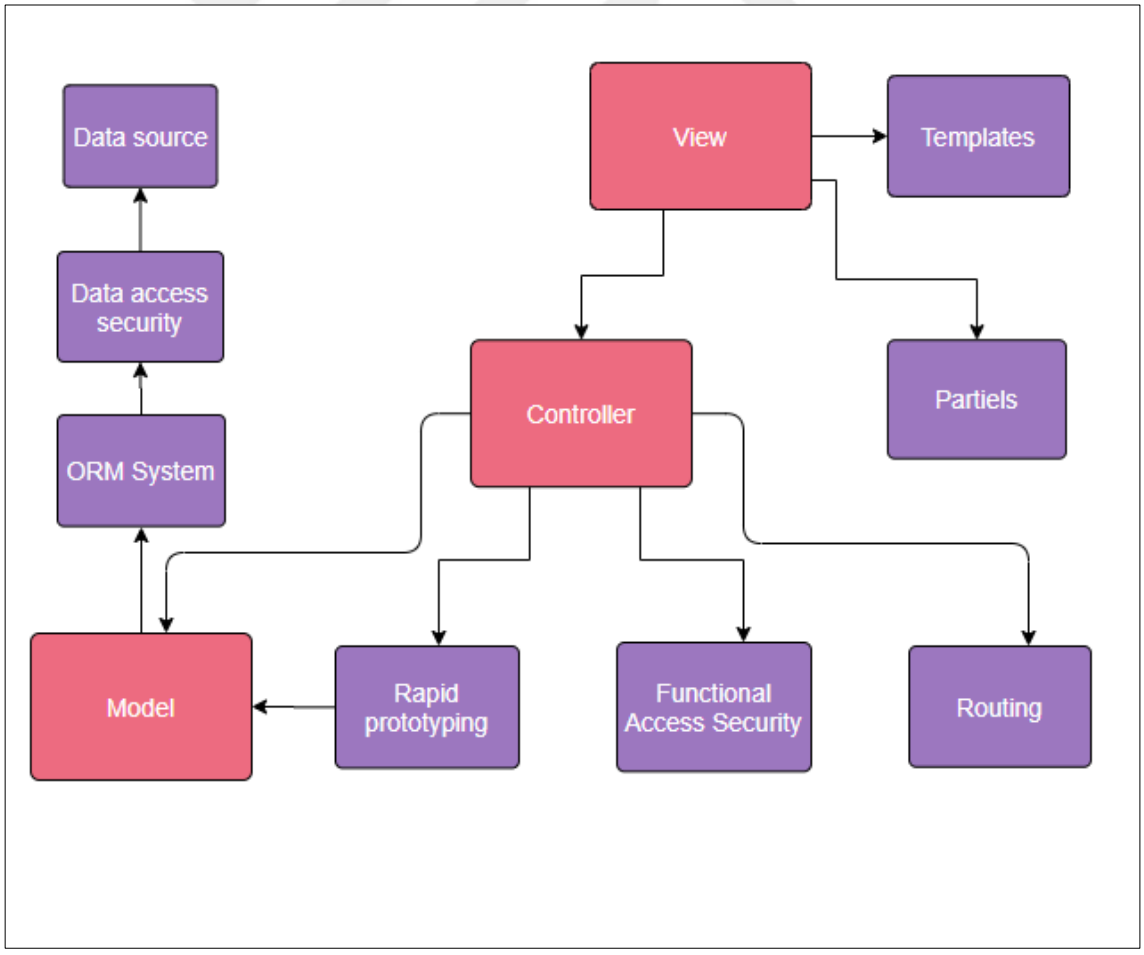
Figure 3.12: Sequence diagram for feedback system



3.3 BULD STAGE

The system has to have an architecture to describe the behavior of applications used in the research, focuses on how they interact with each other and with end-users. The system was built by MVC architecture, this model is predicated on the Model-View-Controller design (MVC) and has a few other valuable parts like routing, data source, and access security. This model was executed utilizing the PHP programming language, yet implemented in other development languages with using same concept (Dragos-Paul Pop*, Adam Altar). This solid structure fit for lessening web application development times radically, because, the system was separated into input, processing, and output and each of MVC components are built to handle specific development. Therfore, with this dedign, the build stage was divided in two parts: Front-end and Back-end.

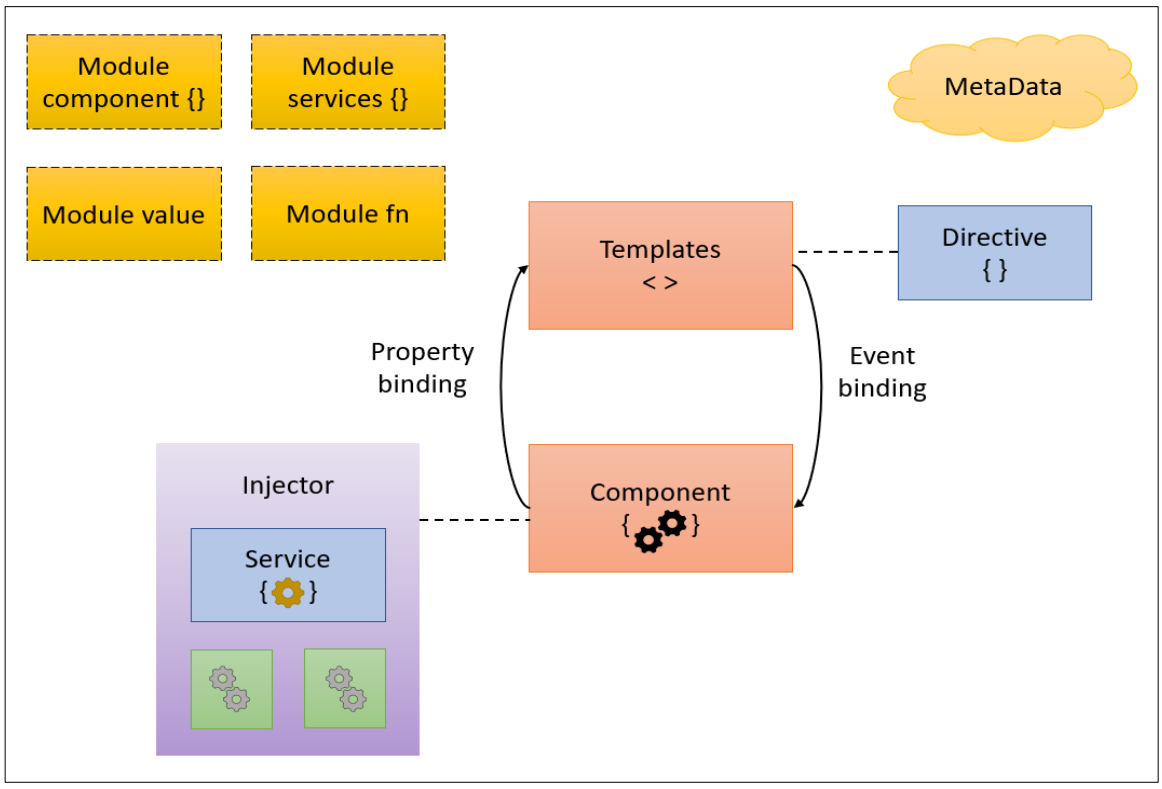
Figure 3.13. Model-View-Controller architecture



3.3.1 Front-End

In this solution, the system uses the Angular framework because it easier to make rich, highly interactive user interfaces by letting us decompose our UI into components and ultimately go completely JS. Angular helps the solution to affect the complexity inherent in rich user interfaces. As UI complexity increases, the normal model of generating pages on the server gets far more complex. Angular allows the system to decompose the UI into manageable chunks and allows to separate the UI from the implementation. This makes server-side page generation an excellent deal easier, but Angular comes into its own once the system moves to pure JS-based applications. Ultimately the way the system solves this is often by pushing the UI more and more into the JS side of the equation. Angular allows the system to break the UI up into components, supplying a clear separation between the look and feel. The system will be built fairly by simple pages on the server, and therefore the JS front is employed to make an upscale UI that creates separate calls back to the server for the info they have.

Figure 3.14: Angular architecture



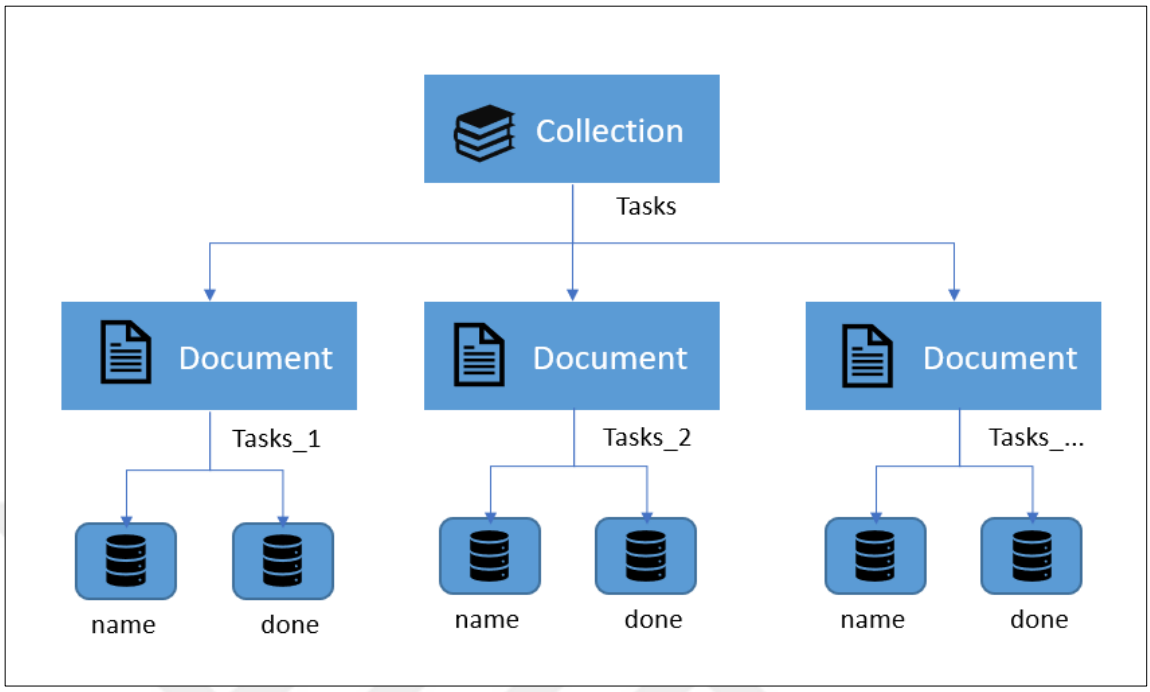
The advantage of choosing the Angular framework for these reasons, Firstly, its framework is installed with the original MVC programming engineering setup. It does not request to divide an application into MVC components and assembles a code that could unite them. Secondly, Angular aides assemble intelligent and dynamic single-page applications (SPAs) with its convincing highlights, including templating, dependency injection, two-way restricting, and RESTful API and AJAX handling. Finally, HTML can be used in the interface design as a template language in order to convey the application's components easily. These features help to build the application respecting the user experience and more robust.

3.3.2 Back-End

In the back-end, the system uses Google Cloud Firestore, which is a Documents type-based NoSQL database implementation. Cloud Firestore, is a completely overseen, cloud-local data set that makes it simple to store, query information, and syn in real-time for all web services, and IoT applications. Its goal is to provide an exceptional user experience and simplify application development with live sync, offline support, and ACID (atomicity, consistency, isolation, durability) exchanges across many of documents and collections. The explanation is that with this tool, it will now be easier and easier to create the application thanks to flexible database security rules, real-time features, and an updated infrastructure fully manual automatic scale.

The data model divides into collections that contain documents, which can contain more collection, although the documents can contain nested data, and each document contains settled key-value pairs. in other means, the document can contain sub-collection and nested objects. which can include complex objects or primitive fields. In Cloud Firestore the collections and documents are created implicitly. Essentially, The Cloud Firestore can create a collection or document that does not exist.

Figure 3.15: Data model



3.3.3 Speech recognition API

In our research, the system needs a way to recognize the speech from the students. The Web Speech API from Google helps to catch the student speech during the lecture. This API permits great control and adaptability over speech recognition capabilities by extracting text data and showing up immediately while students speek. Here, the system uses "webkitSpeechRecognition" to recognize speech in the Angular code. This API is not supported for all browsers. The part of code is in Appendix

There are two main services in the API:

I. **start() method**: At the point when the Start method is called it signifies the second in time the web application starts recognition and that means, the speech input is streaming live through the input media stream, then this Start call appears the moment in time that the service must work to listen and try to meet the grammars related with the speech.

II. **stop() method:** The stop method describes an order to stop the recognition service for listening and to return a result that extracted during the speech. The stop method's helps the end-user with doing the end pointing, like a walkie-

talkie,In the application, when the user finishes their question and clicks on the stop button, the system transforms the voice question into text, then it is up to the components to break the text down into several words. Then, the component calls on the service concerned in order to determine the video response whose tags correspond to the words extracted from the user's question.

3.3.4 Securıty

For the security side, the API asks the end-user for permission to use the microphone, if the application hosted on HTTPS, the permission will be asked just one time, otherwise the application will request permission every single time to capture the audio.

3.4 RESULT

Using the previous requirement, we could build a web application where the Teacher has a dashboard and manage his lectures. Also, he has the ability to see the statistics of understanding coming from the Students and read their feedback. Besides, the Student could now attend the lecture and asking questions by speech feature. Also, he can express his understanding of the contents and sends feedback to the Teacher.

3.5 Method Of Collecting Data

We have invited a teacher from BritishSide, Mr.Adel Omar Ishaq, to use our application for one of his English courses. The data used is collected from students who attend this lecture and asked to fill in the questionnaire by Google Form. Advantages of the online surveys are I) easiness to conduct, ii) reaching the maximum amount of people during a short time, iii) finding more accurate participants, and iv) easiness to research. The scale used is similar to "The perspectives of students and professors on excellence," which was used in Quebec. The factors considered in the scale include the extent to which the students in question accept technology, students anxiety about the usage of computers, and how it affects their academics and performance (Poellhuber et al. 2012).

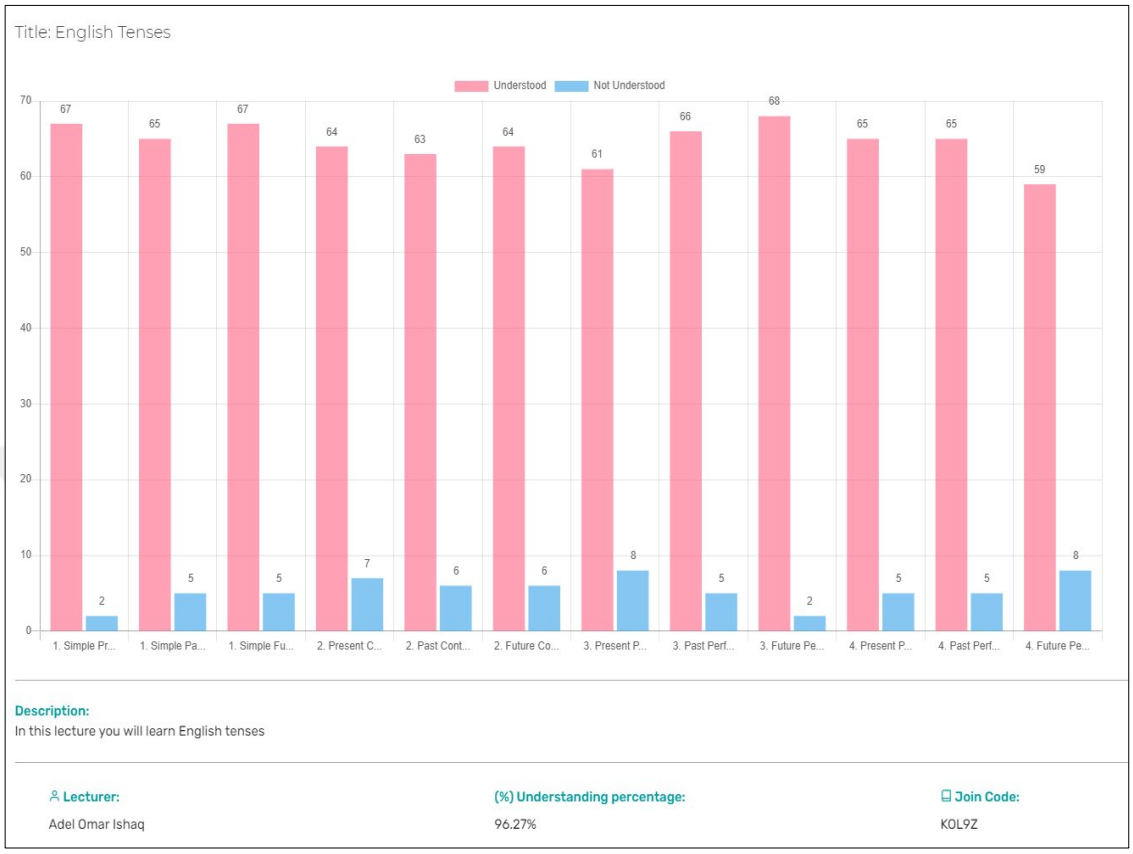
The questionnaire uses both positive and negative questions to measure the degree to the students effectively are comfortable with several activities performed in the class.

Table 3.3: Survey questions

Category	Question
Experience & Technology	1 I am very comfortable using web application technologies. 2 I am very knowledgeable in the use of web application technologies. 3 I like courses where teachers do not use web application technologies.
Content & Structure	4 Learning objectives were clear. 5 Lecture content was organized and well planned. 6 I can get the correct answer for questions. 7 Lecture organized to allow all students to participate fully.
Functions & Interactions	8 I like courses that are entirely online. 9 I like courses that use online resources. 10 I like the way online classes support students understanding by openly discussing points and allowing all students to participate.
Comparison & Preferences	11 I like the way turn-taking is promoted in the online classroom. 12 I do not like the open social interactions between the students and teachers. 13 I feel nervous talking in front of students in the online platform.

The degree of shyness and likeness of students to participate in SmartLecture was measured using a questionnaire. Questions were grouped into three classifications Content and Structure, Functions and Interactions, Comparison and Preferences to get organized answers and distinguish the fundamental markers. The questionnaire aimed to measure the degree of comfort in students when participating in an online Lecture. We had 77 participants for the lecture.

Figure 3.17: Scene Analytics from dashboard



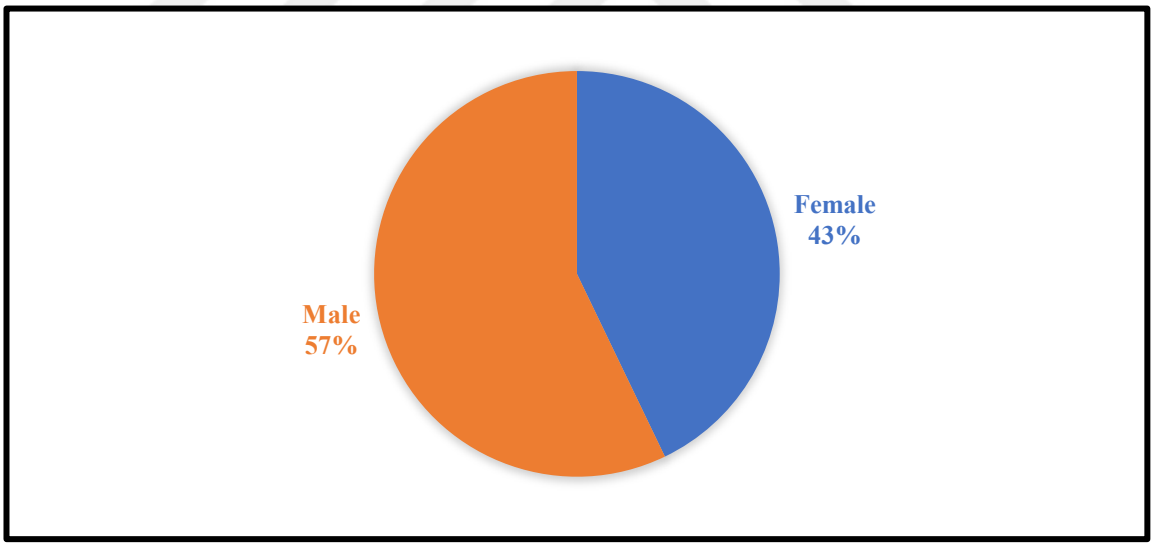
4. FINDINGS

In this part of the research, the answers were collected by the participants that presented in the lecture and they answered the scale questions. The perception scale results were analyzed to know participants' perceptions about the effectiveness of Experience & Technology, Content & Structure, Functions & Interactions, and Comparison & Preferences of SmartLecture.

A complete of thirteen questions were categorized, as referenced in the method of collecting data partWe have filtered the result by gender, and after, we have filtered by if the participant has shyness during the classroom or not. The detailed results of every survey are presented below

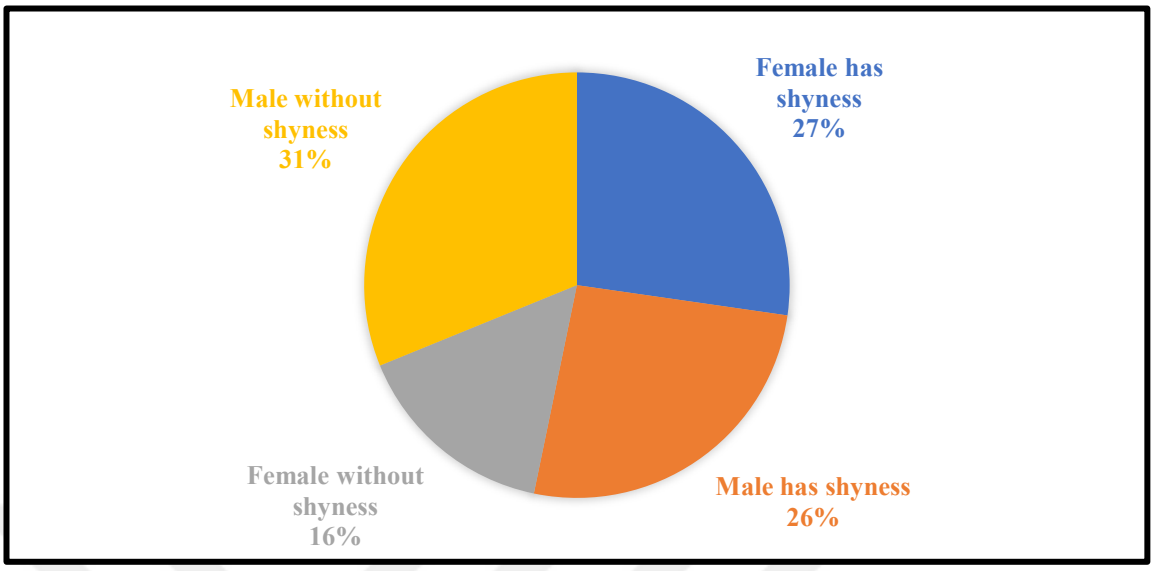
.

Figure 4.1: Gender of participants



Number of participants = 77

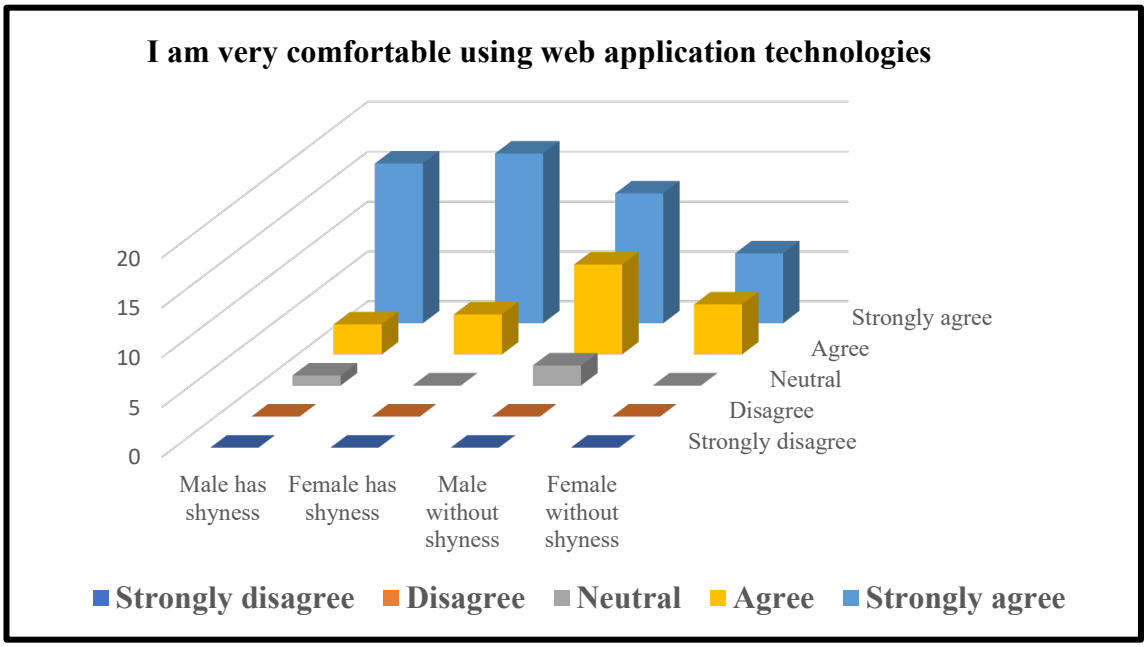
Figure 4.2: Filter Gender by Shyness During Classroom



From figure 4.2, shows that there are more than half of the participants have shyness during the classroom, especially the female

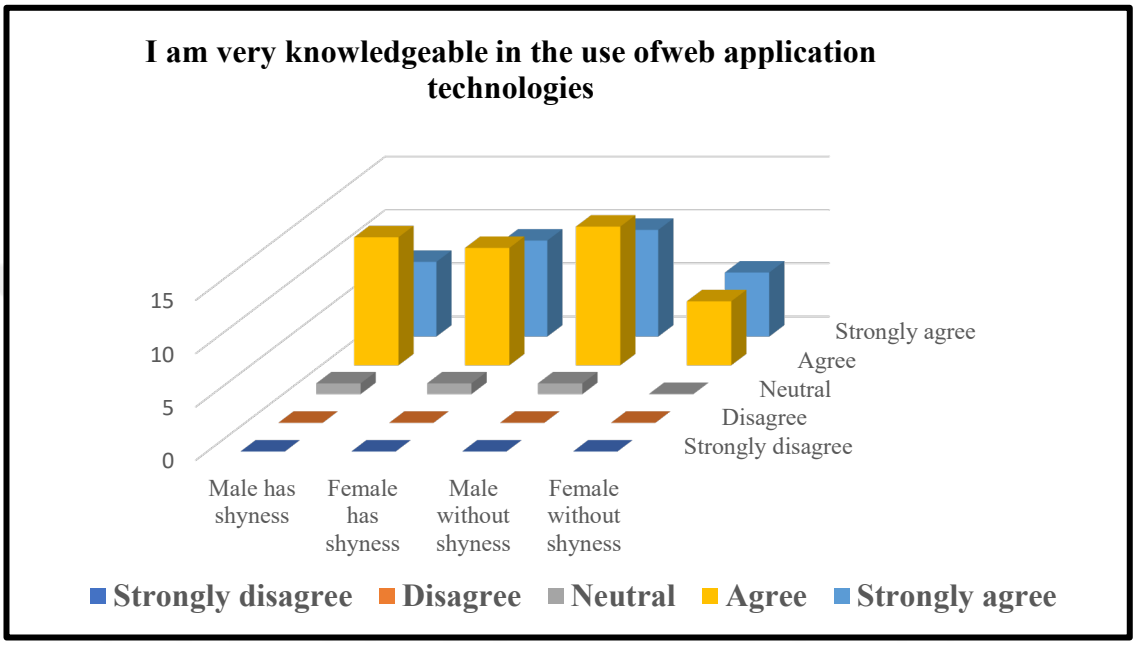
Question 1: When we proposed, "I am very comfortable using web application technologies." 68 percentage of participants were Strongly Agree, 27 percentage Agree. However, 4 percentage was Neutral

Figure 4.3: Question 1



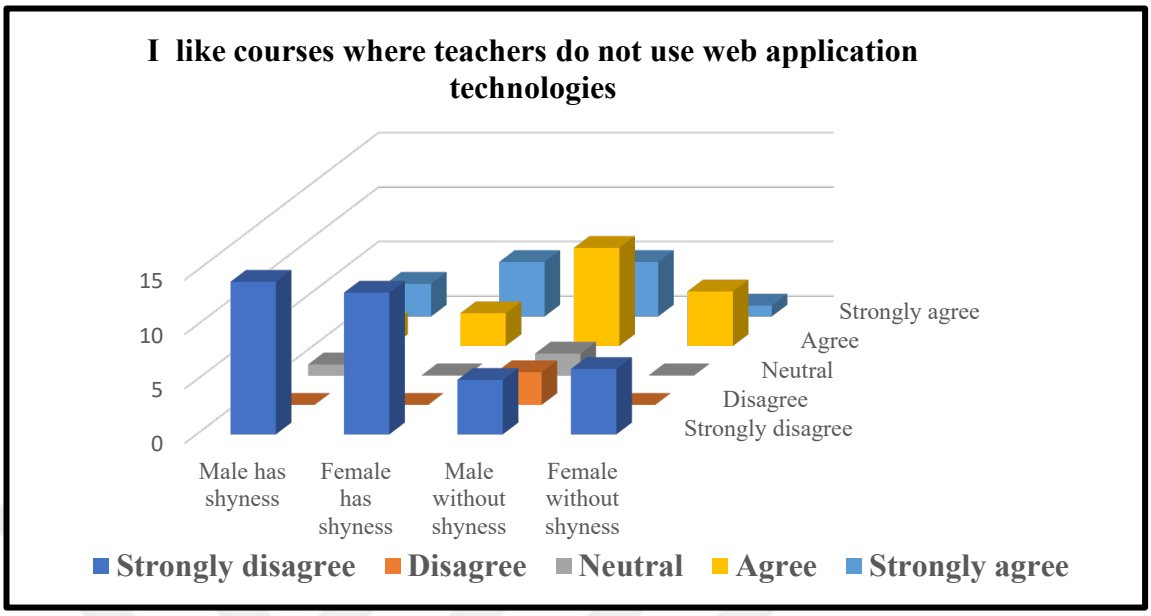
Question 2: When we proposed, "I am very knowledgeable in the use of web application technologies," 42 percentage of participants were Strongly Agree, 54 percentage Agree. However, 4 percentage was Neutral

Figure 4.4: Question 2



Question 3: When we proposed, "I like courses where teachers do not use web application technologies," 18 percentage of participants were Strongly Agree, 25 percentage Agree, 4 percentage was Neutral, 4 percentage was Disagree, 49 percentage Strongly disagreed. Here we can see from figure 4.3 that 65 percentage of participants who have shyness during the classroom accept using web application during the lecture. While, in the other category, 39 percentage of them accept using web application during the lecture.

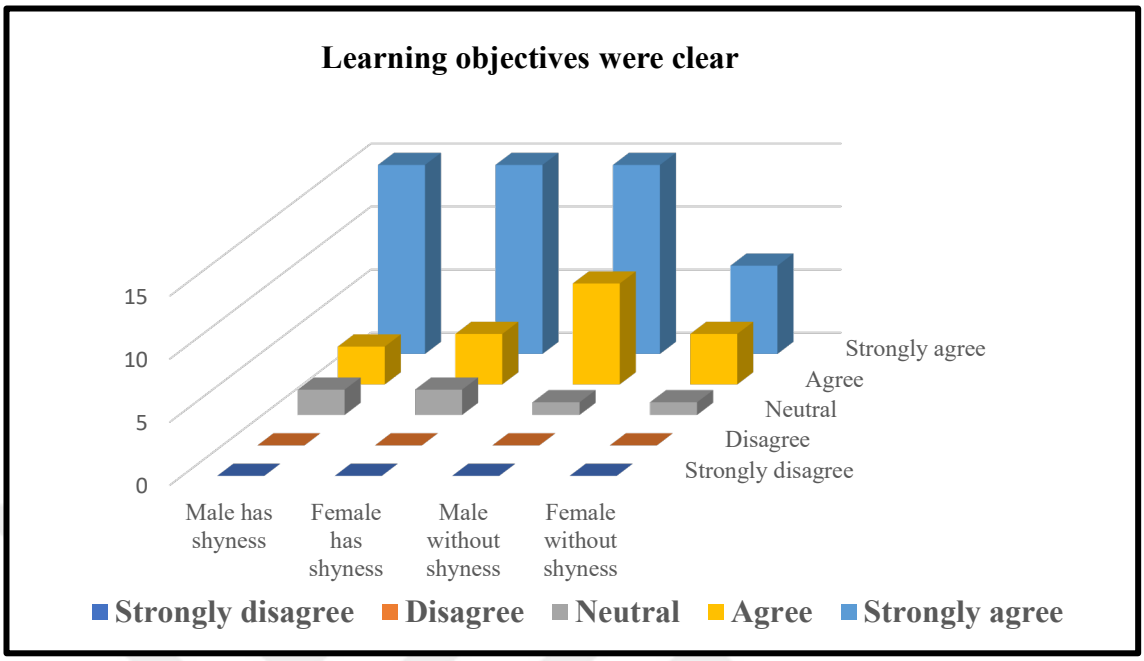
Figure 4.5: Question 3



We can conclude from the "Experience & Technology" category of question, most of them are comfortable with web applications in their life.

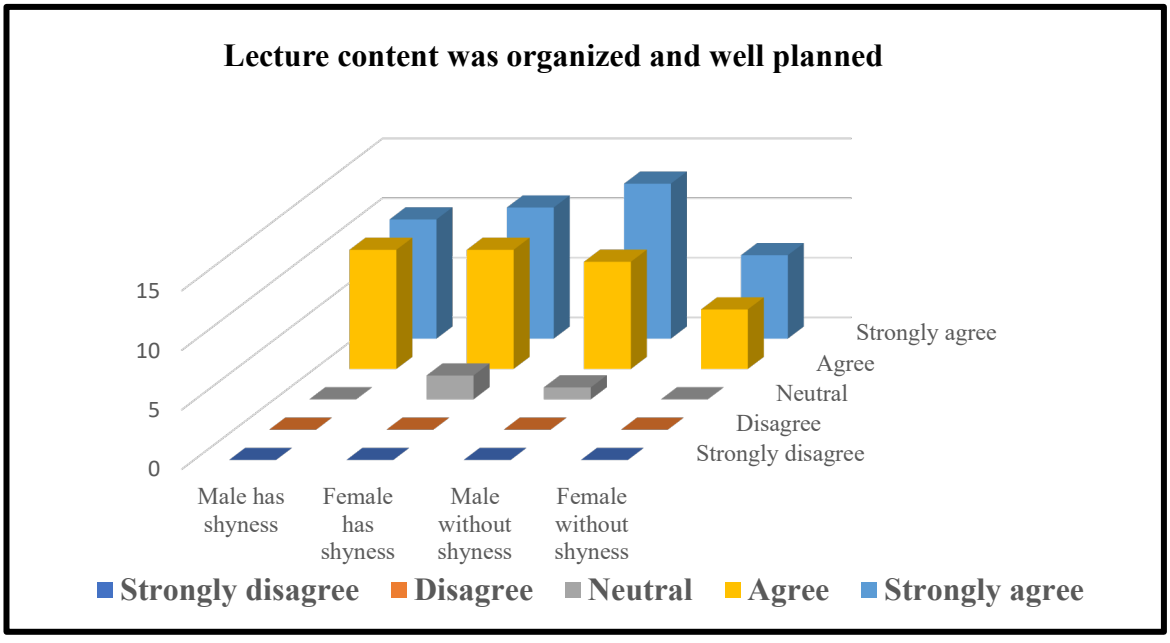
Question 4: When we proposed, "Learning objectives were clear," 67 percentage of participants were Strongly Agree, 25 percentage Agree. However, 8 percentage was Neutral.

Figure 4.6: Question 4



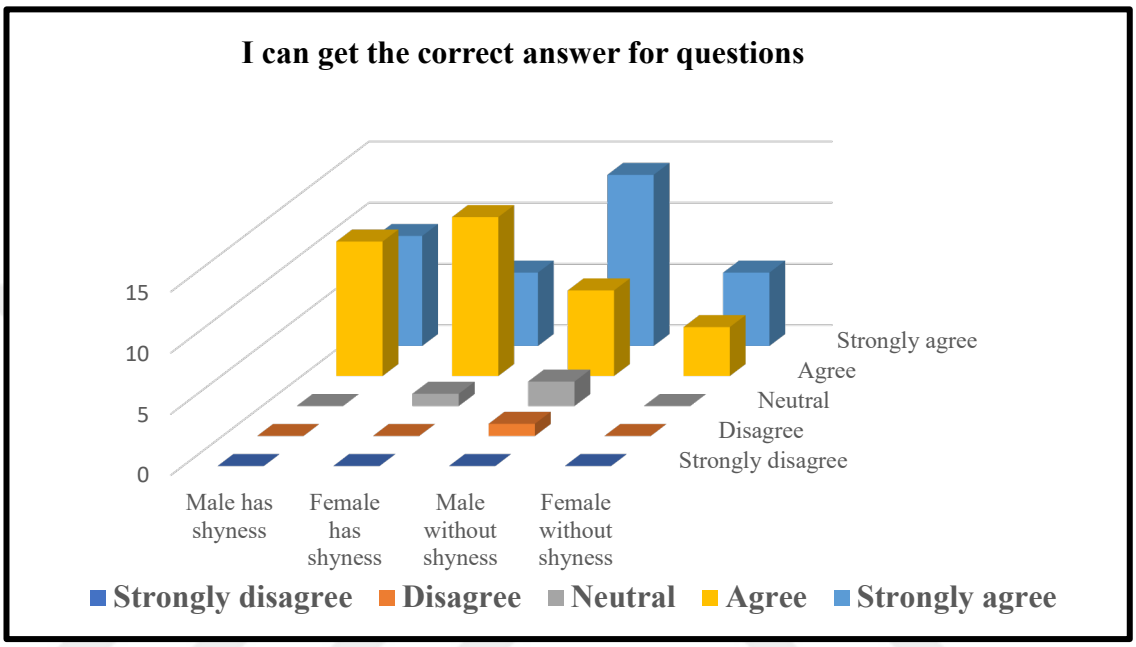
Question 5: When we proposed, "Lecture content was organized and well planned." 53 percentage of participants were Strongly Agree, 44 percentage Agree. However, 3 percentage was Neutral.

Figure 4.7: Question 5



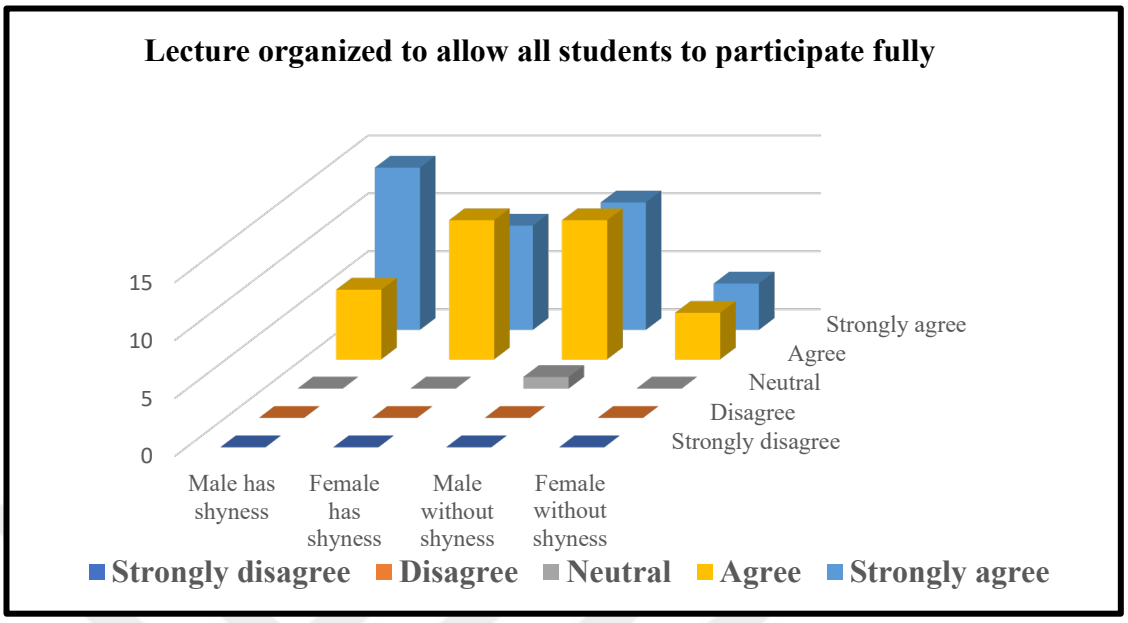
Question 6: When we proposed, "I can get the correct answer for questions." 46 percentage of participants were Strongly Agree, 48 percentage Agree. However, 4 percentage was Neutral, and 2 percentage was Disagree.

Figure 4.8: Question 6



Question 7: When we proposed, "Lecture organized to allow all students to participate fully." 49.5 percentage of participants were Strongly Agree, 49.5 percentage Agree. However, 1 percentage was Neutral.

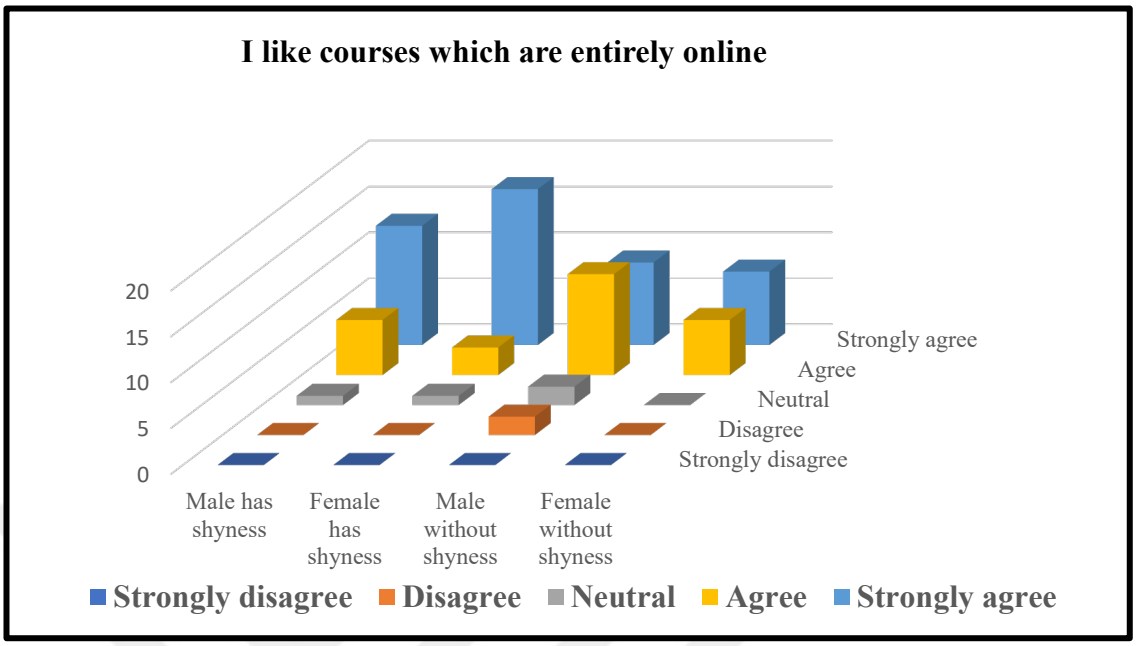
Figure 4.9: Question 7



From the "Content & Structure," category, we can conclude that the participants accepted the content of the lecture. And this gives us confidence from the Teacher and his lecture. Besides this, our web application proves that works very well by presenting the lecture and handling all this number without any problem. Also, we can see they could get the answer by our speech feature.

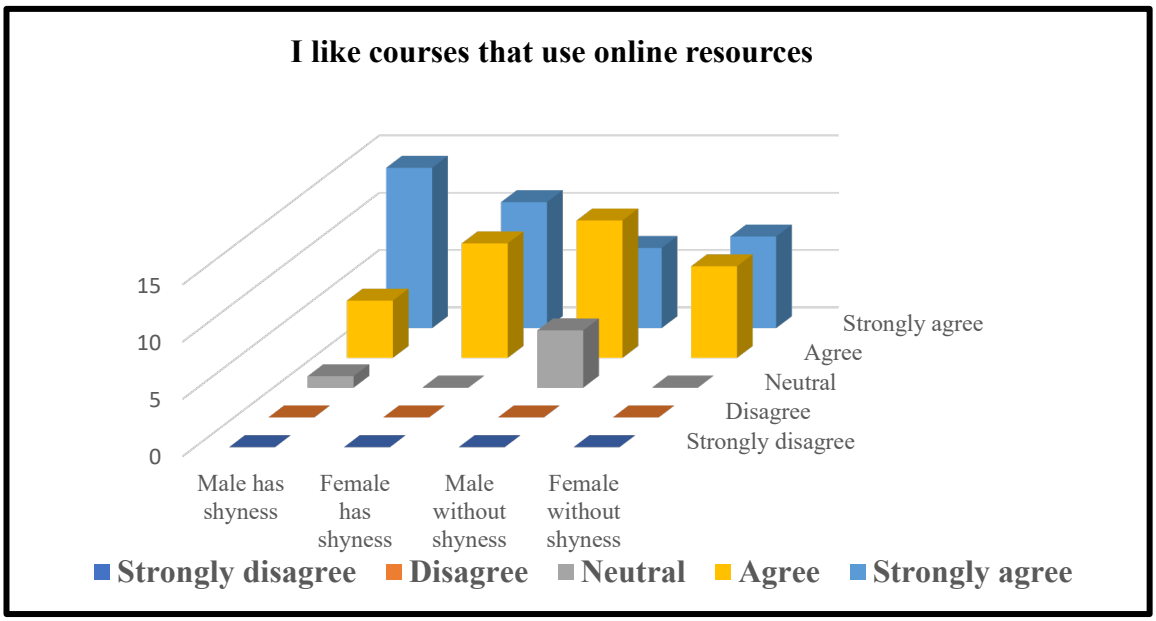
Question 8: When we proposed, "I like courses which are entirely online." 61 percentage of participants were Strongly Agree, 31 percentage Agree. However, 5 percentage was Neutral, and 3 percentage was Disagree.

Figure 4.10: Question 8



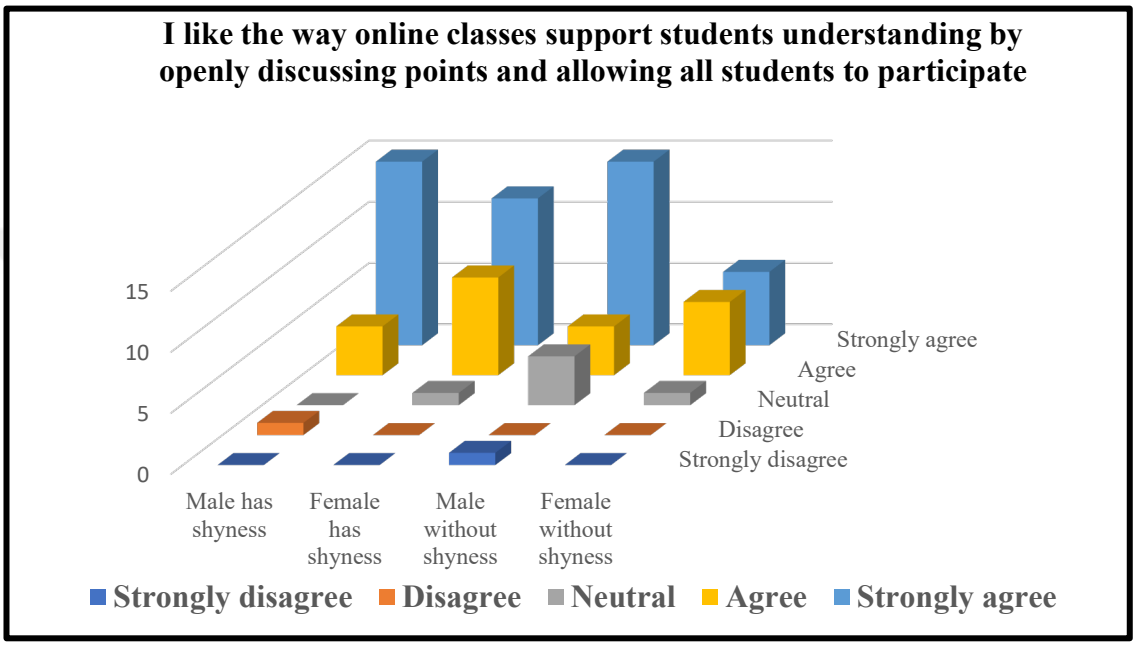
Question 9: When we proposed, "I like courses that use online resources." 52 percentage of participants were Strongly Agree, 40 percentage Agree. However, 8 percentage was Neutral.

Figure 4.11: Question 9



Question 10: When we proposed, "I like the way online classes support students' understanding by openly discussing points and allowing all students to participate." 51 percentage of participants were Strongly Agree, 44 percentage Agree. However, 5 percentage was Neutral.

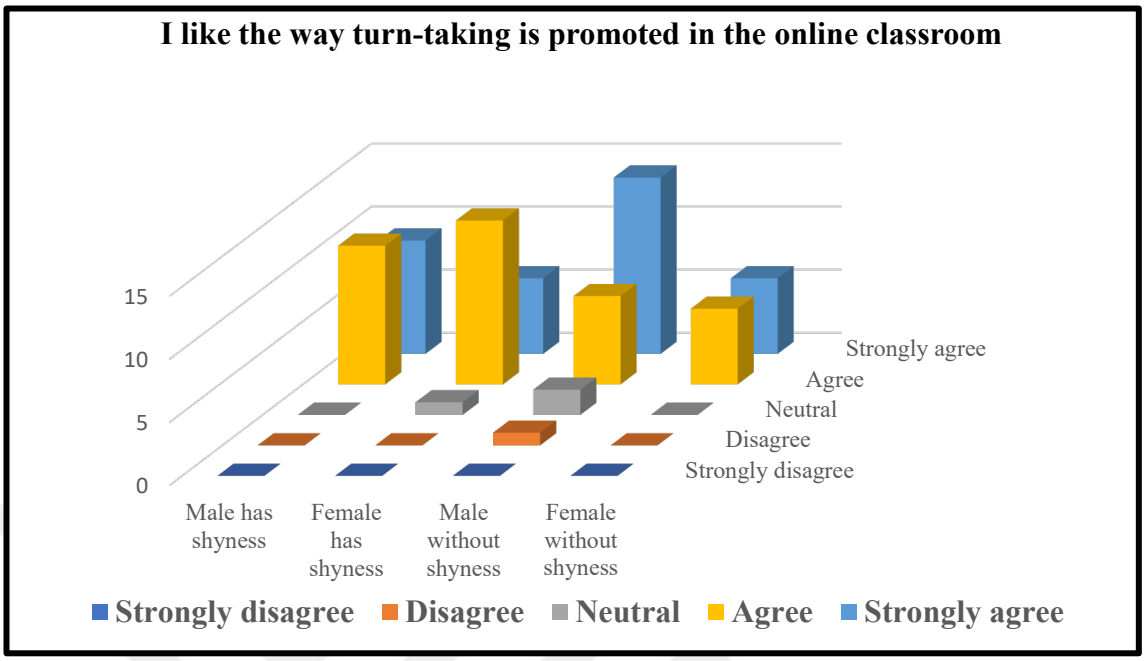
Figure 4.12: Question 10



From "Functions & Interactions," category, we can conclude that most of the participants preferred online resources for their classes.

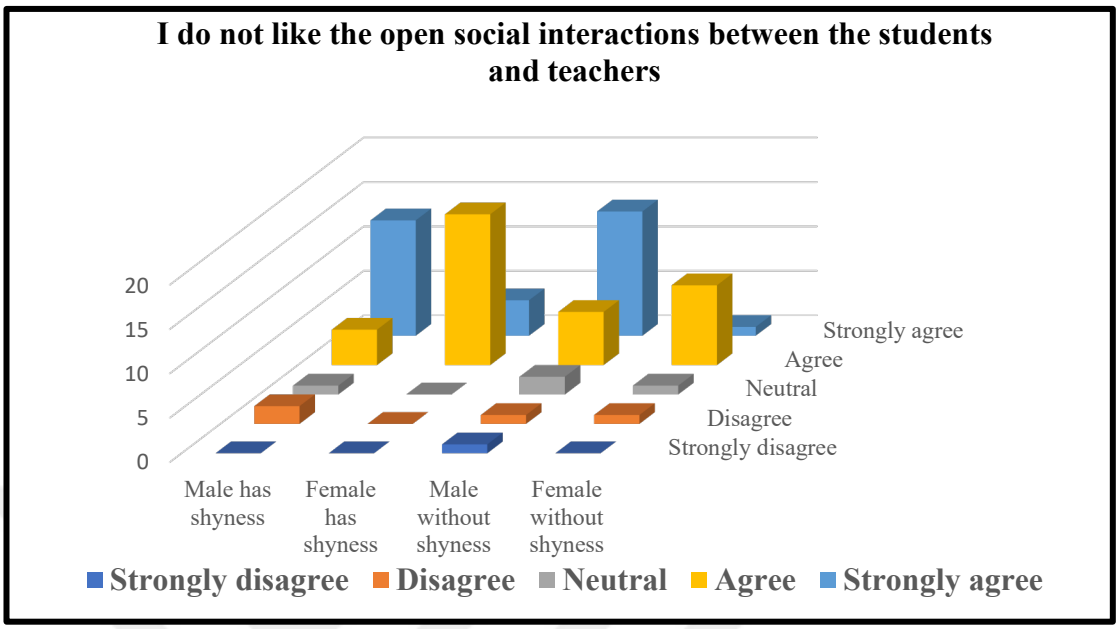
Question 11: When we proposed, "I like the way turn-taking is promoted in the online classroom." 62 percentage of participants were Strongly Agree, 28 percentage Agree. However, 7 percentage was Neutral, 1.5 percentage was Disagree, and 1.5 percentage Strongly disagree. This result helps us to understand that most of the students want to change the way learning, from the traditional way to the online way.

Figure 4.13: Question 11



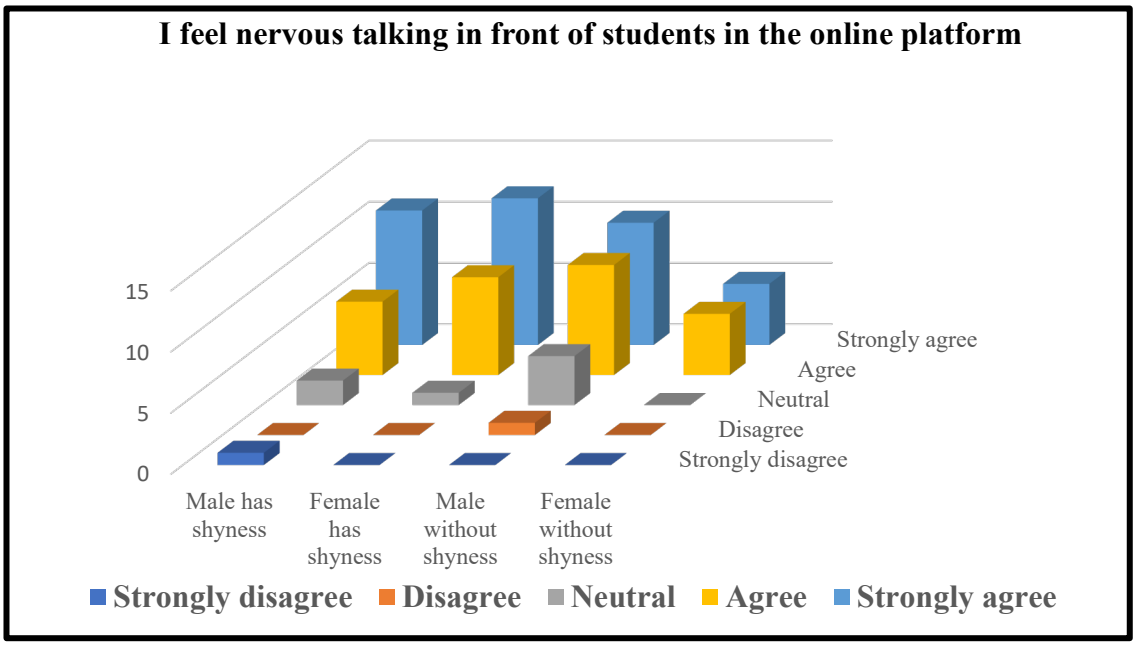
Question 12: When we proposed, "I do not like the open social interactions between the students and teachers." 42 percentage of participants were Strongly Agree, 47 percentage Agree. However, 5 percentage was Neutral, 5 percentage was Disagree, and 1 percentage Strongly disagree. Here we can understand that most students do not like to be an interaction between them and teacher.

Figure 4.14: Question 12



Question 13: When we proposed, "I feel nervous talking in front of students in the online platform." 49 percentage of participants were Strongly Agree, 36.5 percentage Agree. However, 12.5 percentage was Neutral, 1 percentage was Disagree, and 1 percentage Strongly disagree. As we can see here even for students who do not have shyness they have some issue to talk front the other.

Figure 4.15: Question 13



From "Comparison & Preferences," category, we can conclude that most of the participants preferred to be a distance between a teacher and student in order to prevent shyness..

4.2 DISCUSSION OF FINDINGS FOR RESEARCH QUESTIONS

100 percentage of the students completely filled the whole questionnaire, and this is the records that were used in coming up with the final results.

89.96 percentage of those who completely filled the questionnaire showed a positive attitude towards teachers who use SmartLecture.

95 percentage of the total number of students felt that the use of Smart Lecture works fine for them.4.53 percentage of those who completely filled the questionnaire disagreed with the statement that lectures by online resources are better, and they preferred the traditional way..After the lecture the understanding percentage was 96.27 percentage, with some feedbacks.

Participants found the Smart Lecture more attractive, because of the ability they have to ask questions during the lecture with a high level of engagement, which signals they were able to internalize the content. Interactive question where they can ask by speech was very helpful for them. Still, need this web application some improvement like finding a way to enabling in all browsers, and add more features such as school organization. In the end, we wanted to create a new way for education to help students with best practices, and from the result, we can see there is a good engagement and acceptable from people for this new generation of learning.

5. CONCLUSIONS

The most important thing about education is not just about teaching. Rather it is about having the right strategies that enhance learners' experience. It is also about focusing on some of the most important techniques that can help individuals focus on the study concept or lessons in an acceptable way within the social and educational contexts. The use of technologies such as SmartLecture among others is important. This discussion has tried to reflect on some of the most important strategies that can be used to improve academic performance and the overall relationship shop of children across the board. Learner-to-learner education is not a simple issue that can be dismissed in contemporary society. It helps ensure that most of the learners are kept updated on the correct social and economic challenges that the larger group may be facing. Several recommendations can be presented to ensure that student to different levels receives the best out of their sacrifices. First, it is necessary to encourage learners to turn their attention to the online, virtual learning systems. This makes even more sense in countries with better information technological facilities (Larson & Rumsey 2018). Two, it goes beyond simply being literate about technology. Rather, every person should be trained on some of the new learning strategies to improve the experience during the most important times. Finally, it is necessary to cultivate the attitude of most learners positively to enjoy mathematically. This begins by educating parents and other family members with children after school to use logical reason, if needed, to show the child that problems can be solved if such alternatives are considered.

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APPENDIX