A MOBILE-BASED STUDENT CLASS RESPONSE SYSTEM:

CASE STUDY OF THREE KENYAN UNIVERSITIES

KAJE DAVID MURITHI

A thesis submitted to the school of science and technology in partial fulfillment of the requirements for the conferment of the Master of Science degree in Computer Information Systems of Kenya Methodist University

SEPTEMBER, 2022

DECLARATION AND RECOMMENDATION

Declaration

I declare that this thesis is my original work that has not been presented for any award in any other university.

Signature: …  …… Date: ……...

Kaje David Murithi

MCS-3-0773-3/2014

Recommendation

This thesis has been submitted for examination with our approval as University Supervisors.

Signature: …  …… Date: …….

Dr Chao Mbogho, Phd

Kamilimu

Signature: …  ……. Date: ……...

Jenu John,

Department of computer science,

Kenya Methodist University.

COPYRIGHT

DEDICATION

I dedicate this thesis to my lovely mother, Jane Mugure.

ACKNOWLEDGEMENT

I would like to express my deep and sincere gratitude to my first research supervisors, Dr. Chao Mbogho, Founder and CEO of the award-winning mentorship program, KamiLimu and Madam Jenu John director of DVBL for giving me massive support and providing invaluable guidance throughout this research.

I would also like to thank my mother Jane Mugure and my brothers James Muthiora and Dancun Muchui for their love, prayers, care and sacrifices, support and valuable prayers. I would also like to thank my bestfriend charity kinanu for her massive support through this whole process.

A Special mention to Dr Amos Chege, Meru University of science and technology, Dr Josephine Kirimi, Mount Kenya University for their immense help during the data collection process.

Above all I thank almighty God for His abundant grace.

ABSTRACT

University students who learn in large classes face disadvantages such as lack of lecturers' attention and shyness in asking questions. This situation may cause students to not effectively gain the knowledge taught, or they may be uninterested in the subject, ultimately causing poor performance. These consequences of large classes were validated through a pilot study conducted among 70 students and 5 lecturers at Kenya Methodist University. The ubiquity of mobile phones provides an opportunity to use them to increase student participation in large classes. To design such mobile-based systems, student and teacher participation influences their willingness to use such applications. The prime intent of this study was to design and test the effectiveness of a mobile-based student-response system to support learning and student interactions in large classrooms. The specific objectives are to determine attitudes, subjective norms and perceived behavioral controls in use of mobile-based response systems for in-classroom learning, to determine the requirements for a mobile-based student response system, and to test the effectiveness of a mobile-based student class response system. This study was guided by the theory of planned behavior. Mixed methodology was used to collect data from 3 universities; 1 public university, 1 private university, and 1 university with letter of interim authority. The universities were selected first using cluster sampling to identify private and public universities, and then in each of these categories, the specific institutions were selected using convenience sampling. In each selected institution the respondents were deans, heads of departments, lecturers and students. Deans and heads of departments were selected using purposive sampling, while the teachers and students were selected using simple random sampling. Surveys, questionnaires and experimental methods were used to collect quantitative and qualitative data. Pre-testing of research instruments was conducted at Kenya Methodist University, main campus, which was selected using simple random sampling. The experimental method involved the testing of a prototype designed by the researcher among students and teachers at the 3 universities, to measure the effectiveness of a student- response system. SPSS was used to analyze data using descriptive statistics, and text analysis was used for qualitative data. Then data was then summarized and presented in tabulated form by using totals, frequencies, graphs, charts, percentages, and narrations. The findings are used to develop a mobile based SRS that supports active classroom participation by enhancing students to ask questions, take quizzes, participate in virtual group discussions and participate in polls while giving the lecturer immediate feedback, hence improving in-classroom dynamics.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

ABBREVIATIONS AND ACRONYMS

Abbreviation	Meaning
BYOD	Bring Your own Device
CAT	Continuous Assessment Test
COD	Chair of department
CSS	Cascading Styles Sheet
DVBL	Director of Virtual and Blended Learning
HTML	Hypertext Markup Language
IDE	Integrated Development Environment
JS	JavaScript
KeMU	Kenya Methodist University
LIA	Letter of interim Authority
LMS	Learning Management System
M-Learning	Mobile Learning
ODEL	Open Distance and e-Learning
SD	Standard Deviation
SPSS	Statistical package for social sciences
SRS	Student Response System
TPB	Theory of Planned Behavior
TVET	Technical and Vocational Education and Training

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

Large number of students being admitted to institutions of higher education has resulted to large class sizes. Fast growth in population and worldwide incentives towards university education are key factors towards the rapid growth in numbers in institutions of higher learning precisely in developing countries (Korucu & Kartal, 2019). For example, Kenya has seen a growth in the number of universities, which has currently risen to 90 universities consisting of 30 public universities, 30 chartered private universities, and 30 universities with Letter of Interim Authority (LIA) (Ogot & Onyango, 2022). This large number of universities has also led to an increase in student enrollment. For example, a survey carried out in 2019/2020 noted that there were 509,573 university students in Kenya, both full-time and part- time whereas a study conducted in 2021/2022 noted 620,456 students (Ogot & Onyango, 2022). This big number in student enrolment has resulted in large student numbers in classrooms across many courses within Kenyan universities.

A large classroom is whereby the lecturer to student ratio is at least 1 lecturer to 40 students (Wettstein, 2018). Consequently, lecturers in charge of large classrooms in universities are faced with challenges such as not effectively addressing the needs of all the students (Robertson, 2020). Additionally, teachers in large classrooms find it difficult to design teaching methods that actively engage students in their learning

experiences (Korucu & Kartal, 2019). Further, students in these large classes encounter challenges such as high failure rates due to academic under- preparedness and poor classroom participation (Oyoo, 2019). Thus, large classes present learning challenges in many countries around the world. For example, a study conducted in the United States shows that students who sit at the back in large classes are affected in terms of performance and student experience (Jokhio et al., 2020), while another study in Ghana showed that large classes make it difficult to organize regular assessments (Jokhio et al., 2020). In Kenya, overcrowding in primary schools has led to dangerous consequences such as loss of life (Gachanja et al., 2021) reduced quality of teaching and learning in secondary schools (Jokhio et al., 2020) and low teacher-student interaction at a university (Oyoo, 2019).

To gain an in-depth understanding of the specific teaching and learning problems caused by large classes at a Kenyan university, the researcher conducted a pilot study in February 2019 at Kenya Methodist University (KeMU), Main campus. KeMU, Main campus, was selected because as one of the lecturers, the researcher has taught a large class and faced challenges in teaching and delivery. By February 2019, KeMU Main campus had a student population of 2908. KeMU has 7 common courses namely Computer applications (COMP 100/ COMP 016), Basic statistics (MATH 130), Communication skills (COMM 111), Christian beliefs (THEO 111), HIV/AIDS (HSCI 225), Fundamentals of entrepreneurship (BUSS 221) and Environmental Science (ENVI 201). Common courses are the subjects that have to be enrolled by all students in KeMU regardless of their respective fields of study. Due to the number of students in all the

academic programs at KeMU, these common courses tend to have large classes.

The pilot study employed cluster sampling to identify seven common subjects and their lecturers, and then a simple random sampling to select students who were enrolled in each subject. Each of these 7 subjects had a class size of 72, 143, 72, 71, 183, 350 and 107 respectively. Ten students were randomly picked from each cluster leading to a total of 70 respondents, and 5 different lecturers teaching Computer applications, HIV/AIDS, Communication skills, Environmental science and Fundamentals of entrepreneurship at KeMU Main Campus. The pilot study participants completed a survey to determine the challenges that they faced teaching and learning in large classes.

The pilot study at KeMU revealed that students in large classes are affected by issues such as inadequate resources for in-classroom learning and fear of asking and answering questions. Also, lecturers are faced by problems such as difficulty in conducting individualized learning since too often, interaction is restricted to students in front rows and it would take forever to call on every student to answer questions. The lecturers further faced difficulty in managing the classes, pressure to increase students input in classroom through active classroom participation and difficulty in appropriate assessment and feedback. 68% of the student respondents indicated that they were afraid to ask questions or make any verbal contribution in these large classrooms as they thought they might be perceived as stupid by other students. 80% of the lecturers indicated that they had the pressure to increase student throughput via active classroom

participation whereas 60% were faced with the problem of individualized learning where it is impossible for the lecturer to cater for the needs of each individual student. 40% of the lecturer respondents cited the issue with difficulty in managing the classes whereas 20% had problems with assessing the large number of students where the lecturers opted for group work rather than continuous assessment tests (CATs). Further, 15% of total students' respondents cited the problem of inadequate resources as the number of students' vs computers available was not logical since the number of students was more than the number of available computers. 15 % of total students' responses citedthe problem with assessment and feedback in these large classes since they felt that the lecturers didn't give adequate assessments in the sense that due to the big number of students, most lecturersin large classes would be afraid to give proper assessment due to a big workload in marking and hence would end up giving group works instead of continuous assessment tests. These results validated that large classroom led to grave consequences for students and teachers, and they pointto an opportunity to provide a solution that supports better teaching and learning within large classrooms in the Kenyan context.

There are many different approaches that have been used to try and solve these problems associatedwith large classrooms. For instance, consistent use of structured groups in large classrooms has been adopted in many universities in Cyprus (Rodríguez et al., 2022). Other researchers have proposed that instructors should emphasize positive behaviors to improve classroom management. Whereas others believe that peer and self-assessment should be mandatory in large classes (Roshan et al., 2022). All the mentioned

strategies to curb the problems associated with large classes have their drawbacks such as the time factor and the need to effectively address the needs of students in large classes (Jokhio et al., 2020). Researchers believe that the usage of mobile phone for classroom learning should be incorporated alongside any of the above strategies to effectively address problems faced in large classes (Wood, 2020). Further, some researchers back this up and believe that the usage of a Mobile based student response systems (SRS) in classes would be the ideal solution to these problems (Calderón et al., 2022).

Developed countries have adopted the usage of SRS (student response systems) to deal with the above issues and most researchers believe that the usage of Mobile based SRS is the way to go (Barbaro & Yaari, 2020). For example, Kahoot, is a game mobile based student response system and has highly been recommended for big classes by many researchers to enhance interactivity between students and lecturers. Kahoot has been used to facilitate in classroom teaching in many subjects and has highly positively impacted teaching and learning (Wang & Tahir, 2020). Several literature reviews claim the benefits of kahoot include provision of instant feedback, enhancement of active classroom participation, and improved comprehension rates among students learning (Wang & Tahir, 2020). In addition, multiple studies have found that attendance improves when Mobile phones are used in classroom learning, provided that attendance counts in the final marks of the students. Kahoot also plays a vital part in aiding the learners developing the students' capacity to self-regulate their own performance (Nieto & Sit, 2022). However, these benefits of mobile-based SRS systems require that students own mobile phones.

Nintey six percent (96%) of the students who took part of the pilot study owned Smartphones. This level of ownership is aligned with the high ownership level of Smartphones among Kenyan adults (Kemuma, 2021). Further, Kenya has a 91% penetration of smartphone usage, with a high percent being university students, compared to Africa's 80% (Kemuma, 2021). Compared to smartphone ownership, studies indicate that many institutions in Africa have a low number of technology resources withininstitutions to support the learning (Lee, 2022). For example, the number of computers at KeMU's computer laboratories is 78 computers, which does not adequately serve the number of enrolled students. For instance, according to KeMU admissions, the number of students enrolled in a Computer Application class in the September to December term of 2019 was 254 students. Therefore, the ratio of computers to students is roughly 1:3, meaning that three students shared one computer if they were to occupy all computer laboratories.Yet, the recommended ratio for student to computer, for effective teaching of computer studies, is1:1 (Compton & Allen, 2018).

While Smartphones have a high ownership among university students and adults alike, their use within the classroom has been frowned upon (López-Jiménez et al., 2021) due to their influence on cheating, access to improper sites, cyber bullying, and disruption of students' attention (Ault & Horn, 2018). However, studies have shown that increased teacher participation in the design of smartphone applications for in-classroom use, positively influences their willingness to use such applications (Adkins et al., 2021). Further, the COVID-19 pandemic has shifted many classrooms online,thus indicating

that there is opportunity to devise new ways for student participation using technology. Therefore, this study will employ the use of Smartphones to explore their use in designing and developing a student response system.

Student response systems enable students to actively participate in an anonymous way in class. Since most SRS allow students to participate anonymously, students feel comfortable to ask and answer questions in classrooms without fear of being perceived as stupid (Kumar et al., 2018). The students feel safe since it's impossible for their classmates to determine which answer was provided by which student or which question was asked by which student. Students also feel comfortable to respond to sensitive, ethical, legal and moral questions since the whole process is private. Many researchers agree that SRS positively impact the overall learning process (Voith et al., 2018). Many studies conducted worldwide found out that students were twice as likely to answer questions using SRS as opposed to traditional teaching methods (Shahzad et al., 2020).

Similarly, a study conducted at Harvard University, concluded that when student response systems were used to enhance synchronous feedback in large classrooms, students disclosed that they had better comprehension of the course materials, researched more on the course topics before class and performed better than when the student response systems were not in use. The study also concluded that student response systems facilitate improved students' attention in classrooms and enhance active classroom participation (Wood, 2020).

Research on the effectiveness of a mobile based student response system known as Socrative was conducted in physiology Department of the College of Medicine in Taibah University where a total of 128 respondents were chosen 87% of the students provided positive responses; 85% of the students responded that the activities were fun and interactive, 84% claimed to be more actively engaged in classroom, and 71% felt that they were inspired. Furthermore, 90% of the respondents agreed that this exercise boosted the learning process. Most students agreed that Socrative aided them in group. The study also determined that the attitude of the students didn't vary based on their gender or the amount of time they use their phones per day. Approximately 99% of the respondents had a preference for multiple-choice questions over true/false and short answer questions. Instructors responded that Socrative was easy to use (user friendly), had an appealing interface and improved students' exam performance (AlSunni & Latif, 2020),

These examples show that the potential of using mobile based SRS positively in class is really high. Further, the high smartphone proliferation among Kenyan university students provides an opportunity to use them to support learning within large classes so as to reduce effects such as fearof asking questions or making any verbal contribution and pressure to increase student throughputvia active classroom participation by the lecturers. Therefore, this study seeks to test the effectiveness of a mobile based student response system within a large classroom in the context ofKenyan universities.

1.2 Statement of the problem

Studying in a class that has many students is not ideal since students' abilities and background vary and the lecturer unconsciously neglect some of them. Eventually, this lack of attention from the lecturers may create a negative mindset causing students to lose their interestandbe unwilling to actively participate (Korucu & Kartal, 2019). Many researchers have proposed use of student responsesystems to mitigate lack of active classroom participation but most instructors from developing countries are not supportive of the idea since they deem mobile phone usage in classroom to be a technology that deviates students' attention in class. However, research indicates that the involvement of students and teachersin the design of a student response system may improve attitude by the stakeholders in adopting the system and increase its effectiveness. This research aimed to determine the effectiveness of a mobile based SRS in Kenyan universities by using theory of planned behavior to investigate the attitudes, subjective norms and perceived behavioral controls of both learners and instructors.

1.3 Research Objectives

1.3.1 General Objective

- To design and test the effectiveness of a mobile-based student class response system insupporting learning within large classrooms for Kenyan universities

1.3.2 Specific Objectives

1. To determine attitudes, subjective norms and perception of the ease or difficulty in use ofmobile-based response systems for in-classroom

learning.

2. To determine the requirements for a mobile-based student response system.
3. To test the effectiveness of a mobile-based student class response system.

1.4 Research Questions

1. What are the attitudes, subjective norms and perceived behavioral controls in use ofmobile-based response systems for in-classroom learning?
2. What are the requirements for a mobile based student response system that can be used forenhance learning in classroom environment?
3. What is the effectiveness of a mobile-bases system in supporting classroom interaction?

1.5 Limitations

A major limitation of this study was using purposive sampling to select deans and CODs was a challenge. Purposive sampling involves selecting respondents for your research since they have certain characteristics that you need. In case that person is unavailable it will require the researcher to wait since you can't substitute them with anyone else.

1.6 Delimitations of the study

During the pilot study, the researcher found out three main problems faced by large

common unit-based classes. These included lack of enough computer in computer labs, difficulty in conducting individualized learning in large classes by the lecturers and fear of asking and answering questions by the students hence limiting active classroom participation. This research focused on the problem of limited active classroom participation for two major reasons. First, it was the major challenge faced by students in large classes and secondly, in order for the researcher to scope and address the problem effectively hence the need to narrow down to a specific challenge. The universities were selected first using cluster sampling to identify private and public universities, and then in each of these categories, the specific institutions were selected using convenience sampling. The universities selected were Meru University of science and Technology University which is a public university, Mount Kenya University which is a private university and UMMA university which is a university with LIA. The researcher chose these universities, one public, one private and one with LIA, so as to make sure each group is wellrepresented for accuracy purposes.

There are many different units offered at Kenyan universities but this research focused on common course units, because these are the course units that attract more students because theyare tackled by all programs across the university.

1.7 Justification of the study

Most students' response systems nowadays are very expensive, have questions limitations where the lecturer can set a limited number of questions. In addition, all student response systems have only two users i.e., the lecturer and the students

(Kumar et al., 2018). Lack of inclusion of important users such as deans and CODs is an important feature that is overlooked by all SRS. For these reasons, the researcher opted to develop a mobile based students' response system that incorporates all vital users in the academic sector i.e., deans, CODs, lecturers and students. The system is free to all users, effectively addressing the issue of financial implications and supports unlimited number of question upload by the lecturers. The system also has a sleek design and is very user friendly to all the involved users.

University has Common courses which are large classrooms and are faced by the challenges such as active classroom participation. When faced with such challenges the lecturers may be required to look for different teaching methods that are able to cater for the big number of students in class. In a large class, students vary in abilities and background (Wettstein, 2018). It is not advisable for students to study in classes that have many students since it would be impossible for the lecturers to cater for each individual student in such classes. In the long run, this lackof attention may create a negative mindset and lead to students not willing to participate or being uninterested in the course. Furthermore, students would be afraid to answer and ask questions in such a class (Korucu & Kartal, 2019).

The developed mobile based student response system enables the students to actively participatein classroom by asking and answering questions in an easy way since based on a several studies that have been conducted students reported

they were more likely to ask and answer questions using SRS than when the lecturer is using traditional teaching methods (Voith et al., 2018)

1.8 Significance of the study

This research is important because it shows how the problem with large classes can be effectively addressed using technology. A number of researchers have identified many problems associated with large classes worldwide and this research shows how most of these problems can be effectively addressed using student response system.

The research also validates the hypothesis made by researchers that if stakeholders are involved in the design of a student response system, it would influence their willingness to adopt such a system for in-classroom use.

1.9 Chapter Summary

This chapter gives an overview of the study from the background of the study, research questions and objectives. In addition, the chapter also describes the significance of the study, limitations and defines terms used and the thesis outline.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

The aim of this research was to determine the requirements of a mobile based SRS and develop a Mobile based SRS for in-classroom learning to enhance active classroom participation in large Kenyan university classrooms. In order to achieve the above this research aimed to determine the attitudes, subjective norms and perception of both learners and lecturers in using such a system. Therefore, this chapter begins by reviewing the problems associated with large university classes, followed by an analysis of both non-tech and tech strategies used by other universities globally to solve the problems associated with such classes. Non-tech strategies are approaches that don't involve technology whereas tech strategies involve the usage of technology to solve problems associated with large classes. The latter i.e., tech strategies have proved to be more effective in handling some of the problems experienced in large classes. As a result of this, it was apparent that problems associated with large classrooms among Kenyan universities can be solved by a mobile based SRS. Therefore, this chapter presents a review of related work that address usage of SRS for in-classroom learning. Thereafter, the chapter reviews theory of planned behavior as a potential approach to evaluating factors that would determine user willingness in using such a system for in-classroom learning. The chapter concludes with a summary of gaps and opportunities identified from the related work, which form the foundation of this study

2.2 Problems associated with large classrooms and strategies being used to mitigate them

Economically today, education is one of the highest valued aspects to success. Education is not only important to a few people, but to all the members of society (Wettstein, 2018). Due to this reason, enrollment levels, especially in universities has gone up over the years meaning the number of students in universities has gone up (Rodríguez et al., 2022). The high number of students in undergraduate class sizes means that the need of each individual learner isn't effectively addressed hence most learners aren't likely to actively participate in classes (Jokhio et al., 2020). Most common problems associated with large classrooms include lack of adequate resources for in-classroom learning and fear of asking and answering questions by the learners. On the other hand, lecturers are faced by problems such as, pressure to increase students' throughput through active classroom participation, difficulty in managing learners in big classrooms, lack of attention to the learners, limited progress checks on learners and difficulty in ensuring that learners participate in classroom activities and difficulty in appropriate assessment and feedback (Mohammed, 2017). There is also a high probability that such learners don't acquire enough knowledge from such classes hence affecting their studies (Mohammadi et al., 2020).

As a result, to the above problems, different strategies, both non-tech and tech related have been used to try and solve these problems associated with large classrooms. For instance, usage of structured study groups where students are divided into groups, allowing them to

be self-managing and allow more time for practice (Wettstein, 2018). Other non-tech strategies emphasis on positive behaviors to improve classroom management, introduction of peer, increase in student responsibility and self-assessment in large classes (Mohammadi et al., 2020).

On the other hand, some universities have opted to use of tech related strategies by using SRS for in-classroom learning. Student response systems (SRSs) have been in existence since the 1960s and started were already getting utilized in the early 1970s in teaching science related courses (Mohammadi et al., 2020). Since then, multiple researches on SRSs have been conducted with findings including enhanced in-classroom dynamics, optimistic attitude from learners and teachers and improvement in exam performance, learners more likely to actively participate in class, increased student attendance and improving learning environment (Kumar Basak et al., 2018). For instance, Padua university in Italy, uses web-based SRS whereby Students use computers in computer lab for answering quizzes and for activities such as report generation (López-Jiménez et al., 2021). Other universities use web-based SRS in class to create and get responses from polls, play educative games via game-based SRS and online signing of lecture attendance (Ault & Horn, 2018).

2.3 Web-based SRS Usage for in-classroom learning

In addition, Harvard and Cambridge Universities use web-based SRS and it has led to great benefits (Wood, 2020). In Harvard University, students use SRS to choose their perceived correct answers from the provided multiple-choice questions. The lecturers ask

these questions after the they lecture for around 20 minutes. The questions focus on one sub-topic from the learning outcomes set for a class. The answers given enables the lecturer to determine the level comprehension by the learners before proceeding with the rest of the lecture. The lecturer poses questions that engage and asses the comprehension of the learners. If many students choose the right answer, the lecturer briefly discusses the notion in question and proceeds with the lecture. Otherwise, the lecturer provides in-depth discussion of the notion to the learners. In the case where many answers are wrong, the lecturer might sometimes ask the learners to have discussions with their neighbors in classrooms regarding the question posed. They are then allowed to choose their answers again from the multiple-choice question and procedure is repeated. Such systems allow the lecturer to have access to instant feedback from the learners (Ismail et al., 2020). The SRS in the mentioned universities are also helpful in administering class attendance, conducting quizzes, conducting polls, conducting formative assessments and integrating quizzes from learning materials (Adkins et al., 2021). Due to their many capabilities, usage of SRS has led to improved classroom dynamics hence promoting active classroom participation, (Nieto García, 2022) Many universities across the globe have realized the advantages of SRS (Shahzad et al., 2020).

2.4 Smart Phone Usage Penetration and usage of Mobile based SRS for in-classroom learning

While the usage of web-based SRS has been a success in many universities worldwide, researchers believe that the problem of lack of infrastructure would make its usage difficult in most African universities. This is where the number of computers is low compared to the number of students in these universities. To mitigate this problem, usage

of smartphones which are ubiquitous has been highly recommended (Kocak, 2022). The current number of smartphone users globally today stands at 6.648 billion, meaning that 83.37% of theworld's population owns a smartphone (Barbaro & Yaari, 2020). Further, a study conducted by Pew Research in 2020 found that 80% of adults in Kenya are mobile phone owners, with 50% owning a smartphoneand 30% owning a basic phone (Kocak, 2022). In addition to their ubiquity, smart phones are able to connect us to a variety of information sources and enable communication nearly everywhere we go (Voith et al., 2018). There should be high interest in exploiting the ubiquity of these technologies for their educational use as institutions of higher education are getting big numbers in admission of new students and the number is expected to constantly go up over the years (Ismail et al., 2020).

The usage of mobile phone for in-classroom learning isn't a new concept since we have mobile applications that incorporate SRS. One of the most popular such application is Kahoot. Kahoot has around 70 million end-users and is widely used by many institutions across the globe (Wood, 2020). Kahoot is a game-based learning platform used for classroom assessment or as an alternative to the normal traditional activities conducted in classrooms. Kahoot incorporates an SRS to the infrastructure already in schools and enhances learner participation, attentiveness and entertainment hence improving in-classroom dynamics (Ault & Horn, 2018). One other mobile application that has many similar features as Kahoot is Socrative. Socrative furnishes the users with synchronous classroom assessments to get feedback from the learners via forms and incorporates Space Race which is a game played by teams of students. In this game, the teams proved answers

to questions and every correct answer moves their rocket across the screen. The teams compete to move their rocket faster than the other teams across the screen and the team that moves their rocket the fastest wins (Voith et al., 2018). Another example of a mobile based SRS is Quizlet, which allows learners to get knowledge from various topics through spellers, tests and virtual flashcards. Quizlet also incorporates a game namely Space Race. In this game players can kill items crawling across a screen by answering questions correctly. The player who kills all the crawling items the fastest, wins the game. Quizlet focuses on word spelling and defining the words correctly (Nieto & Sit, 2022). Another mobile based SRS is Quizizz. Quizzes supports asynchronous quizzes which means that leaners don't need to wait for other leaners to answer their questions before proceeding to the next question unlike in Kahoot. Poll Everywhere is another mobile based SRS used for gathering feedback from audience in synchronous manner either through open-ended questions or quizzes (Kocak, 2022). There are also many SRS in market that aren't game based for instance Learning Catalytics which is a math-based SRS. Learning Catalytics allows learners to submit responses that are algebra based or are graphical. Plicker is another example of such SRS. Plicker allows learners to provide feedback using Plicker cards. Plicker cards are virtual cards which have a distinct pattern for every learner. Leaners usually rotate their cards to provide four different responses that are received by a camera embedded on lecturer's digital equipment (Wood, 2020). These mobile based SRS have been used worldwide for in-classroom learning and has brought forth many advantages in increasing active classroom participation in a fun way since monotony in a computer learning environment can affect the overall learning process (Calderón et al., 2022).

2.5 **Drawbacks to smartphone usage for in-classroom learning and Mitigation strategies**

While it is clearly apparent that mobile phone usage for in-classroom learning has numerouspositive effects, there are many drawbacks to their integration with educational technologiesin the teaching and learning process. These challenges vary from different institutions globally (Adkins et al., 2021). The usage of mobile phone inside classrooms for whichever reason is strictly prohibited in several countries such as Serbia, with many others also banning mobile phone usage in classroom. For instance, in African context, Nigeria and Ghana leaners are mostly discouragedagainst the usage of mobile phones in classrooms where they are either forced to have their devices either switched off or in silent mode during classes, with those breaking this rule being punished (Nieto & Sit, 2022). Further, Kenyan universities put a major emphasis on quality but the use of mobile phones for learning has yet to be harnessed (Wood, 2020). This is totally opposite to what is done in developed countries like United states of America, Denmark and New Zealand where "Bring Your Own (BYOD) is supported. This is whereby learners are allowed to bring their personal devices to school for in-classroom learning. The perceptions of some educators and some policies that isrigid in some educational institutions, which often prohibit mobile phone usage for in-classroom learning, have made it very hard for instructors and learners to take advantage of the learning potentials of mobile phone technology, which have been effectively used in developed countries (Ault & Horn, 2018). According to many researchers, the issue of negative attitude towards mobile phone usage for in-classroom learning would be eliminated if both the learners and teachers would be

involved in the process of developing a system that would aid teaching and learning in a classroom environment (Wood, 2020).

To develop such a system, its mandatory to evaluate the perceptions, behavioral control and subjective norms and hence this research was strongly guided by theory of planned behavior (TPB). There are many theories that can be used to design mobile based applications for in-classroom use. The researcher chose this theory because it has been previously used successfully by many other researchers, in regards to using mobile Phones as tools for learning in classroom environment (Kumar Basak et al., 2018). For instance, this theory was used at Chulalongkorn University, Bangkok, Thailand to conduct a study with the aimof developing a mobile application to promote efficiency in online learning (Adkins et al., 2021). The same theory was also used in a study conducted among Chinese colleges, involvingsmartphone usage for educational purposes among college students (Compton & Allen, 2018).

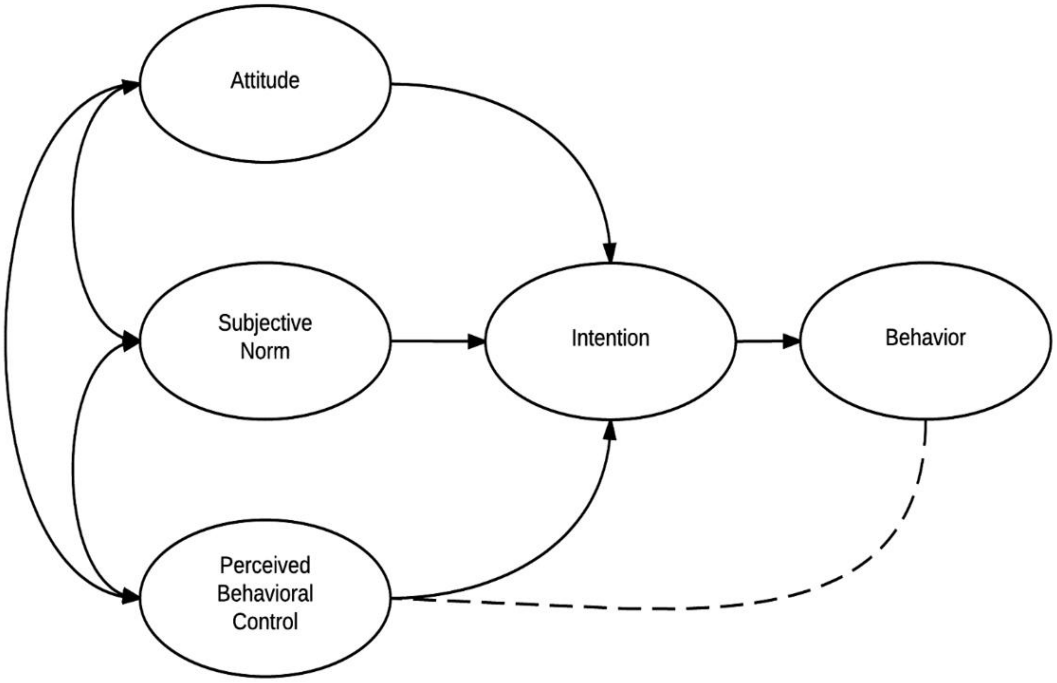
2.6 Theory of Planned Behavior

TPB was developed by Icek Ajzen in 1985. The theory came up with a model in order to determine what guides human actions. It predicts the potential of behavior occurring as long as the behavior is intentional. There are three variables that this theory is comprised of that are used to predict intention to do something as long as the behavior in question is intentional. These three variables include attitude, perceived behavioral controls and subjective norms towards the behavior (Ulker & Ciftci, 2020).

Attitude toward the behavior referrers to the individual assessment of either the behavior carried out to be carried out. This behavior can be determined based on two different beliefs i.e., behavioral belief and outcome evaluation. Behavioral belief refers to the outcome of carrying out the behavior whereas outcome evaluation refers to whether the individual deems the behavior to be carried out either as positive or negative. On the other hand, subjective norms refer to individuals' self-evaluation on social pressure to carry out or not to carry out a behavior. Subjective norms usually involve evaluation of two beliefs, i.e., beliefs about how other people who are valuable to the person may want the person to conduct themselves (normative beliefs), and how these people will judge if they opt or opt not to carry out the beliefs. The judgement can be positive or negative (outcome evaluations) (Yuriev et al., 2020). Perceived behavioral control refers to level at which a person is confident and comfortable to carry out the behavior. It hastwo control beliefs: how much a person feels in charge/control over the behavior, and how confident a person feels about being able to enact or not enact the behavior in question. It is determined by control beliefs about the power of both situational and internal factors to perform the behavior (Bosnjak et al., 2020).

Figure 2.1

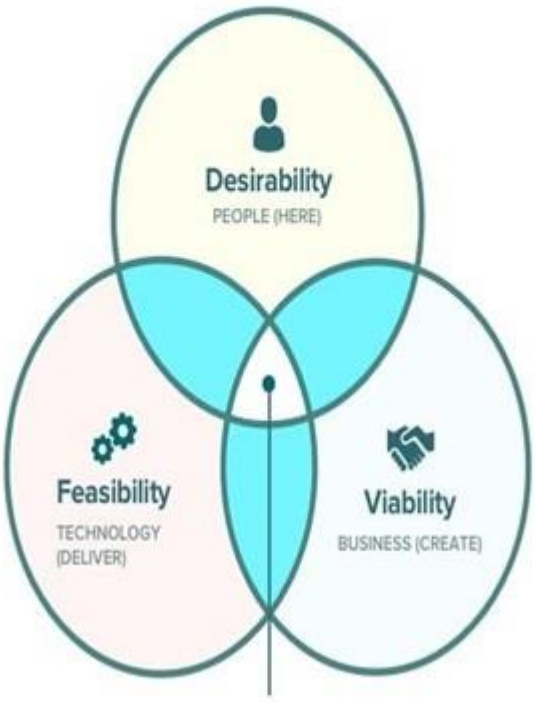
Theory of Planned Behavior icek ajzen, 1985



This research adopted Human Centered Design (HCD). HCD approach is a measurable, iterative and driven by results and refers to a way of thinking that places the sample of a research and people involved in certain research at the center stage during design and implementation processes (Ulker & Ciftci, 2020).

Figure 2.2

Human-centered Design Principles John.E. Arnold, 1985



2.7 Summary of Opportunities and Gaps from Related Work

The gaps and opportunities identified from the related work, which motivated this study, are

summarized in Table below.

Table 2.1

Summary of opportunities and Gaps from related work

Opportunities	Gaps
Increased use and penetration of mobile devices, including smartphones in Kenya (Gachanja et al., 2021)	Lack of acceptance of usage of mobile phones in class by teachers (Oyoo, 2019)
A major pro to mobile based SRS is its ability to engage the learner in a fun way and to provide immediate feedback to the lecturer (Kocak, 2022)	Lack of user centered mobile based SRS that includes learners and students in design process (Dwanoko & Arin, 2021)
Theory of Planned Behavior (TPB) helps in understanding the users' behavioral control and subjective norms that would affect users' usage of SRS (Ulker-Demirel & Ciftci, 2020)	Limited research in Kenya on mobile phone usage for in-classroom learning (M'mboga Akala, 2021).

2.8 Chapter Summary

This chapter reviewed the challenges faced in large classrooms, challenges facing mobile phone usage for in-classroom learning and how to mitigate these challenges. It also examined usage of mobile based SRS as a strategy to increase active classroom participation in large classes. Further, it looks into the literature reviews on mobile usage

in classrooms and theoretical review. The chapter ends by presenting research gaps and opportunities.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

The aim of carrying out this study is to determine the requirements for a mobile based student class response system which will help in designing an effective mobile based student class response system for Kenyan universities. The research was conducted in Mount Kenya University, Meru University of science and technology and UMMA University. Therefore, this section gives an outline of the methodology that was used in carrying out the research. It focuses on the design that was used for the study as well as the population, sample and sampling procedures, instrument to be used for the study, data collection and data analysis.

For the purpose of this study, effectiveness implied that students would be expected to show willingness to fully participate in class by asking and answering questions in class. Meaning that Students are not expected to participate for the sake of it but instead should benefit both academically and intellectually from the instructor. For this reason, the research will test the effectiveness of the mobile based SRS by finding out how students felt about their experience after using student response system in their classes and also how Deans, Cods and Lecturers felt about their experience of incorporating student response system through Smartphones in their classes.

Also, for the purpose of this study, attitude referred to how students and lecturers felt about using a mobile phone in a classroom environment. Metrics used to evaluate attitude, subjective norms and perceived behavioral controls were adopted from TPB. The metrics

used to measure attitude of the respondent's level of self-confidence, level of comfort, having sufficient level of knowledge and the overall feeling of the respondents in using mobile phones in classrooms.

3.2 Research Design

In this study, mixed methodology was used to collect data from 3 universities; 1 public university, 1 private university, and 1 university with letter of interim authority. Mixed methods refers to a methodology that incorporates a mixture of both quantitative and qualitative data within a single research (Snyder, 2019). It involved collecting information through surveys, interviews and observation where both qualitative and quantitative data was collected. Quantitative data is measurable and can be represented using numbers (Mohajan, 2018). in relation to this research quantitative data include the number of smartphone users. Qualitative data can't be measured since it's information regarding qualities (Luo et al., 2022). Qualitative data in relation to this research is the perception of mobile phones usage in classroom environment.

3.3 Variables

The variables for this study are divided into two main categories which are:

Dependent variable which is the usage of human-centered designed mobile-based student response system for active classroom participation, which can be influenced by the independent variable either on the positive or negative

Independent variables of this study are five in number i.e., attitudes of the stakeholders, subjective norms of the stakeholders, perceived behavioral controls of the stakeholders, requirements of the SRS and effectiveness of SRS.

3.4 Location of the study

The research was carried out in the following universities; Meru university of science and technology university which is a public university, Mount Kenya University which is a private university and UMMA university which is a university with LIA The researcher chose these universities, i.e., one public, one private and one with LIA, so as to make sure each group is well represented for accuracy purposes.

3.5 Sampling Design

The universities were selected first using cluster sampling to identify private and public universities, and then in each of these categories, the specific institutions were selected using convenience sampling. cluster sampling is a sampling design where researchers divide a population into smaller groups known as clusters (Wood, 2020). The researchers then select among these clusters to form a sample. In each selected institution the respondents were deans, heads of departments, lecturers and students. Deans and heads of departments were selected using purposive sampling, while the teachers and students were selected using Simple random sampling. Purposive sampling involves researchers relying on their own discernment when selecting respondents whereas Simple random sampling is a type of probability sampling in which participants are randomly selected from a population by the researcher (Lê & Schmid, 2022). The experimental method involved the testing of a prototype to measure the effectiveness of an SRS system (Mohajan, 2018). Pre-testing of research instruments was conducted at Kenya Methodist university, Main campus, which was selected using simple random sampling.

3.6 Instrumentation

Surveys, questionnaires and experimental methods were used to collect quantitative and qualitative data. The experimental method involved the testing of a prototype to measure the effectiveness of an SRS system. The questionnaires were administered via google forms to deans, Chairs of departments, lecturers and students sampled from the entire population. For ease of filling the questions in the survey tool was purely closed ended. Interviews were also used which is one of the various existing tools for primary data collection.

3.7 Validity and Reliability of the instrument

The validation process seeks to highlight issues or biases in the methodology, and any potential effect of these on the study (Luo et al., 2022)

There are advantages of the online survey via google forms, which are: its suitable for large audience since it can reach many people, it's very flexible, respondents gets the convenience of answering the questions anywhere anytime, data entry and analysis can be done online using google sheets and there is absence of interviewer bias hence anonymity of the respondent (Wood, 2020).

On the other hand, shortcomings of online survey exist, such as: Potential ambiguous questions can be the most significant drawback as the researcher may not necessarily be present to clarify any unclear questions and this may be met by unclear answers (Lê & Schmid, 2022). This limited contact with the researcher can limit the opportunity for participants to further probe for in-depth details the way an open-ended interview or focus

group could allow and the response rate might be low, and can then undermine the anticipated validity and credibility of the collected data (Mohajan, 2018).

In this study, to minimize these risks, a test survey was sent to 20 individuals in the pilot phase and 10 individuals in the evaluation phase, to seek feedback on errors so that there is assurance that there would be no challenges from the respondents while answering the questions(Wood, 2020). Furter, the researcher ensured that the questionnaire was well designed and was purely made up of close ended questions to prevent the problem of potential ambiguous answers. Moreover, on the random design that the research used, although random sampling can be a clear representation of the entire population, some other respondents can refuse to answer the survey (Lê & Schmid, 2022). The research mitigated this by getting to know why the respondents declined to answer (Wood, 2020).

3.8 Data Analysis

SPSS was used to analyze data using descriptive statistics, and text analysis was used for qualitative data. Then data was then summarized and presented in tabulated form by using totals, frequencies, graphs, charts, percentages, and narrations. The findings were used to inform the design of a mobile-based student response system to be used in large classes within universities.

3.9 Logistical and Ethical Consideration

Before starting the survey, the researcher first obtained an ethical clearance form from office of research (NACOSTI) as shown in appendix 6.7. The researcher also explained the research and questionnaire to the potential respondents and show them the entire research instrument before they start so as to obtain an informed consent from the

respondent. This also put the minds of the respondents at ease reducing chances of getting distressed during response submission, which is a valuable basis of ethics in research. Most important, for the sake of confidentiality, the identity of participants was concealed hence participants were not required to indicate their names in the questionnaires and will be informed that the exercise is absolutely voluntary in the sense that no one will be forced to participate against their will.

3.9.1 Research Protocol

The researcher conducted a pilot study in February 2019 at Kenya Methodist University (KeMU), Main campus. The pilot study employed a cluster sampling to identify seven common subjects and their lecturers, and then a simple random sampling to select students who were enrolled in each subject. Each of these 7 subjects had a class size of 72, 143, 72, 71, 183, 350 and 107 respectively. Ten students were randomly picked from each cluster leading to a total of 70 respondents, and 5 different lecturers teaching Computer applications, HIV/AIDS, Communication skills, Environmental science and Fundamentals of entrepreneurship at Kenya Methodist University Main Campus. The pilot study participants completed a survey to determine the challenges that they faced teaching in large classes.

This study was guided by the theory of planned behavior to determine attitudes, subjective norms and perception of the ease or difficulty in use of mobile-based response systems for in- classroom learning. In this study, mixed methodology was used to collect data from 3 universities; 1 public university (Meru University), 1 private university (Mount Kenya

University), and 1 university with letter of interim authority (UMMA University). The universities were selected first using cluster sampling to identify private and public universities, and then in each of these categories, the specific institutions will be selected using convenience sampling. In each selected institution the respondents were deans, heads of departments, lecturers and students, who were selected using purposive sampling, while the teachers and students were selected using stratified sampling. Surveys, questionnaires and experimental methods were used to collect quantitative and qualitative data. Pre-testing of research instruments was conducted at one of the universities, which will be selected using simple random sampling.

The researcher then collected system requirements to determine the specifications of the mobile based SRS to be developed. The requirements were divided into three categories technical/ design requirements, pedagogical requirements and design/technical requirements to determine features that mobile-based system should have to support classroom interaction. This was done via structured questionnaires administered to the respondents with the output of this process being the development of requirements document, stating the products purpose and what it must achieve.

The experimental method was used to test the designed prototype among students and teachers at the 3 universities and to measure the effectiveness of the student-response system. SPSS was used to analyze data using descriptive statistics, and text analysis will be used for qualitative data. Then data was then summarized and presented in tabulated form by using totals, frequencies, graphs, charts, percentages, and narrations. The findings

are used to show the effectiveness of a mobile-based student-response system to support learning and student interactions in large classrooms in Kenya.

3.9.2 System Design

The system was developed via SDLC (software development life cycle) approach and adopted the Iterative enhancement model/ incremental model. This means that the system was developed in modules and each increment in a new module would add some enhancements and capabilities to the system until the full system was developed. Additions and modifications were done at each step.

The researcher opted to use this model because it allowed better testing since testing each individual module is likely to be easier than testing an entire system like in waterfall model. The increment provided feedback to the client which is useful for determining the final requirements of the entire system.

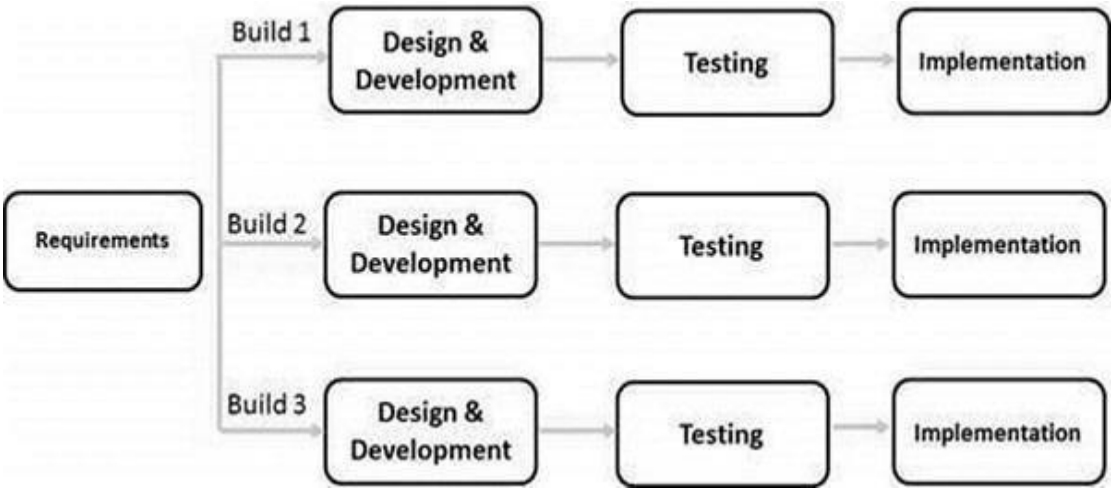
3.9.2.1 Tools needed to develop the system

1. Android studio for building, testing, and debugging: Andoid studio is and integrated development environment (IDE) used to develop mobile applications.
2. Pycharm for Backend development using Django framework and Python: PyCharm is a Python Integrated Development Environment (IDE) that provides important tools for Python developers and provides an environment for productive Python, web, and data science development
3. Vs Code for frontend development using HTML, CSS, JavaScript and Bootstrap: Vs code is a text editor used by developers to write code and

supports a variety of languages.

Figure 3.1

Iterative enhancement model Groose Kostleve, 2008



3.10 Questionnaire Structure

The study was conducted in two phases – pilot phase and evaluation phase. For the pilot, the questionnaire that was used to collect data is attached in Appendix 6. In the pilot phase study, to minimize any potentially ambiguous questions and to validate the survey, the questionnaire was sent to 10 individuals (9 students and 1 lecturer) before the study commenced. Evaluation process was important to seek feedback and ensure that respondents would not encounter difficulties when answering the questions. The survey contained questions that aimed to gauge whether the respondents owned smartphones and problems they encounter in large classes.

In the evaluation phase collection, the questionnaire that was used to collect the data is attached in Appendix 7. In this phase, to minimize any potentially ambiguous questions, a testing questionnaire was sent to 10 individuals so that they could five feedbacks on the quality of the survey and ensure that respondents would not have problems in answering the questions. The survey contained 54 questions. The questions were divided into 2 sections, aligned with the specific objectives. Section A used TPB and focused on determining the attitudes, subjective norms and perceived behavioral controls. This section comprised of 3 subsections. On the other hand, section B focused on gathering the requirements that were used to develop the mobile based SRS. The questionnaire was structured as below:

Section A: Attitudes, subjective norms and perceived behavioral controls in SRS usage

i. **Attitudes towards mobile phone usage in classroom**: This sub-section contained close-ended questions that determined the attitude on both the student and the lecturer in using a mobile based SRS.

ii. **Subjective norms for mobile phone usage in classroom**: This sub-section contained close-ended questions that determined the users own estimate of the social pressure to use or not to use mobile based SRS.

iii. **Perceived behavioral controls of mobile phone usage in classroom**: This sub-section contained close-ended questions that determined the extent to which students and lecturers felt they would be able to use mobile based SRS for in-classroom learning.

Section B: Mobile Based SRS Requirements

iv. **Pedagogical requirements**: This sub-section contained close ended questions that

would determine the features that the students and lecturers needed to interact with the system in order to boost learning in classrooms.

v. **Social cultural requirements**: This sub-section contained close ended questions that would determine the system features that would be needed in the system to ensure common traditions, habits, patterns and beliefs present in both lecturers and students was met.

vi. **Economical requirements**: This sub-section contained close ended questions that would determine the system features that would be needed in the system to ensure it used lowest cost to attain the results that were intended

vii. **Technical and Functional requirements**: This sub-section contained questions that aimed to collect the details of end user expectations of the product functionality and factors required to deliver a desired function or behavior from the mobile based SRS to satisfy the needs of both lecturers and students.

In the evaluation phase, the questionnaire that was used to collect the data is attached in Appendix 6.9 and was aligned with the last specific objective. In this phase, to reduce the possibility of having ambiguous questions, a testing questionnaire was shared with 10 individuals so that they could five feedbacks on the quality of the survey and ensure that respondents would find it easy answering the questions. The survey contained 33 questions. The questions were divided into sections, which was focused on a specific area:

i. **Attitudes and user evaluation after using the mobile based SRS**: This section contained questions that gathered responses on how the lecturers and students felt after using the mobile based SRS.

ii. **User satisfaction with the mobile based SRS requirements**: This section contained questions that gathered responses as to how the user was satisfied with the requirements that they needed in the mobile based SRS.

3.11 Chapter Summary

This chapter provides an overview of how the research was conducting using various methodologies and approaches. The chapter describes the methodology selected for data collection, data analysis, and the population of interest. To address research questions, a two-phase process was followed. Phase 1 addressed the first and second specific objective that investigated attitudes, perceived behavioral controls and subjective norms in mobile based SRS usage as well as gathering the requirements for the mobile based SRS. Phase 2 addressed the third specific objective that aimed to design a mobile based SRS to improve active class participation in large classrooms. Phase 2 also addressed the third research question that sought to evaluate how effective the mobile based SRS was for in-classroom learning.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 Introduction

This chapter presents the results findings from the students, deans, COD's and lecturers. The section is arranged into various sections i.e., attitudes towards usage of mobile learning in classrooms, the subjective norms of a student based mobile based system, perceived behavioral controls for mobile phone usage in classroom and the requirements and effectiveness of a mobile based SRS for in classroom learning. The requirements include, social cultural, pedagogical, technical and functional requirements for a student's response system.

4.2 Demographics of the study

4.2.1 Demographics in Pilot phase of the study

The study in the pilot phase involved 200 students, 5 lecturers, 2 CODs and 1 dean from each of the selected universities. A total of 29 university staff and 601 students distributed among the three universities responded to this study bringing up over 100% response rate. The results indicate that there were 68.33% male students and 31.67% female students. This could be a pointer of few females taking science-based courses as compared to male students. However, it does not indicate about perception of either gender on the mobile based response system. This implies that both gender male and female have the capacity to access and use the student mobile response system. The pie chart below shows the results.

4.2.2 Demographics in Evaluation phase of the study

On the other hand, in evaluation phase, there were 63 students, 1 lecturer, 1 dean and 1 COD. From the students' sample, there were 44 male respondents which was 69.8% of the respondents and 19 female respondents which was 30.2% of the respondents as shown below:

4.3 Attitude towards usage of mobile Learning in Classrooms

This section of the study intended to determine the attitudes of both students and academic staff members in using a mobile based SRS in class. The findings indicated that both the staff and the student had a positive attitude towards usage of mobile based SRS in classrooms. Majority of the student 362(60.3%) were confident to make decision to adopt mobile usage in classrooms. While 348(58%) strongly agreed that a mobile device would provide them more opportunities to create knowledge in their course work. Further, 367(61.2%) students demonstrated that they are confident on using a mobile devise on their coursework work. This means that the students have a positive attitude towards m-learning and especially through the use of their mobile devices. The 312(52%) students noted that they would be able to have self-paced learning with a mobile device. This means through student's response system there is feedback and the trainer is able to regulate the speed and mode of learning. The trainees are engaged and they feel as part of class which gives them a sense of ownership and determinants of their own success.

Majority of the students 317(52.17%) agreed that they have sufficient knowledge to use M-learning. This implies a little or less effort would be required to make use of a student's mobile response system. Most students are aware and knowledgeable of other mobile

applications and with little guidance they would find it easy to use. Majority of the students 345(57.5%) believe that a student's mobile response system would get their work done more quickly. This implies that the perceived ease of use is a critical factor in adoption of mobile based response system. Interestingly the most 328 (54.7%) students believed that mobile devises would improve their ability to learn. This implies that the student's response system has an ability to enhance individual student's academic performance. This would therefore reduce poor performances especially in large classes. Similarly, the Chair of departments, deans and Lecturers had a positive attitude towards usage of mobile learning in classrooms (*Mean=4.48, sd 0.735*). The mean of 4.48 implies most of the respondents (563) either strongly agreed or agreed with the metrics under attitude deeming them as important. An overall average SD of 0.735 in a normal curve implies that 2/3 of the respondents leaned towards strongly agree and agree in the metrics used to measure attitude. This implies that the student response system is a welcome idea among the academic instructors and would really influence positively on delivery and students' performance. The table 4.1 below presents the results.

Table 4.1

Attitude towards usage of mobile learning in classrooms

Part A: Attitude towards Usage of Mobile Learning in Classrooms							
Frequencies (Percentages)	**strongly agree**	**Agree**	**uncertain/ not applicable**	**disagree**	**strongly disagree**	**mean**	**standard deviation**
I am self-confident to make decision to adopt m-learning	362(60)	203(33)	20(3.3)	10(1.7)	5(0.8)	4.51	0.719
I would have more opportunities to create knowledge in my coursework with a mobile device	348(58)	230(38)	12(2)	4(.7)	6(1.0)	4.52	0.671
I am confident about using a mobile device for my courses	367(61)	198(33)	23(3.8)	9(1.5)	3(.5)	4.53	0.691
I would find it comfortable to adopt usage of mobile device in my courses	346(57)	216(36)	21(3.5)	12(2)	4(.8)	4.48	0.735
I would be able manage learning	312(52)	233(38)	41(6.8)	6(1)	8(1.3)	4.39	0.772

pace in my classes with a mobile device.							
I have a enough knowledge to use m-learning	317(52)	225(37)	40(6.7)	13(2.2)	5(.8)	4.39	0.777
Using mobile phone for learning is a good idea	322(53)	229(38)	36(6)	9(1.5)	4(.7)	4.43	0.732
I believe that mobile devices would prove beneficial for my learning	351(58)	234(39)	7(1.2)	4(.7)	4(.7)	4.54	0.626
I believe that I would be able to do my work quicker using mobile learning	345(57)	214(35)	27(4.5)	11(1.8)	3(.5)	4.48	0.714
I believe that I would be able to improve learning activity using mobile learning	328(54)	229(38.2)	31(5.2)	8(1.3)	4(.7)	4.45	0.715

4.4 Subjective Norms for phone Usage in Classroom

This section presents the subjective norms for mobile phones usage in Classroom. Generally, the academic instructors and the students responded in favor of mobile phone usage in classroom. The challenge of implementing mobile student response system in most places like how the lecturers or the university stakeholders perceive and support behavior. However, most students 271(45.2%) agreed that they would be willing to use a mobile device for learning purposes. This means that it would be easy to implement since they perceive that the deans, Cod and lecturers support the idea of Student mobile response system. Further, most students 242(40.3%) strongly agreed that most people who are important to them would be in favor of using a mobile devise system. It means since the lecturers and university administration are in support of Student mobile response system the problem of large classes would be solved and therefore the uptake would be high. The findings indicated that most students and instructors would support usage of m-learning in course work.

The objective of most students and parents when they go to the university is knowledge transfer, and acquisition of skills and knowledge. This implies that they believe and support by other students would encourage uptake. This alludes to the fact that if other students support it, it wouldn't be difficult to adopt it also by them. The Cod's deans and Lectures strongly agreed that the stakeholders of the university would support a student response system with a (*Mean=4.45, SD=.662*). This is shown in table 4.2

Table 4.2

The subjective Norms for Mobile phone usage in classroom

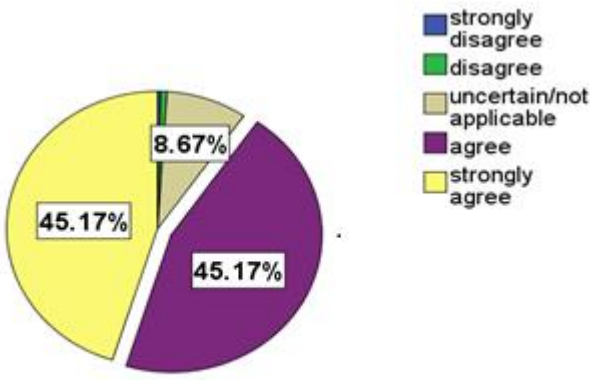
Part B: Subjective Norms for Mobile Phone Usage in Classroom

	Frequencies (Percentages)	**strongly agree**	**Agree**	**uncertain/ not applicable**	**disagree**	**strongly disagree**	**mean**	**standard deviation**
1	I think my classmates would be willing to adapt a mobile device for learning	271(45)	271(45)	52(8.7)	4(.7)	2(.3)	4.34	.692
2	Most people who are important to me would support using a mobile device for university courses	242(40)	284(47)	55(9.2)	14(2.3)	5(.8)	4.24	.779
3	I think the students would be in favor of utilizing m-learning for in-classroom learning	242(40)	284(47)	55(9.2)	14(2.3)	5(.8)	4.34	.750
4	Most people who valuable to	279(46)	269(44.8)	35(5.8)	12(2)	5(.8)	4.45	.662

me think it would be easy to use mobile device for university courses

Figure 4.1

Student's willingness to adapt M-leaning



4.5 Perceived Behavioral Controls for Mobile Phone Usage in Classroom

This section presents the findings on perceived behavioral controls for mobile phone usage in classroom. The findings indicated that most students 313(52.2%) would use a mobile device for learning. This is explained by perceived ease of use meaning that the problem of actively engaging learners in class would be solved. Further, most students have sufficient control of the decision to adopt M-learning. Since majority of students own

smartphones, it can help them to achieve learning outcomes and objectives even ahead of the lecturer. Most student 337(56.2%) also plan to take part in m-learning if it is initiated. This means that student mobile response system would raise learner's interest in learning as well as active participation in classroom. This would further ease delivery of content and transfer of knowledge among the lecturers. Therefore lecturers, Cod and deans were in full support of a student mobile based response system. Further, majority of the learners also indicated that they would use a mobile devise to easily share the course materials online which would encourage active engagement in class ease. This though is not the focus of this study. The overall mean was 4.465 implying that majority of the respondents leaned towards strongly agree and agree based on the metrics used to measure perceived behavioral controls. This was also backed up by the overall average SD which was 0.6446 which implied that majority of the respondents either strongly agreed or agreed. The table 4.3 below presents the results

Table 4.3

Perceived behavioral controls for mobile phone usage in classroom

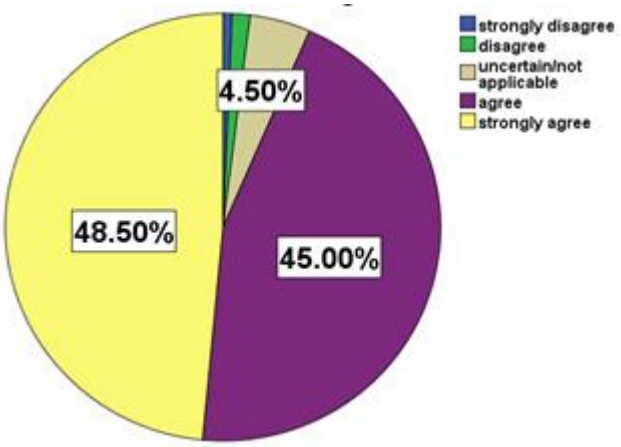
Part C: Perceived Behavioral Controls for Mobile Phone Usage in Classroom

	Frequencies (Percentages)	strongly agree	Agree	uncertain/ not applicable	disagree	strongly disagree	mean	standard deviation
1	I intend to adopt a mobile device for learning	313(52.2)	252(42)	27(4.5)	6(1)	2(3)	4.45	.662
2	I have a sufficient extent of control to make decision to adopt m-learning	291(48.5)	270(45)	27(4.5)	8(1.3)	4(.7)	4.39	.700
3	I will fully participate in m-learning if introduced	337(56.2)	238(39.7)	19(3.2)	4(.7)	2(.3)	4.51	.628
4	I predict I would use a mobile device for my courses	289(48.2)	269(44.8)	35(5.8)	5(.8)	2(.3)	4.40	.668
5	I plan to use a mobile device if a course has mobile learning functions	308(51.3)	274(45.7)	10(1.7)	5(.8)	3(.5)	4.47	.627
6	I would be able to actively	361(60.2)	223(37.2)	13(2.2)	1(2)	2(3)	4.57	.583

share coursework material with a mobile device

Figure 4.2

Control to make decision to adopt M-leaning



Part D (i): Pedagogical requirements for a students' response system

This section presents pedagogical requirements for a student's response system. The findings indicated it is very important 477(79.5%) for the content quality to be valid, trustworthy and accurate. It means accuracy of the content, validity and trustworthiness would imply transfer of knowledge with high confidence level. It would mean provision of quality education and marketability of the courses offered by the university. Additionally, the students also strongly agreed 396(66%) that the content should motivate the learner to actively participate. It implies that the ability mobile based student response system to meet pedagogical requirement is very essential determinant of its adoption. The

findings indicated that content delivery should be simple, Modula and flexible 447(74.5%). It implies that the flexibility and simplicity are important components that should be considered when developing the system. Further, the results indicate that the system should be easy to navigate 440(73.3). This implies the ease of movement from one module or to another should be easy and navigation levels should also be few. The findings also indicated that the system should have intuitive, logical and appropriate structure for the learners 426(71%). With and intuitive system logical and appropriate most learners would find it easy to adopt the system. This implies that the problem of student lacking interest especially in big classes would eventually be solved. The results also show that the system should allow real-time and correct feedback. Feedback from the lecturer to the students may be cumbersome especially with large classes. It implies that the system can mitigate this problem where results are marked and results never get back to the students on time. Quizzes are given and results are instantly received by the students. Therefore, it improves turnaround time between input and feedback. Table 4. 4 below present the results.

Table 4.4

Pedagogical requirements

	Frequencies (Percentages)	Very Important	Important	Somehow	Not very	Not Impor	Mean	Stand
1	Content Quality should be valid trustworthy and accurate	477(79.5)	115(19.2)	6(1)	0	2(.3)	4.64	.534
2	Should motivate the learner to actively participate in class	396(66)	190(31.7)	13(2.2)		1(.2)	4.73	.476
3	Content delivery should be simple, modular and flexible	447(74.5)	146(24.3)	6(1)	0	1(.2)	4.72	.489
4	Should be user friendly	440(73.3)	154(25.7)	5(.8)	0	1(.2)	4.69	.515
5	Should have intuitive, logical and appropriate structure for the learners	426(71)	163(27.2)	9(1.5)	0	2(.3)	4.64	.561
6	There should be few navigation levels in order the learner not to be lost.	407(67.8)	172(28.7)	19(3.2)	0	2(.3)	4.73	.519
7	Should allow feedback to the learner at the right quantity at the right moment	451(75.2)	137(22.8)	9(1.5)	0	1(.2)	4.73	.519

Figure 4.3

Feedbacks to the learner

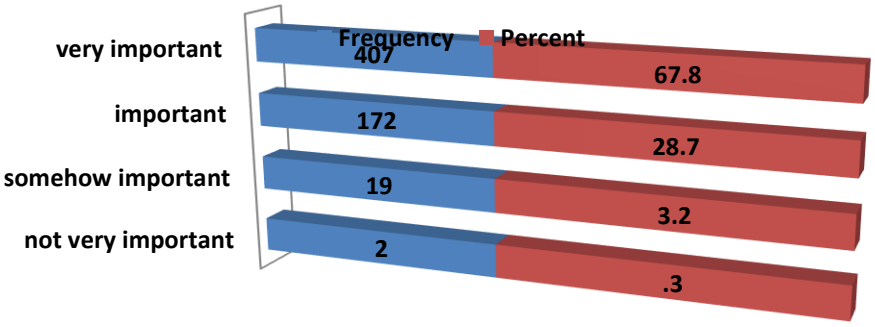
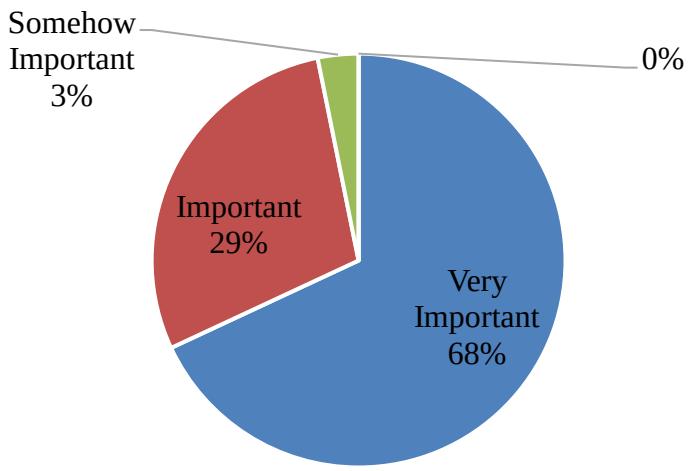


Figure 4.4

Navigation levels



4.7 Social cultural requirements

This section presents the social-cultural requirements for a student's response system. The results indicated that the system should not discriminate in terms of age, gender and health issues 451(75.2%). 405(67.5%) of the respondents also indicated that the system should enhance active classroom participation. These conditions are therefore an essential element that needs to be put into place for the system is to be adopted. The findings indicated that the system should enhance the learner's self-efficacy, self-esteem and commitment. Most students 417(69.5%) agreed. This implies that the student will be actively be engaged mentally, physically and visually which works well for all types of learners. However, it's important to note that the students felt that the system should adhere to computer ethics and not secretly monitor or spy on the them. It implies that privacy and confidentiality of the learners as well as freedom with the system within set bounds is upheld. Majority of the students agreed that privacy of the intellectual property of the learner should be upheld 456(76%). It implies that the learner would trust the system and be willing to share information with the lecturer without withholding it. This open mindedness would in return encourage innovation and creativity among the students.

Table 4.5

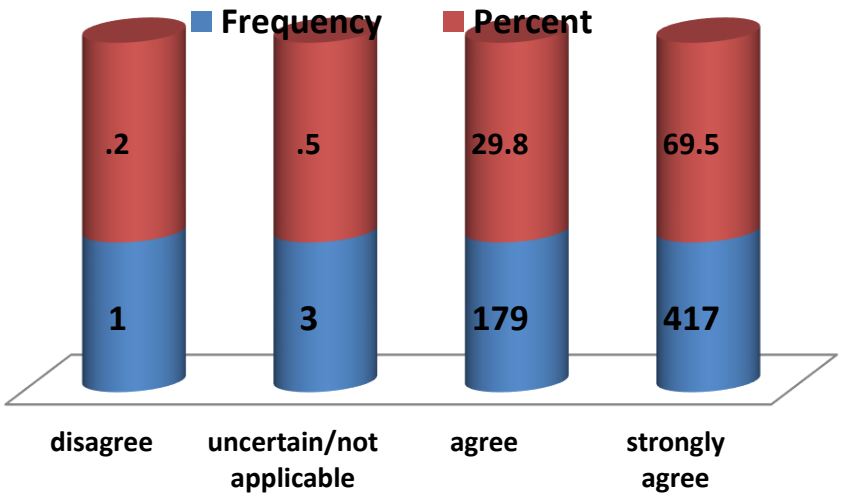
Social cultural requirements for a student's response system

Part D (ii): Social-Cultural requirements for a students' response system

Frequencies (Percentages)	strongly	Agree	uncertain/ not	Disagree	str	Mean	Standar
Should not discriminate	451(75)	136(22.7)	11(1.8)	0	2(.3)	4.73	.506
Should promote and support the learner in active classroom participation	405(67)	189(31.5)	4(.7)	0	2(.3)	4.666	.508
Should enhance the learner's self-efficacy, self-esteem, confidence, and commitment hence motivating the learner	417(69)	179(29.8)	3(.5)	0	1(.2)	4.669	.485
There should be no secret monitoring and recording of the learner's transactions without the learner's knowledge.	396(66)	178(29.7)	16(2.7)	8(1.3)	2(.3)	4.660	.644
The privacy and intellectual property of the learner should be assured in a way that no one without proper authorization will have access to his information	456(76)	135(22.5)	7(1.2)	1(.2)	1(.2)	4.74	.496

Figure 4.5

Learner's efficacy, self-esteem confidence and commitment



4.8 Economical requirements for a student's response system

This section presents the economical requirements for a student's response system. The findings indicate that the system needs to achieve the results and benefits at the lowest cost possible. Majority of the students 426(71%) strongly agreed with this. The Dean, Cod, and lecturers also strongly agreed with the statement. It implies that if the student's mobile response system is cost effective then the university is likely to adopt it even for other courses. Further it implies that more students are likely to benefit from it. The results also indicated that various types of contracts, service level agreement or licenses to choose from. Majority of students strongly agreed 342, (57%). This implies that there should be

clear contractual agreement between the provider and the universities to protect the students from access as a result of faulty contractual agreements. Therefore, guarantees and licenses for support must be provided. Table 4.6 below presents the data.

Table 4.6

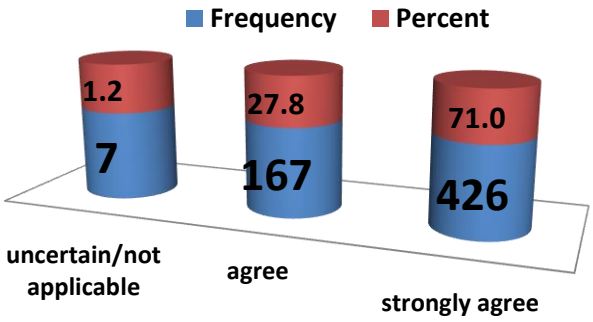
Economical requirements for a student's response system

Part D (iii) Economical requirements for a students' response system

Frequencies (Percentages)	strongly	agree	uncertain/ not	disagree	str	Mean	Standar
Should use lowest cost to achieve possible results	426(71)	167(27.8)	0	7(1.2)	0	4.70	.484
Should be various types of Contracts, Service Level Agreement or Licenses to choose from.	342(57)	244(40.7)	11(1.8)	3(5)	0	4.54	.562

Figure 4.6

Lowest cost to achieve Possible results



4.9 Technical and functional requirements for a student's response system

This section presents the technical functional requirements for a student's response system. The Deans, Cod's and the Lecturers agreed that the technical and functional requirements must be met for adoption of the system. The findings indicated the interface should be visually appealing. Most students 417(69.5%) strongly agreed. This means that the visual learners would find the system very interesting which would enhance learning. Majority of students 437(72.8%) strongly agreed that the system should be simple and convenient to operate. This implies that the ease of use as well as user friendliness is important technical aspects of the system. The results also indicated that the system should neither distract nor overload the learner. Majority of the students agreed 415(69.2). It implies that the system must be built in a way that it ensures no distractions in order to support learning. Majority of the respondents 397(66.2) strongly agreed that the system

should improve user productivity through various means. Some students are shy and fail to ask questions freely. It implies that those students who are not willing to participate are fully involved. The results indicate that the system should be tailored to the individual user such that a user may have various levels of control over it for personalization purposes. The findings also showed that the function of the system should be useful and suitable to meet learning outcomes. Most respondents 397(66.2% strongly agreed). It implies that the system should be aligned with the organization vision and mission as well as the current academic policies. This would ensure that the system support the goal of the institution as well as achieving the stakeholders needs.

Majority of the respondents 428(71.3) strongly agreed that the search module should provide complete, accurate and relevant results. It implies that the students can easily access notes from the search engine by just typing the keywords. This makes it easy for a student to find whatever materials they could be looking for without complications. The majority of respondents 406(67.7%) agreed that the system should be as usable as possible by as many people as possible regardless of age, ability or situation. It implies that anyone can use the system in a classroom context whether primary or secondary. However, the focus of this study is university in-classroom environment.

The findings indicate that the system should support special needs people by having features such as ability to allow zooming font on the screen. Majority of the students agreed 452(75.3%). It implies that student can easily be able to adjust the font size, magnification as well as color depending on their needs. Therefore, the system must be customized in a way that the user finds it easy to use.

The findings indicate that the system should be tailored to the individual user such that a

user may have various levels of control over it for personalization purposes. Majority of the respondents agreed 403(67.2%). it implies that the system should be tailored and customized such that the student can easily add their profile pictures, edit their profile as well as easily change the theme colors. The study found out that the student should offer various forms and tools to support the user majority 402(67%) agreed. It implies that student can have self-paced learning where the quizzes are spread that the student can send them at their own flexible time. Should be light and support fast and easy installation process in any appropriate device or system. Most students, 425(70.8%) strongly agreed. It implies that system should be easily installed in any android, operating system. Further the results indicated that the system should have low maintenance costs. Majority of the respondents 402(67%) agreed that the system should be flexible to allow for addition of new students and instructors. It means that the system should be flexible enough to support large classes and additional without inefficiency. The system is not limited at all with increase in number of users. This ensures that learners can access it anywhere and thus supporting the distance learning mode University. The system also supports many security levels based on different categories of users. Majority of the respondents strongly agreed 436(72.7). The Table 4.7 below presents the results of the study. The finding show that deans, Cod, s and lecturers strongly supported the application of the technical and functional requirement as a determinant for adoption of mobile response system.

Table 4.7

Technical and Functional requirements for a students' response system

Part D (iv) Technical and Functional requirements for a students' response system

Frequencies (Percentages)	**strongly agree**	**Agree**	**uncertain/not applicable**	**disagree**	**strongly disagree**	**mean**	**standard deviation**
The interface should be visually appealing and pleasant	443(73.8)	152(25.3)	5(.8)	0	0	4.73	.463
The interface should be user-friendly	417(69.5)	177(29.5)	5(8)	1(2)	0	4.72	.475
Should be simple and convenient to operate	437(72.8)	158(26.3)	4(.7)	1(.2)	0	4.68	.506
It should neither distract nor cognitively overload the learner. Rather, it should attract the learner's attention and focus.	415(69.2)	178(29.7)	5(.8)	2(.3)	0	4.65	.510
Should be simple and intuitive to use. Its design should be aesthetically attractive,	401(66.8)	191(31.8)	7(1.2)	1(.2)	0	4.67	.506

pleasant and fun to use							
Should be easy, simple and intuitive to navigate. They should be accurate and consistent.	408(68)	186(31)	4(.7)	2(.3)	0	4.65	.508
Should provide useful, appropriate and meaningful means to increase the user productivity.	397(66.2)	196(32.7)	6(1.0)	1(.2)	0	4.65	.549
Should be as usable as possibly by as many people as possible regardless of age, ability or situation.	406(67.7)	181(30.2)	10(1.7)	2(.3)	0	4.74	.460
Should support persons with special needs (e.g., screen magnification/ zooming)	452(75.3)	142(23.7)	6(1)	0	0	4.66	.503
Should offer various forms and tools to support the user	402(67)	190(31.7)	8(1.3)	0	0	4.70	.482
The search module should	428(71.3)	167(27.8)	4(.7)	1(.2)	0	4.65	.547

provide complete, accurate and relevant results							
Should be tailored to the individual user such that a user may have various levels of control over it for personalization purposes.	403(67.2)	185(30.8)	9(1.5)	1(2)	0	4.65	.521
Functions should be useful and suitable for the educational objectives, the learner and the situation	401(66.8)	188(31.3)	10(1.7)	1(.2)	0	4.66	.517
Should always be available when needed and should survive at most extreme situations keeping on its integrity.	408(68)	183(30.5)	7(1.2)	2(.3)	0	4.70	.489
Should be easy and fast to install at any appropriate	425(70.8)	167(27.5)	8(1.3)	0	0	4.68	.513

device or system.							
Should need minimal effort and time to maintain its efficient operation.	416(69.3)	175(29.2)	7(1.2)	2(.3)	0	4.70	.490
Its response should be fast and appropriate meaning that the user shouldn't experience any delays	429(71.5)	164(27.3)	6(1.0)	1(.2)	0	4.65	.510
Should be easy to increase the number of supported learners, data, mobility patterns, areas, and services.	402(67)	188(31.3)	10(1.7)	0	0	4.69	.500
Should incorporate current, updated security technologies	426(71)	163(27.2)	11(1.8)	0	0	4.71	.496
Should support multiple levels of security for different users and resources	436(72.7)	157(26.2)	6(1.0)	1(.2)	0	4.64	.492

4.10 Regression analysis Overall Model

This section presents the regression results of the overall model. The R^2 for the overall model was 74.9% and adjusted r square of 72.4%. A strong size effect is presented by the result. It implies that 72.94% of the variations in adopting a student mobile response system are explained by the (model) the independent variables of this study. Therefore, it can be concluded that there is a strong positive relationship between independent variables and the dependent variable of this study.

Table 4.8

Regression model summary

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.865[a]	.749	.724	.258

The analysis of variance table below shows that the model is significantly useful in determining the adoption of a Mobile based student response system *F, (55,544) =29.51, p<.01)*

Table 4.8

Anova

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	108.444	55	1.972	29.508	.000[b]
	Residual	36.349	544	.067		
	Total	144.793	599			

4.11 M-jishirikishe mobile based SRS

The above gathered requirements, enabled the researcher to develop a mobile based SRS that checked all the requirements. The researcher came up with the name M-Jishirikishe for the mobile based SRS. The word Jishirikishe is derived from Swahili which loosely means ‘to participate’. The motivation for the name was the fact that the researcher intended to develop an SRS that would be able to help both the students and academic staff to actively participate in classroom

The mobile based SRS was developed using Android studio which was paramount in building, testing, and debugging. Pycharm for Backend development using Django framework and Python was also adopted for the system and finally Vs Code was used for frontend development using HTML, CSS, JavaScript and Bootstrap. The mobile based SRS was developed using incremental/ iterative model under SDLC approach.

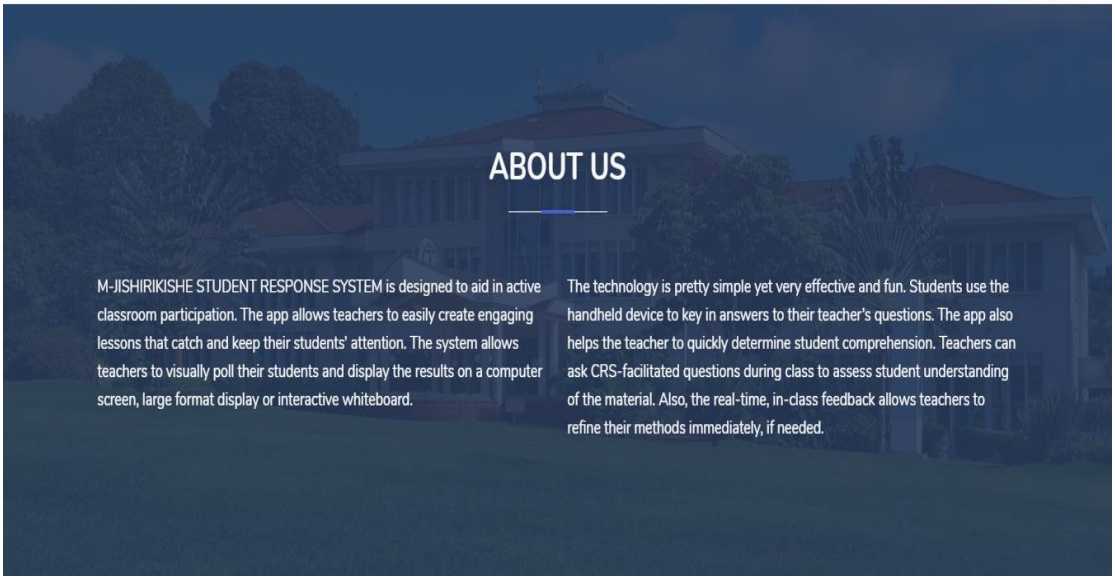
Figure 4.7

M-Jishirikishe Landing Page

Above is the homepage the student sees when they access the system

Figure 4.8

M-Jishirikishe About US Page



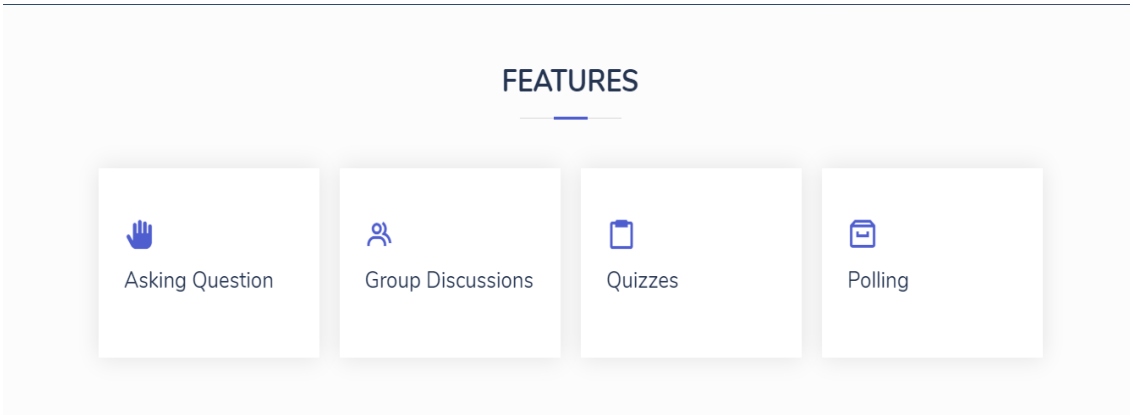
About US Page explains what the system is all about

4.9.3 M-Jishirikishe Features

The below 4 main features are the standard features that emerged from the requirements gathered. The mobile based SRS enabled the students to ask questions, have virtual group discussions, take quizzes so as to help the lecturer conduct instant formative assessments and conduct polls to enable lecturers to ask questions and allow students to vote on correct answers.

Figure 4.9

M-Jishirikishe Features



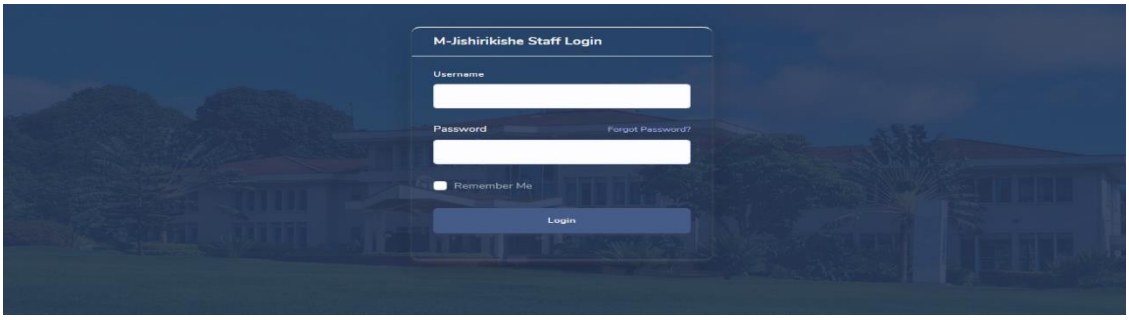
Above Picture shows the features possessed by system

4.9.4 M-Jishirikishe Staff Portal

This portal helps the administrator, dean, COD and lecturer to login to the system. Each of these users have different rights in the system.

Figure 4.10

M-Jishirikishe Staff login Page



Above screenshot shows the login page for the users

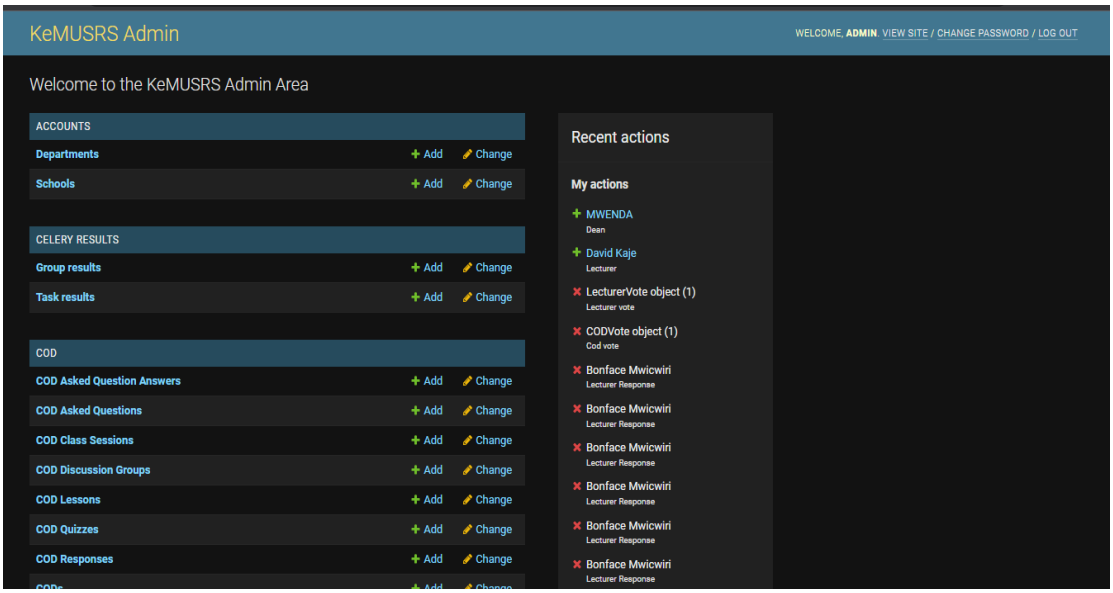
4.9.3 M-Jishirikishe Administrator Dashboard

The administrator is the super user in the developed mobile based student response system. The administrator operates from the web-side and has full control of the back-end. The administrator has full account rights meaning he can create accounts for all other users and can also approve accounts upon creation by the users. The administrator can also disable the account.

From the below units, the administrator can add different departments and schools available within the university. The administrator can also view all group and individual results after each class session.

Figure 4.11

M-Jishirikishe Administrator dashboard



Above screenshot shows administrator dashboard

The administrator can also add CODs to the system, view all the registered COD's and survey all the activities conducted in classroom by the COD using the system. The activities include viewing questions asked by the COD in class, viewing the discussions set by the COD, viewing all the responses the COD received and viewing poll results from polls conducted by the COD.

The administrator also can monitor everything deans and lecturers do from the system. This includes viewing all the registered Lecturers and Deans and survey all the activities conducted in classroom by the Lecturers and Deans using the system. The activities include viewing questions asked by the Lecturers and Deans in class, viewing the discussions set by the Lecturers and Deans, viewing all the responses the Lecturers and

Deans received and viewing poll results from polls conducted by the Lecturers and Deans. The administrator can also monitor all polls created by either the deans, lecturers and COD. The administrator can also view all student activity conducted via the system.

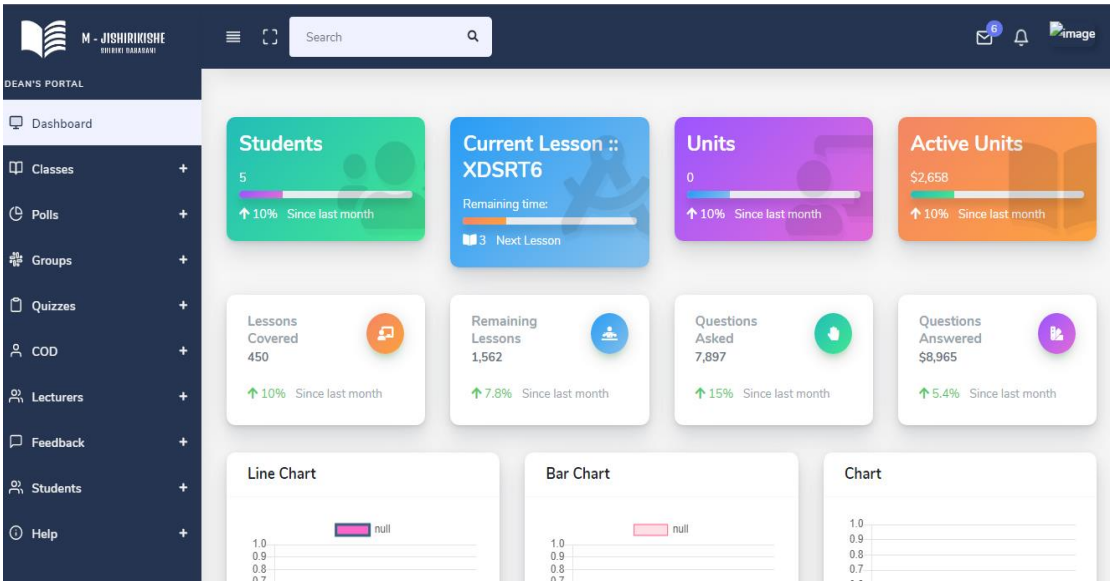
4.9.5 Deans Module

4.9.5.1 Deans Dashboard

From the dashboard, the dean can be able to see the number of students registered, registered and active units, current lessons, lessons covered, remaining lessons and the number of questions asked.

Figure 4.12

M-Jishirikishe Deans Dashboard



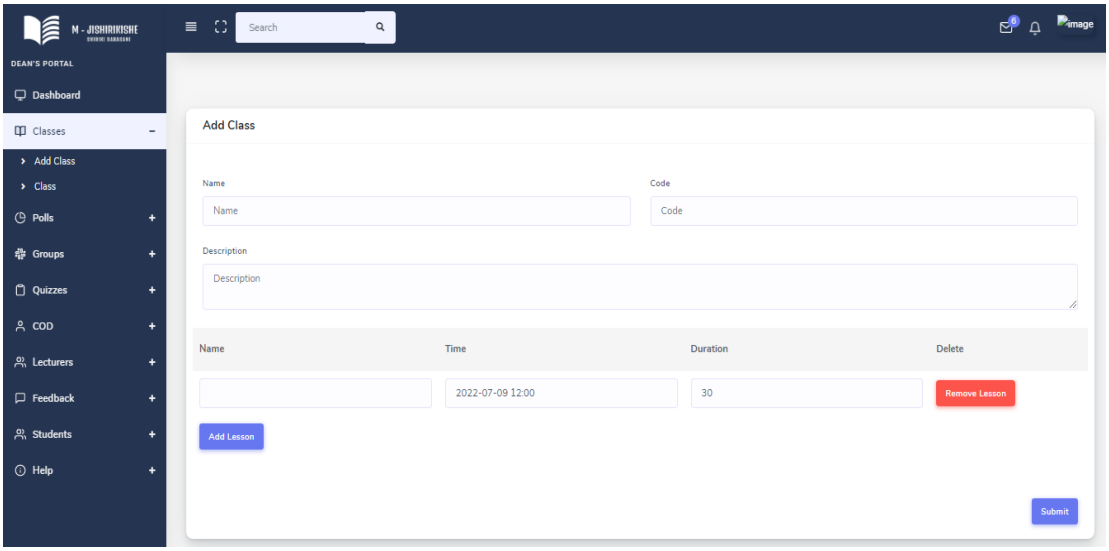
Above screenshot shows features in deans' portal

4.9.5.2 M-Jishirikishe Deans Classes tab

From the add classes tab, the dean can be able to add classes. The dean can also be able to add or remove lessons for the classes as well as add date and time for the particular lesson and the duration of each lesson. The dean can also be able to view the list of registered classes from the class tab.

Figure 4.13

M-Jishirikishe Deans Classes tab



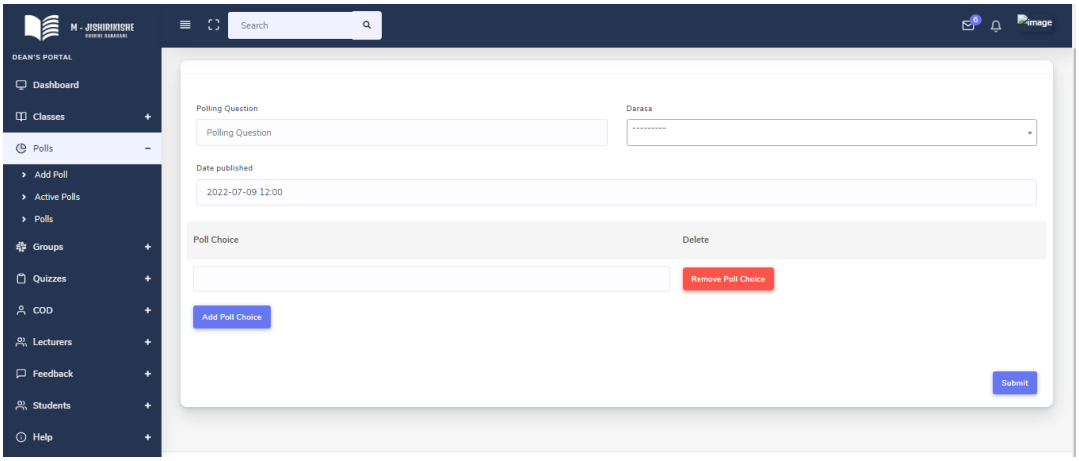
Above screenshot shows how to access classes from Deans' portal

4.9.5.3 M-Jishirikishe Deans Polls tab

Under the add poll tab, the dean can be able to add polls. Here the dean can add a polling question, add the publishing date, create choices for the poll question as well as remove the poll choice and also select the unit or class where the question will be posted.

Figure 4.14

M-Jishirikishe Deans Polls tab

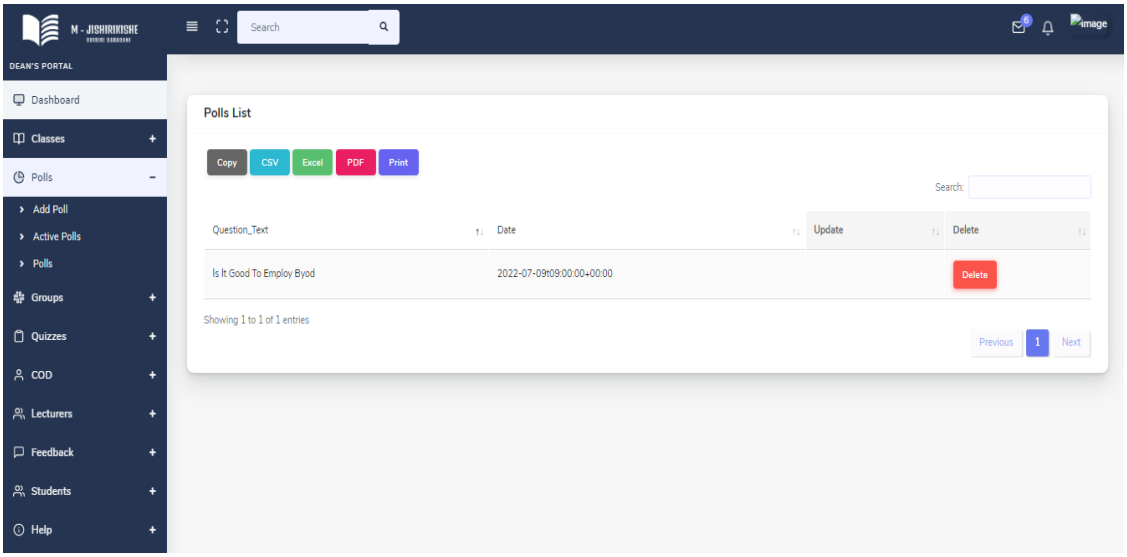


Above screenshot shows how to conduct polls from deans' portal

Under the active polls tab, the dean can be able to view the number of active polls as well as view a poll by clicking the view button on the poll card. Under the polls list in the polls tab, the dean can be able to see the list of all polls that is, the active and the inactive polls and can be able to delete a poll or update the polls list

Figure 4.15

M-Jishirikishe Deans active and inactive polls



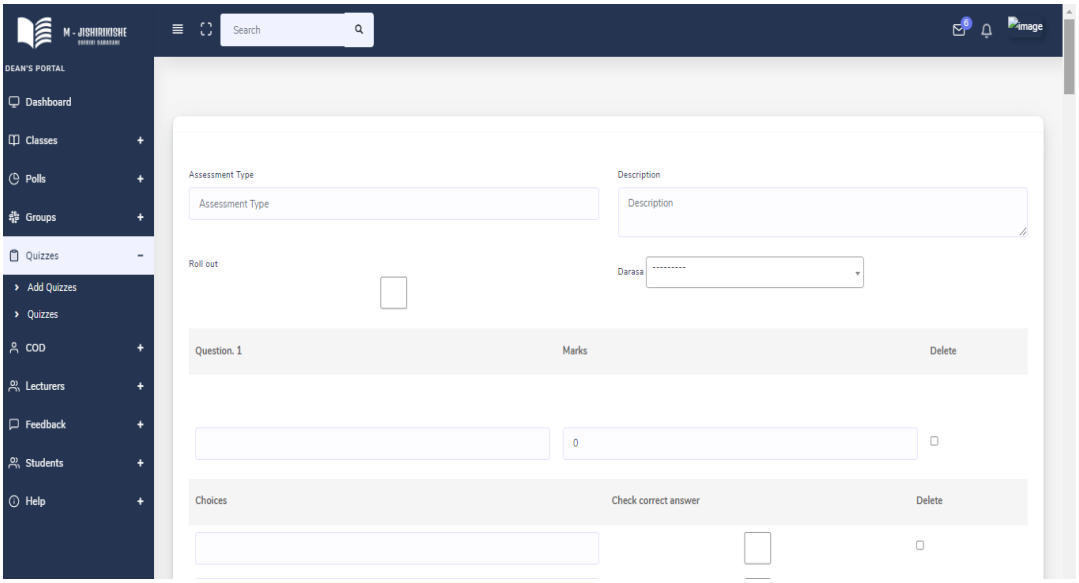
Above screenshot shows how to activate polls and access inactive polls

4.9.5.4 M-Jishirikishe Deans Quizzes tab

Here, under the add quizzes, the dean can be able to create quizzes. This also includes ability to add questions and the choice of answers to choose from as well as selecting the correct answer, allocating marks to the questions and selecting the class for the quiz.

Figure 4.16

M-Jishirikishe Deans Quizzes



Above screenshot shows how to conduct quizzes from deans' portal

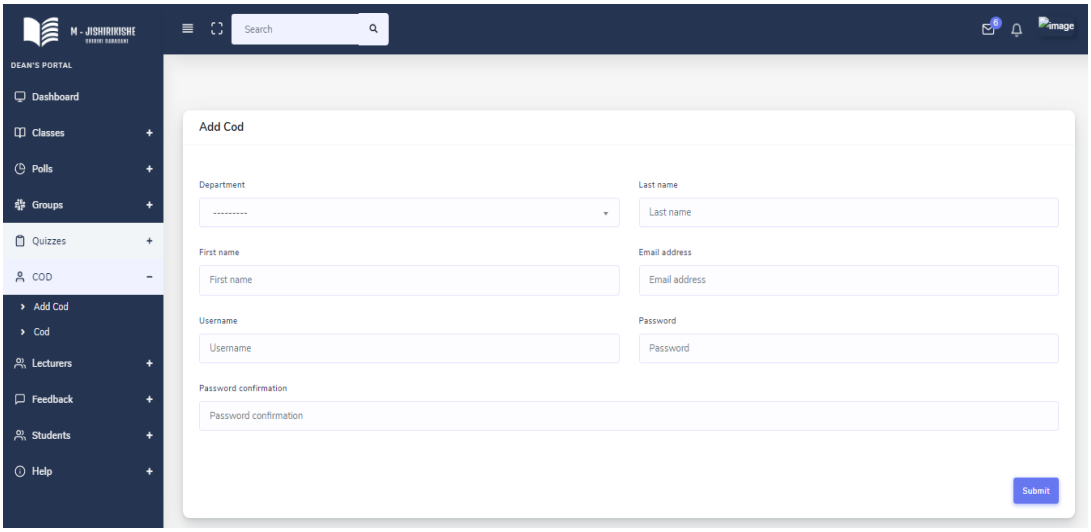
Under the Quizzes, dean can be able to view the quizzes in the quiz list. The dean can also be able to update or delete the quizzes.

4.9.5.5 M-Jishirikishe COD management tab

The dean can be able to add Cod under the add Cod tab. Here the dean can select the department, add the names and email of the Cod and create a login password for the Cod to the Cod portal.

Figure 4.17

M-Jishirikishe Deans Management of CODs



Above screenshot shows how manage CODs from dean's portal

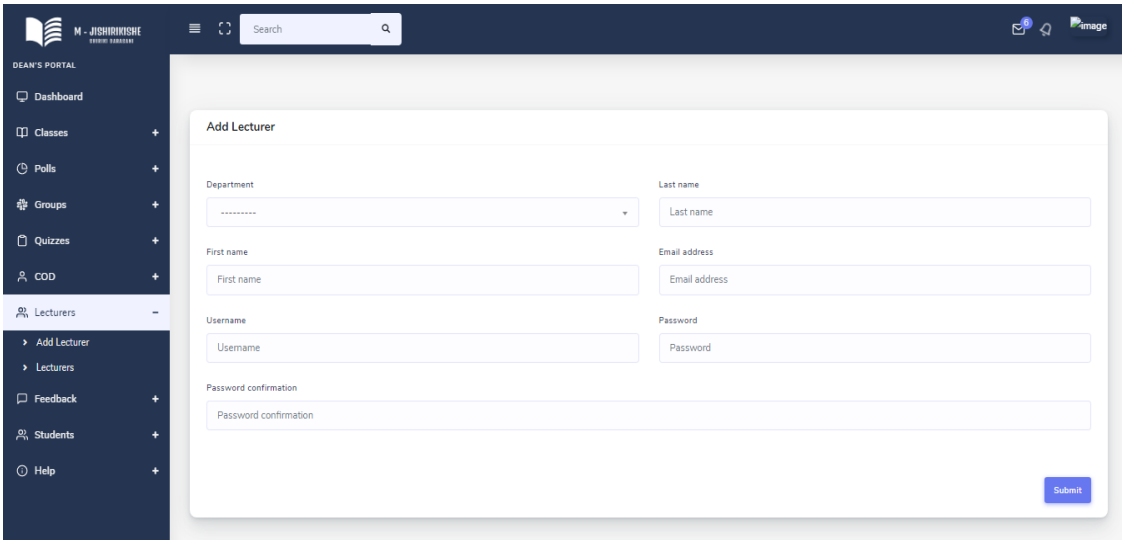
The dean can also be able to view the number of the registered Cod's by clicking on Cod under the Cod tab. Here the dean can also be able to update the Cod list.

4.9.5.6 M-Jishirikishe Deans Lecturers tab

The dean can be able to add Lectures under the add lecturer tab. Here the dean can select the department, add the names and email of the lecture and create a login password that the lecturer will use to login to the lecturer portal.

Figure 4.18

M-Jishirikishe Deans Management of Lecturers tab



Above screenshot shows how manage lecturers from dean's portal

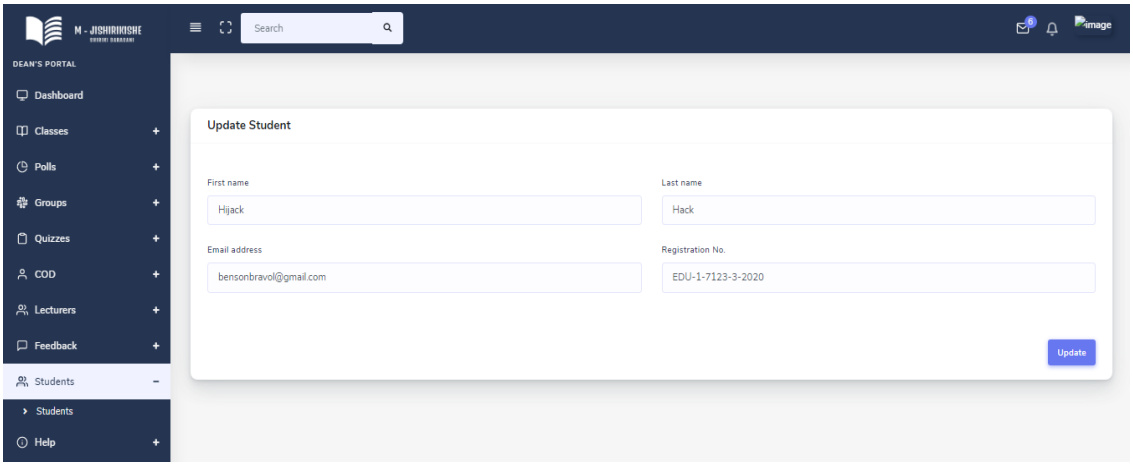
The dean can also be able to view the number of the lecturer registered by clicking on the Lecturer under the Lecturer tab. Here the dean can also be able to update the lecturer list. The dean can also download, print or export the list.

4.9.5.7 M-Jishirikishe Deans Students tab

The dean can be able to view the number of registered students under the students list. More so, the dean can be able to edit and update the students list. The dean can also download, print or export the list.

Figure 4.19

M-Jishirikishe Deans Management of students' tab



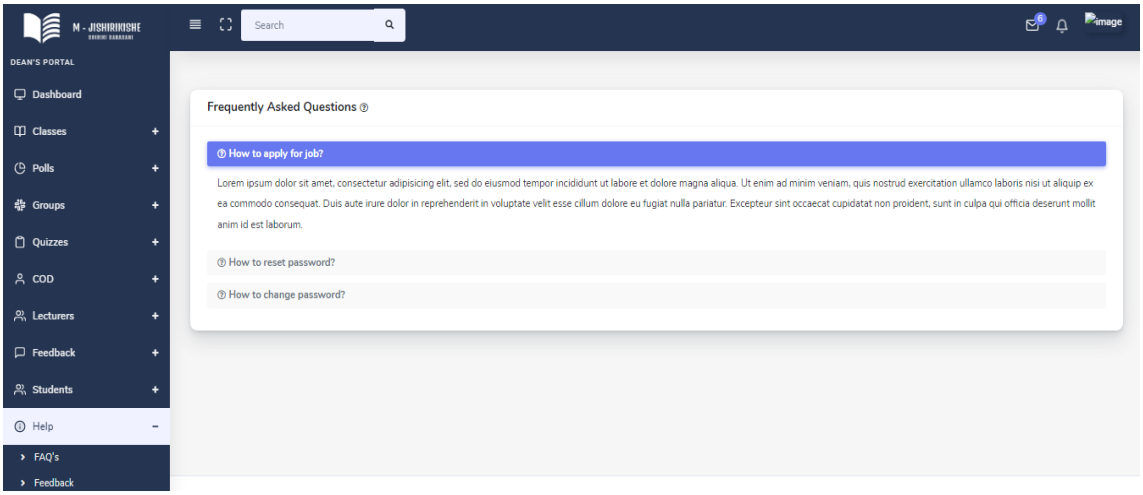
Above screenshot shows how manage students from dean's portal

4.9.5.8 M-Jishirikishe Deans FAQs Module

Under the help tab, the dean can be able to access the frequently asked questions by clicking on the FAQ'S tab.

Figure 4.20

M-Jishirikishe Deans FAQs module



Above screenshot shows how access frequently asked questions from dean's portal

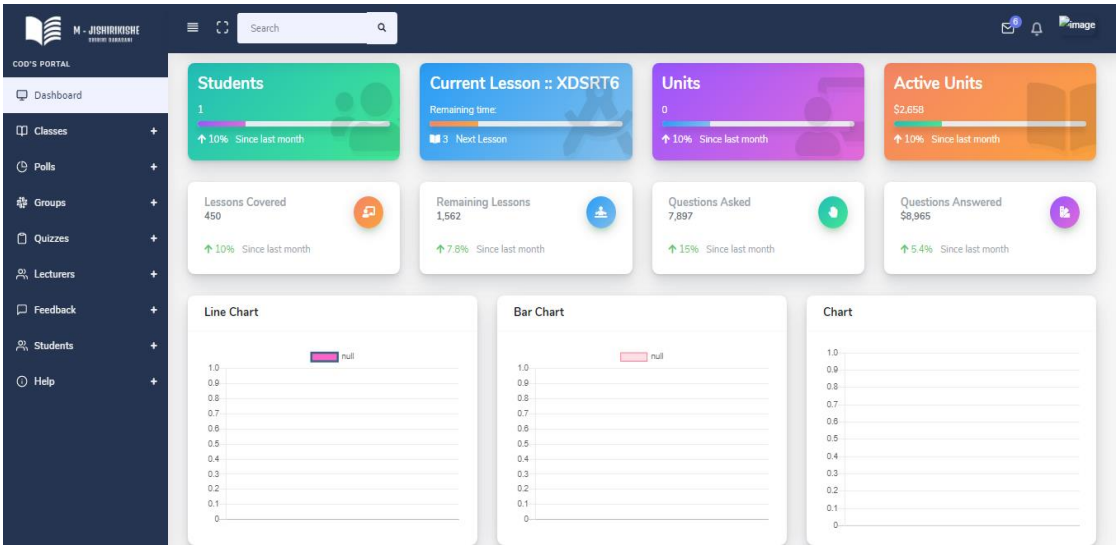
4.9.6 M-Jishirikishe Cod Module

4.9.6.1 COD'S Dashboard

From the dashboard, the Cod can be able to see the number of students registered, registered and active units, current lessons, lessons covered, remaining lessons and the number of questions asked.

Figure 4.21

M-Jishirikishe CODs Dashboard



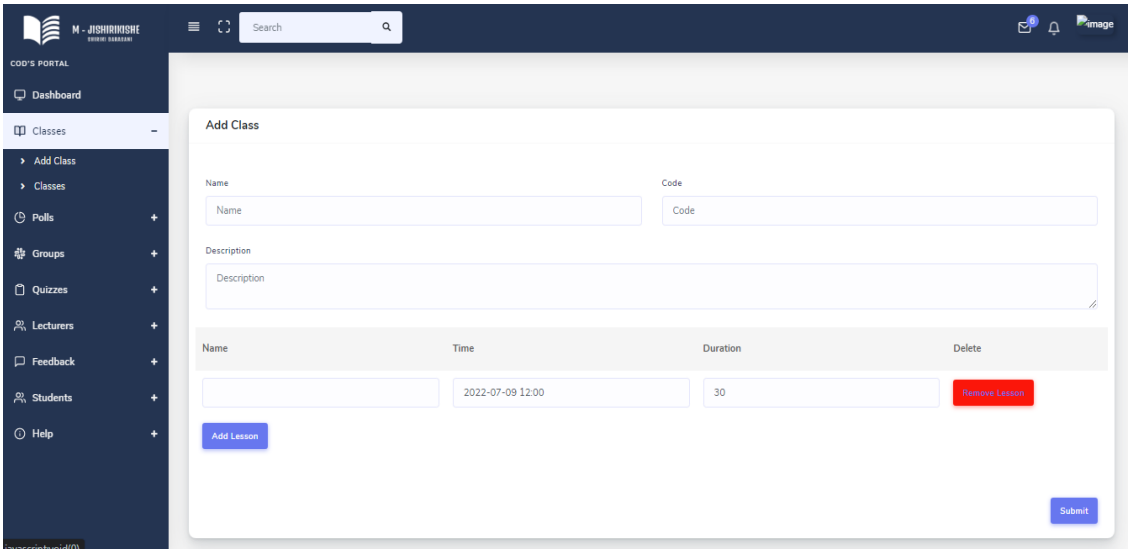
Above screenshot shows CODs dashboard

4.9.6.2 COD'S classes tab

From the add classes tab, the Cod can be able to add classes. The Cod can also be able to add or remove lessons for the classes as well as add date and time for the particular lesson and the duration of each lesson.

Figure 4.22

M-Jishirikishe CODs Classes tab



Above screenshot shows how manage classes from CODs portal

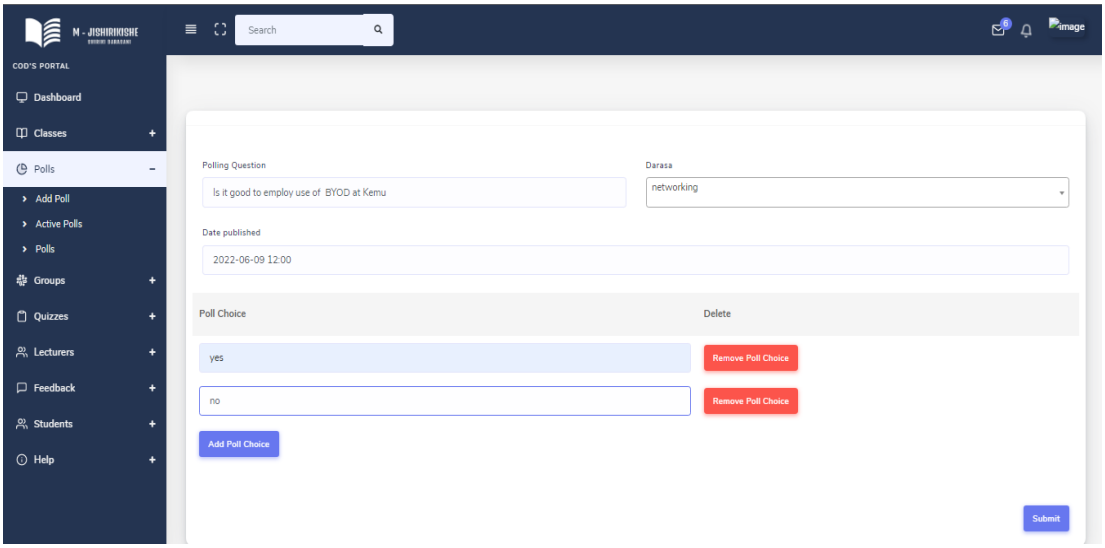
The Cod can also be able to view the list of registered classes by clicking on the class tab. The Cod can also delete and update the Class list. The Cod can also be able to download or print the list.

4.9.6.3 COD'S Polls tab

Under the add poll tab, the Cod can be able to add polls. Here the Cod can add a polling question, add the publishing date, create choices for the poll question as well as remove the poll choice and also select the unit or class where the question will be posted.

Figure 4.23

M-Jishirikishe CODs Polls tab



Above screenshot shows how to conduct polls from CODs portal

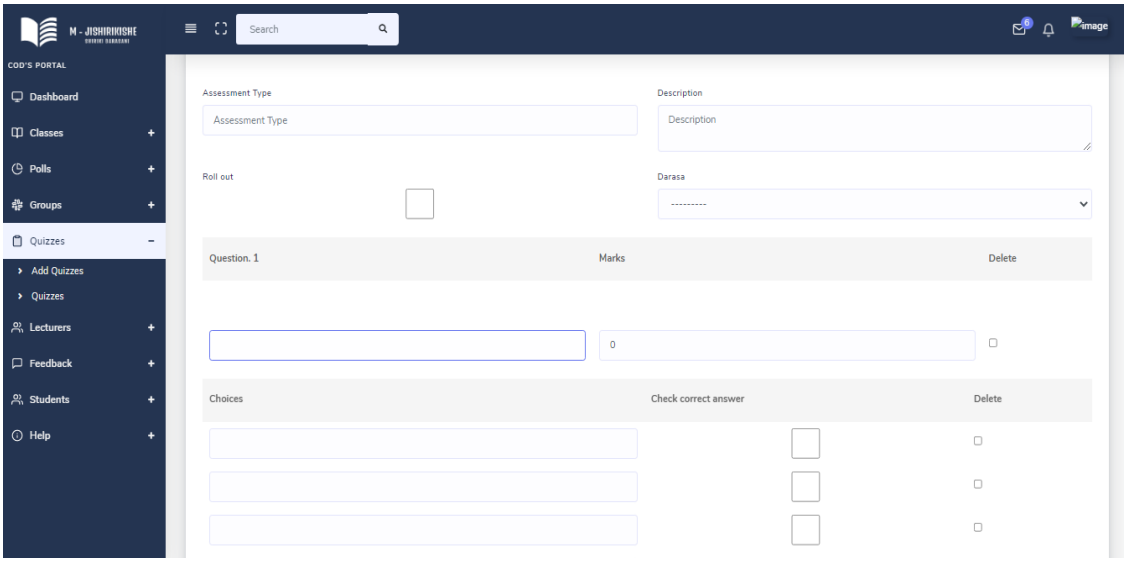
Under the active polls tab, the Cod can be able to view the number of active polls as well as view a poll by clicking the view button on the poll card. Under the polls list in the polls tab, the Cod can be able to see the list of all polls that is, the active and the inactive polls and can be able to delete a poll or update the polls list.

4.9.6.4 COD'S Quizzes tab

Here, under the add quizzes, the Cod can be able to create quizzes. This also includes ability to add questions and the choice of answers to choose from as well as selecting the correct answer, allocating marks to the questions and selecting the class for the quiz.

Figure 4.24

M-Jishirikishe CODs Quizzes tab



Above screenshot shows how to conduct quizzes from CODs portal

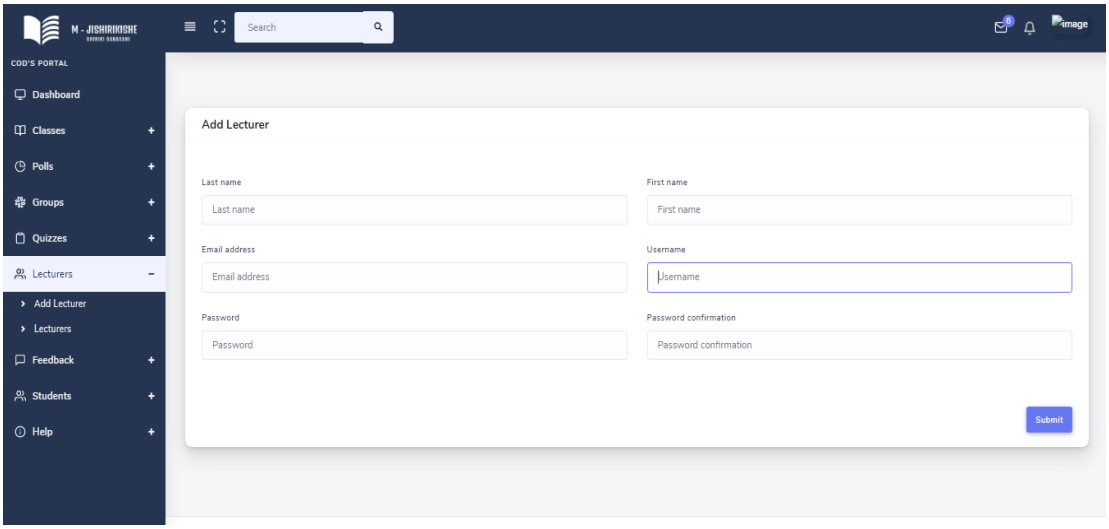
Under the Quizzes, Cod can be able to view the quizzes in the quiz list. The Cod can also be able to update or delete the quizzes. The Cod can also download, print or export the quiz list.

4.9.6.5 COD'S Lecturers tab

The Cod can be able to add Lectures under the add lecturer tab. Here the Cod can select the department, add the names and email of the lecture and create a login password that the lecturer will use to login to the lecturer portal.

Figure 4.25

M-Jishirikishe CODs Lecturers Management tab



Above screenshot shows how to manage lecturers from CODs portal

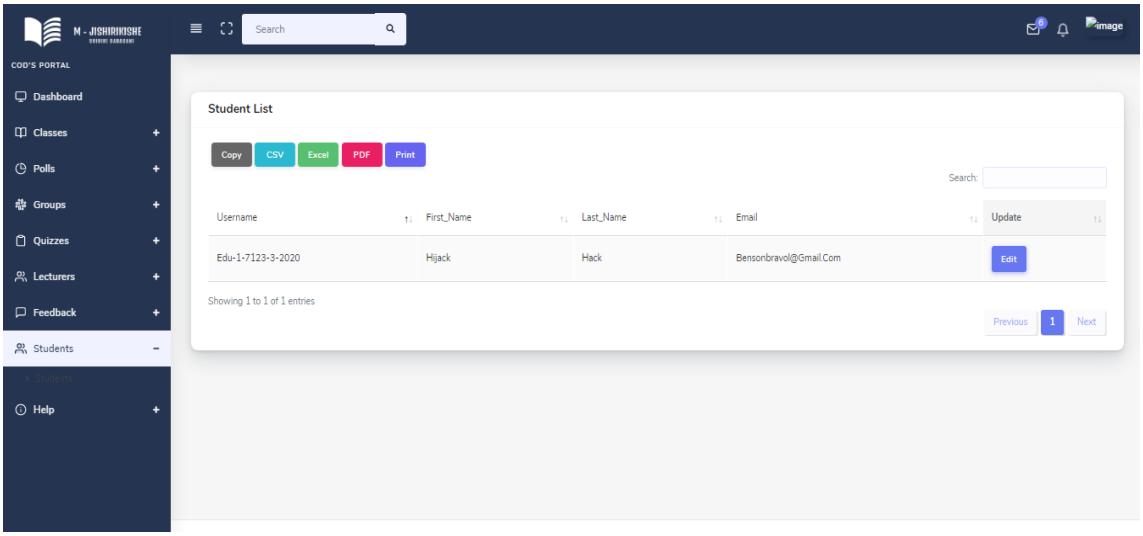
The Cod can also be able to view the number of the lecturer registered by clicking on the Lecturer under the Lecturer tab. Here the Cod can also be able to update the lecturer list. The Cod can also download, print or export the list.

4.9.6.6 COD'S Students tab

The Cod can be able to view the number of registered students under the students list. More so the Cod can also download, print or export the list.

Figure 4.26

M-Jishirikishe CODs Students tab



Above screenshot shows how to manage students from CODs portal

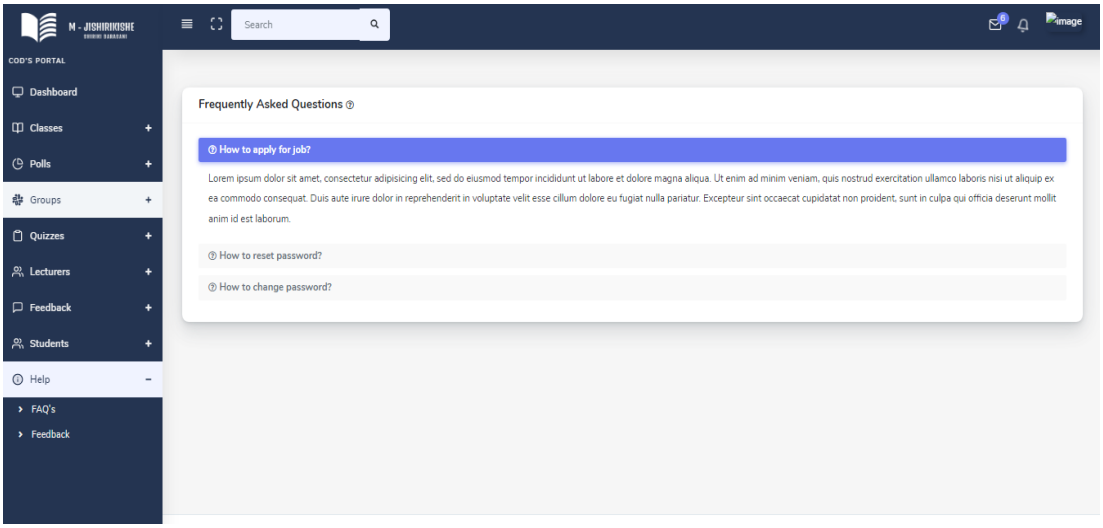
The Cod can also be able to edit and update the students list.

4.9.6.7 COD'S Help tab

Under the help tab, the Cod can be able to access the frequently asked questions by clicking on the FAQ'S tab.

Figure 4.27

M-Jishirikishe CODs Help tab



Above screenshot shows how to access frequently asked questions from CODs portal

4.9.7 M-Jishirikishe Lecturer's Module

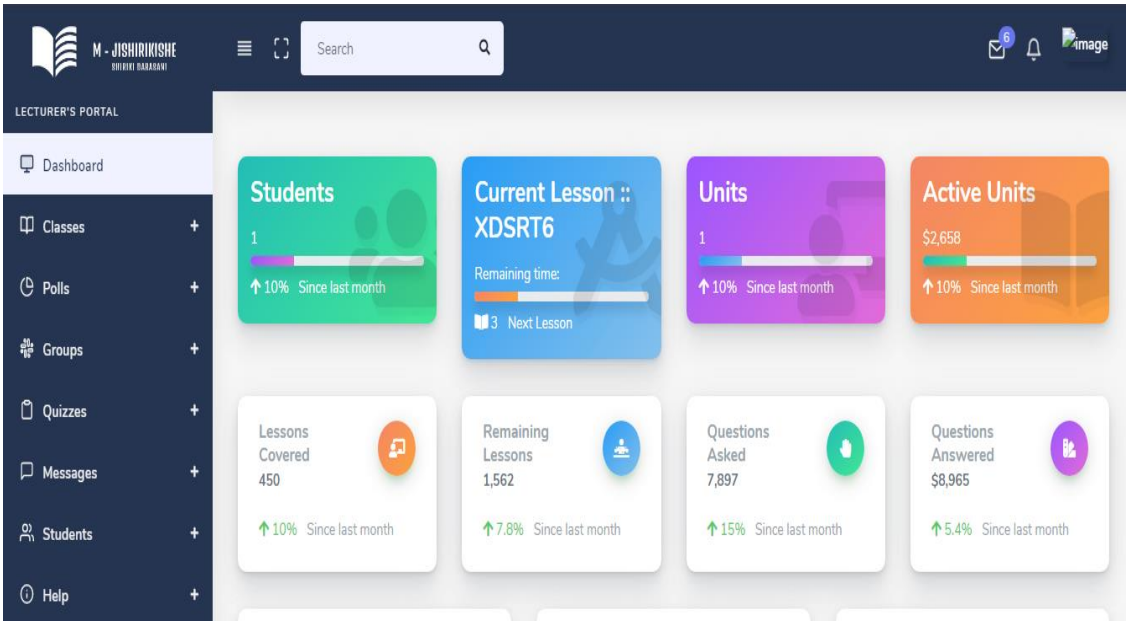
Under the lecturer's module, there are different option such as dashboard, classes, polls, groups, quizzes, messages, students and help

4.9.7.1 Lecturer Dashboard

Here the lecturer can be able to see students, current lesson, units, active units, lesson covered, remaining lesson, question asked, question answered, polls result tabulated in line chart, bar chart, and in chart and lastly lecturer will be able to see the groups.

Figure 4.28

M-Jishirikishe Lecturers Dashboard



Above screenshot shows lecturers module

4.9.7.2 Lecturers Classes Interface

Under class, the lecturer can be able to add a class and view already created classes for various units.

Add class

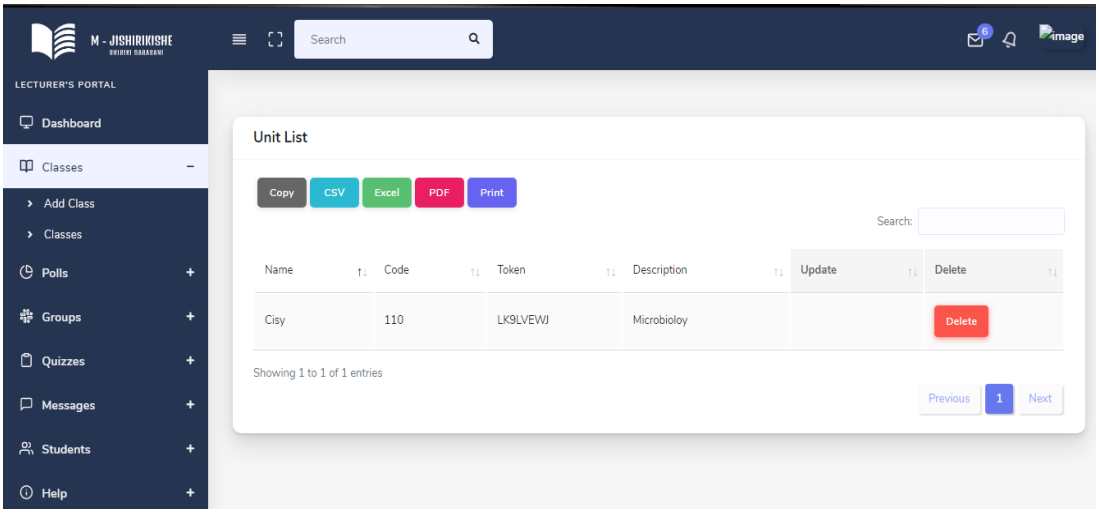
Under add class the lecturer will be able to create a class by indicating the unit/course name, unit code, class description. The lecturer will be able to give the lesson a name, the time it will take place, its duration and also remove the class.

Manage Classes

The lecturer will be able to see all the classes he or she has created.

Figure 4.29

M-Jishirikishe Lecturers Class management tab



Above screenshot shows how to manage classes from lecturers' interface

4.9.7.3 M-Jishirikishe Lecturers Polls Interface

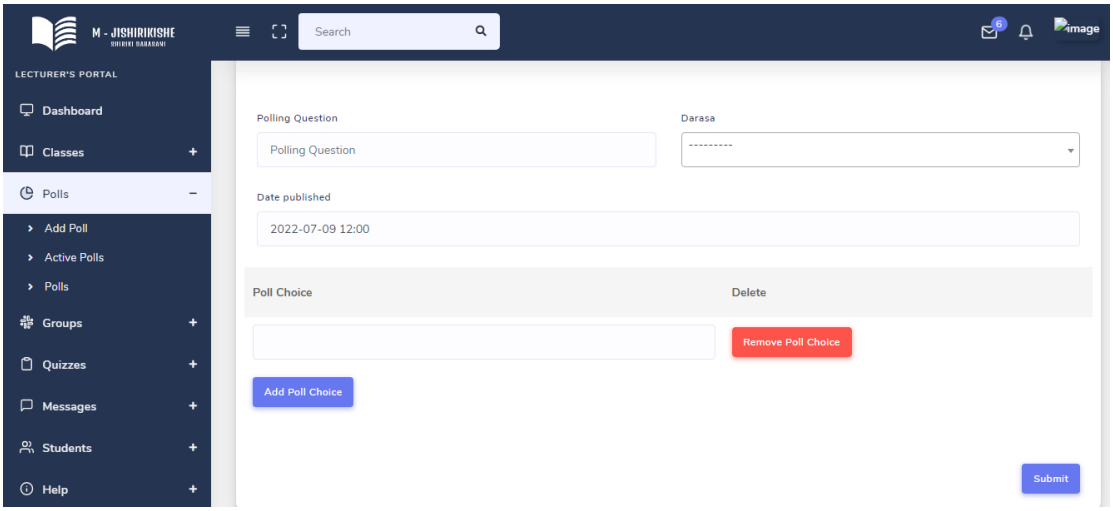
Under polls, the lecturer can be able to add a poll, view active polls and he or she will be able to see the created polls

Adding a polls

The lecturer will be able to create the polling question, choose the unit/course (Darasa) for polls, choose the date of publishing the poll and also give the poll choices. Lastly, the lecturer will click on the submit button to create or add a poll.

Figure 4.30

M-Jishirikishe Lecturers Polls tab



Above screenshot shows how to manage polls from lecturers' interface

Monitoring Active polls

The lecturer will be able to see created polls. He or she will be able to view the created polls

Editing Polls

Under the polls, the lecturer will be able to see the created poll question and date published.

The lecturer can delete the created poll.

4.9.7.4 M-Jishirikishe Lecturers Groups Interface

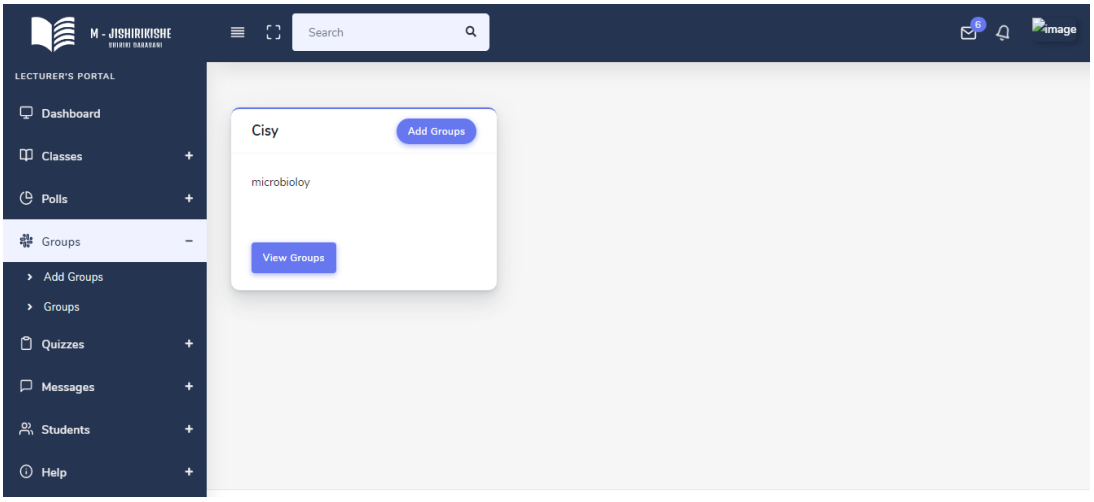
Under the groups, the lecturer can be able to add groups and view groups

Add groups

The lecturer will be able to see his or her unit, where he or she will be able to add or view created groups.

Figure 4.31

M-Jishirikishe Lecturers Groups interface



Above screenshot shows how to manage groups from lecturers' interface

Manage Groups

Here the lecturer will be able to see all the created groups for his or her unit/course. Also, the lecturer will be able to add members in the group and view the group.

4.9.7.5 M-Jishirikishe Lectures Quizzes Interface

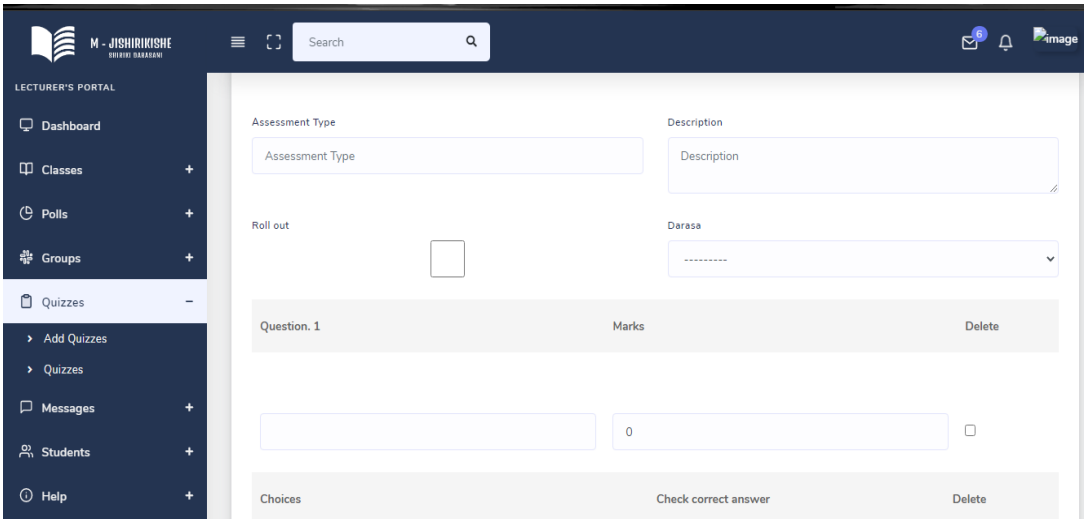
Under the lecture will be able to add quizzes and see the created quizzes.

Add quizzes

The lecturer will be able to create quiz by indicating assessment type, description, clicking on roll out, choosing the name of the unit (Darasa), typing question on provided spaces, awarding marks and lastly clicking on the submit button. The lecturer can delete a quiz question by selecting the delete checkbox.

Figure 4.32

M-Jishirikishe Lecturers Quizzes Interface



Above screenshot shows how to manage quizzes from lecturers' interface

Editing created Quizzes

The lecturer will be able to see the already created quizzes for his or her unit/course. Also, he or will be able to delete a quiz.

Lecturers Messages

Under messages, the lecturer will be able to see messages send to him or her and also feedback from the student

Students

The lecturer will be able to see all students registered for his or her unit.

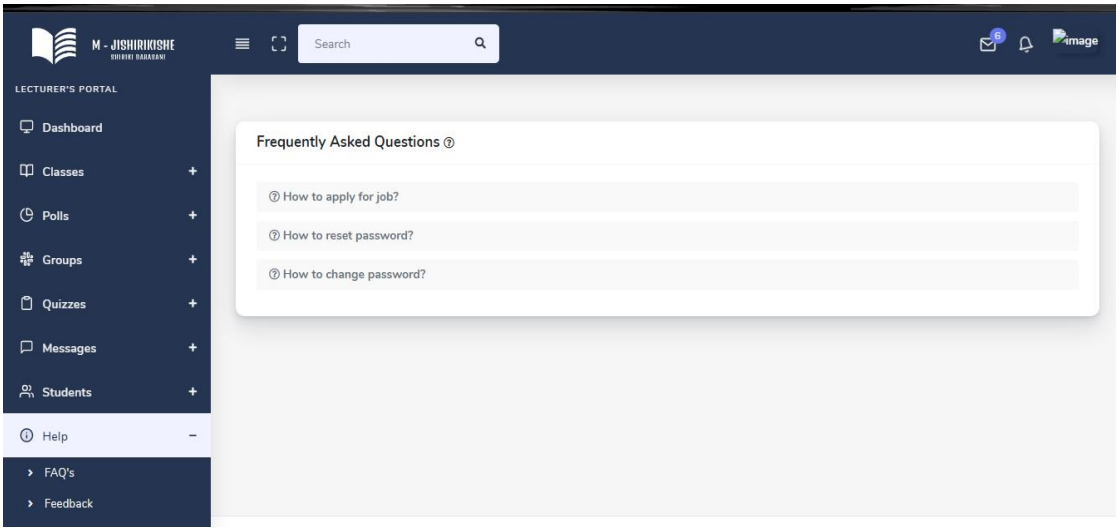
4.9.7.7 M-Jishirikishe Lecturers Help Module

Under help option will have two options that is the FAQ and Feedback.

Under FAQ, the lecturer will be able to see the frequent asked questions.

Figure 4.33

M-Jishirikishe Lecturers Help Module



Above screenshot shows how to manage lecturers from lecturers' interface

4.9.8 M-Jishirikishe Students Module

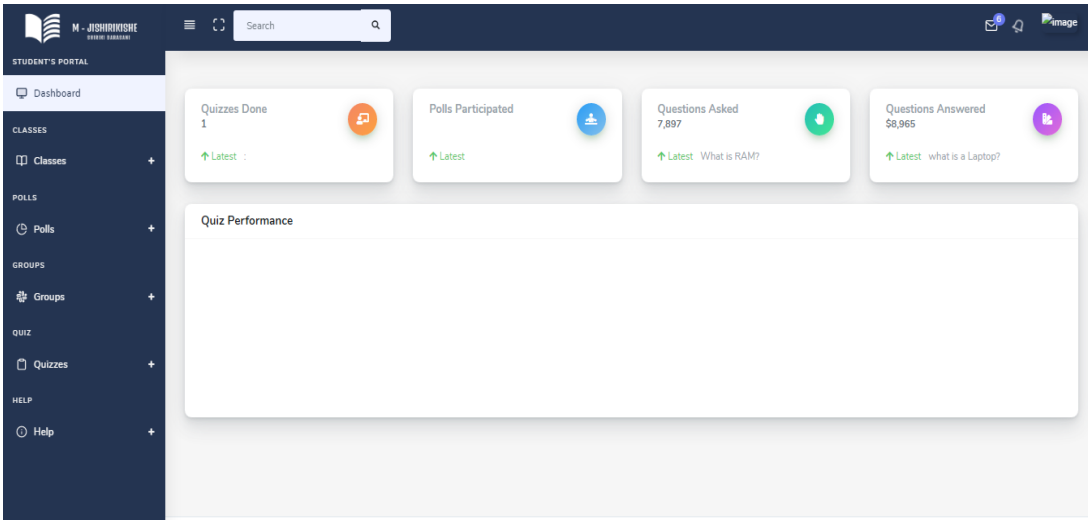
Under the student module, there are different option such as dashboard, classes, polls, groups, quizzes and help

4.9.8.1 Student Dashboard

Here the students will be able to see all the quizzes done, poll they have participated, Question Asked, Question Answered and the Quiz performance.

Figure 4.34

M-Jishirikishe Students Dashboard



Above screenshot shows how to manage students from lecturers' interface

M-Jishirikishe Students Classes

Under classes we have two options, that is, classes and join classes.

4.9.8.2.1 Classes

Under classes, the students will be able to view the classes they have joined.

After clicking the view button, the students will be able to open the lesson, see polls and quizzes in that class.

Student will be able get access to lesson by just clicking open lesson button, students will be able to see the course and they will be able to give feedback.

Students will be able to take polls by clicking on the take polls button

Also, students will be able to take quiz by clicking on take quiz button and lastly clicking on start. After they have done, they quiz they will receive a notification "Congratulation,

you have answered all the questions.”

4.9.8.2.2 M-Jishirikishe Students Joining Classes

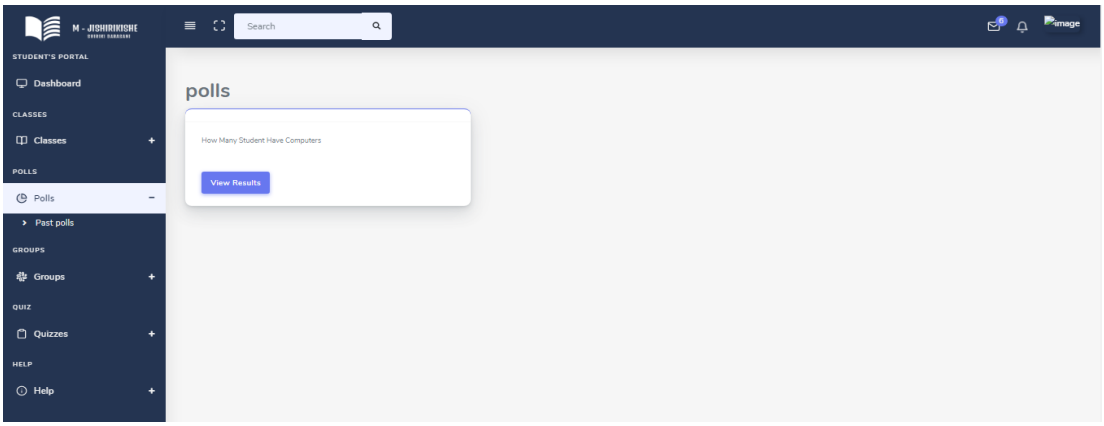
The student will be able to join a class through a token which will be shared by the lecturer.

4.9.8.3 M-Jishirikishe Students Polls

Under polls students will be able to see past polls he or she has attempted.

Figure 4.35

M-Jishirikishe Students Polls interface



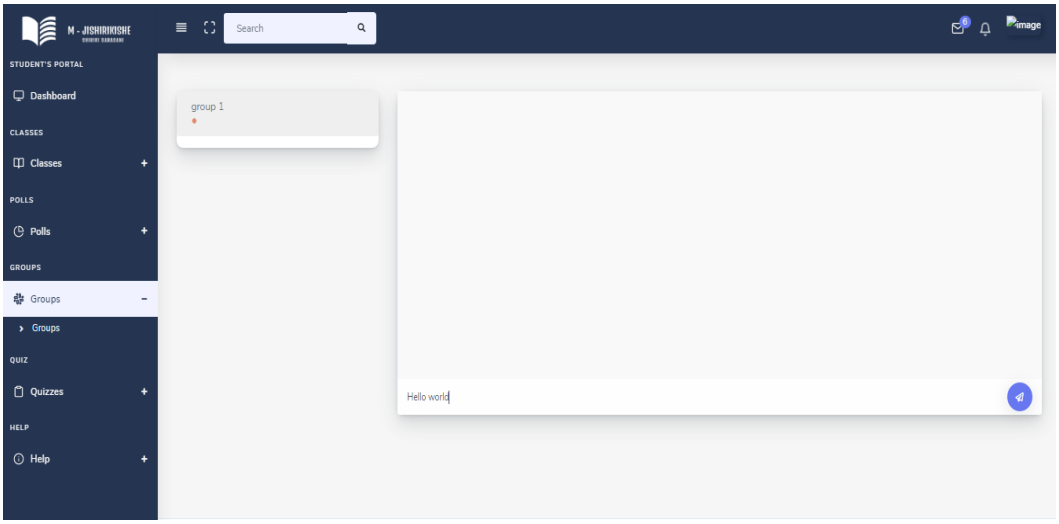
Above screenshot shows how students access polls

4.9.8.4 M-Jishirikishe Students Groups

Student will be able to see the group they have been added to by lecturers.

Figure 4.36

M-Jishirikishe Students Groups



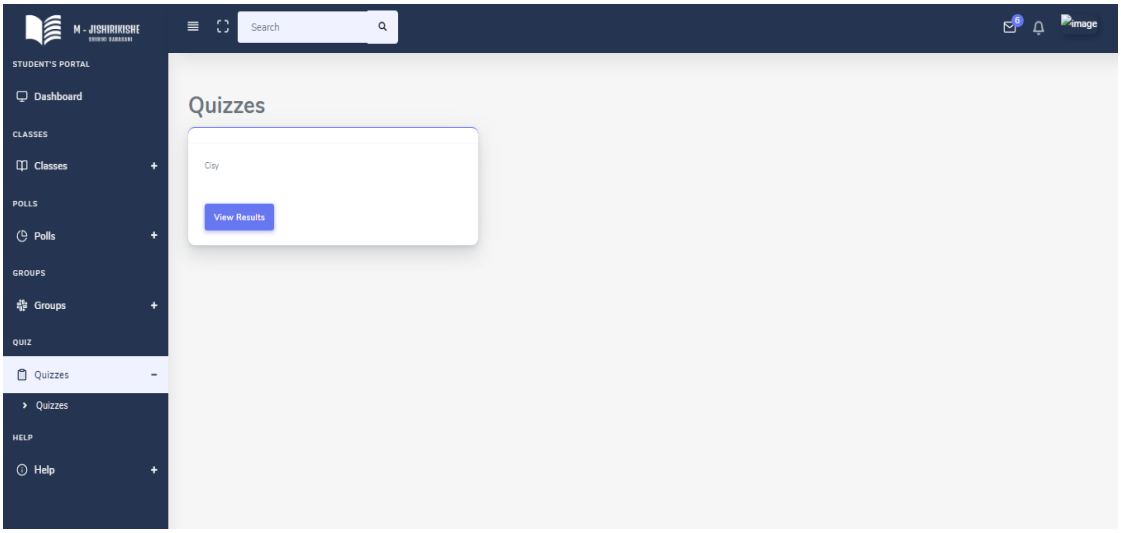
Above screenshot shows how students access groups

4.9.8.5 M-Jishirikishe Students Quizzes

Under quizzes, students will be able to see the quizzes they have attempted

Figure 4.30

M-Jishirikishe Students Quizzes interface



Above screenshot shows how students access quizzes. After they click on view results, they will be able to see the unit/course, the points they got out of the total points of the quiz and the quiz Ranking.

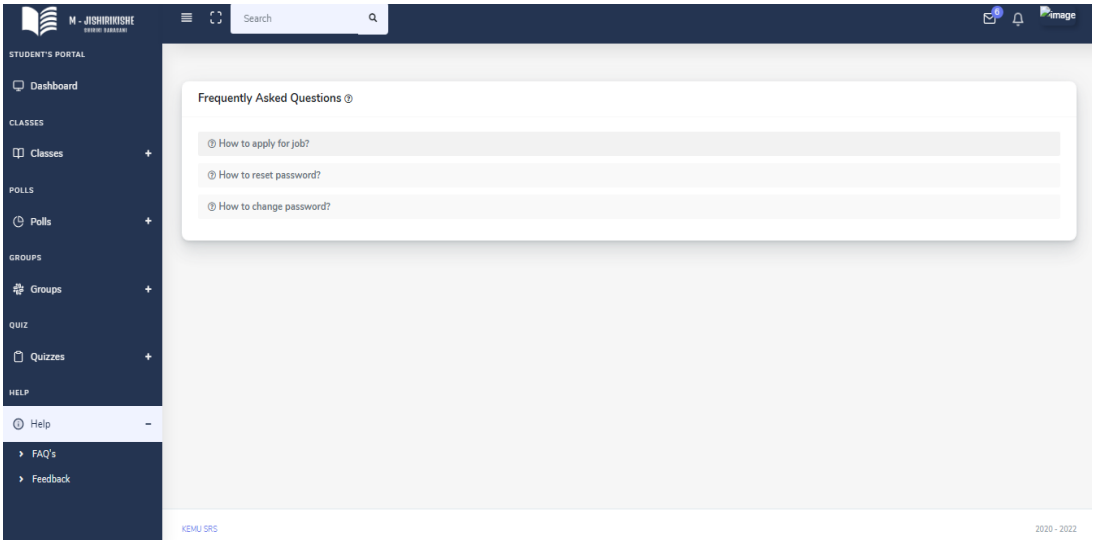
4.9.8.6 M-Jishirikishe Students FAQs and Feedback

Under help option will have two options that is the FAQ and Feedback.

Under FAQ, the see will be able to see the frequent asked questions.

Figure 4.37

M-Jishirikishe Students FAQs Module



Above screenshot shows how students access frequently asked questions

4.9.9 Effectiveness of a mobile-bases system in supporting classroom interaction

After development of the M-Jishirikishe mobile based SRS, a follow up test was carried to evaluate the application from both the students and the staff.

To test the system, the researcher organized an online class comprising of 63 students i.e 20 students from meru university of science and technology, 20 students from UMMA university and 23 students from Mount kenya university. The researcher picked a number bigger than 40 since Colleen,2020 describes a large classroom as a classroom is whereby the lecturer to student ratio is at least 1 lecturer to 40 students. Also in attendance was one lecturer, one dean and one COD. Everyone in attendance was furnished with a link to download the mobile based SRS and register for an account.

The lecture conducted was a lecture on cybersecurity and focused on computer malware. The lecturer kicked it off by explaining what the term 'MALWARE' stands for and expounded on its dangers. After 15 minutes the lecturer activated 'Question asking' button and received 2 questions one on where 'MALWARE' originates from and another on 'How to identify a computer that has been infected by 'MALWARE'. The lecturer answered the questions in depth and provided some relevant examples. Thereafter, the COD took over and explained different types of malwares and their key characteristics for 20 minutes. The COD then proceeded to conduct a poll where he asked the students to vote on the malware that encrypts users' data and ransom is demanded for decryption. 60 of the responses were correct and hence the COD did a short recap for the 3 students who got it wrong. The dean had set a 3-question quiz in advance and had allocated 3 minutes to complete the quiz. She activated it for the students who proceeded to take the quiz against the timer. 42 students had 100% based on the questions asked in the quiz.

Finally, the students were divided into virtual groups and given discussion topics and the lecturer could easily keep track and promptly see everything they typed in their respective discussion forum. Every response from the polls, quizzes, group discussions was displayed in real time for the lecturer, COD and dean. At the end of the lecture, students were given a google form link to evaluate the system. The lecturer, dean and COD also had their separate link for evaluation of the system.

This section indicates the student's evaluation of the mobile response system

The Likert scales responses are presented in order of strongly agreed, agree, uncertain/not applicable, disagree, and strongly disagree.

Majority of the students 81% were comfortable using mobile device in class while 19% who agreed. Majority of the students 77.8% strongly agreed that the mobile application was useful for their learning. Also 69.5% of the students strongly agreed that mobile application improved their ability to learn. The results showed 76.2% that the application was easy to operate. The students 74.6% also agreed that the application helped them in their group work, therefore, it can be concluded that the student appreciated the effectiveness and the benefits that a mobile response system provided.

Table 4.9.

Attitude towards Usage of Mobile Learning in Classrooms

Statements	**strongly agree**	**agree**	**uncertain/not applicable**	**disagree**	**strongly disagree**	**mean**
I was comfortable using a mobile device in classroom	51(81%)	12(19%)	0	0	0	4.73
Using the mobile application in my class work was a wise idea	47(74.6%)	15(23.8%)	0	0	0	4.72
The mobile application was useful for my learning	49(77.8%)	14(22.2%)	0	0	0	4.68
Using mobile application improved my ability to learn	44(69.5%)	21(31.3%)	0	0	0	4.65
The mobile application was easy to operate	48(76.2%)	15(23.8%)	0	0	0	4.67
I intend to use the application for my future classes	45(71.4%)	16(25.4%)	1(1.6%)	1(1.6%)	0	4.65
Usage of the mobile application helped me and my classmates to effectively work as groups	47(74.6%)	15(23.8%)	1(1.6%)	0	0	4.65
I would encourage other institutions to adopt usage of the mobile application in class	49(77.8%)	14(22.2%)	0	0	0	4.74
Usage of the mobile application in classroom had positive benefits	47(74.6%)	14(22.2%)	0	0	0	4.66

The evaluation results indicated that that the interface was user friendly and easy to navigate as indicated by 74.6% of the students. The students 81% also noted that the application was simple and convenient to operate. The students 71.4% noted that the application attracted their attention and focus. It was found that the mobile application

design was appealing to the eye and fun to use 69.8%. The system also had a capacity to increase user productivity and it provided forms and tools for the user. The students reported that the mobile application was light and supported fast installation appropriate device or system 73%. The app was fast and incorporated current, updated security technologies 65.1 %. Finally, 68.3% the students noted that the mobile application had many levels of security for different users and resources of the students.

Table 4.10

Technical and Functional requirements

Statements	**Strongly agree**	**Agree**	**Uncertain/not applicable**	**Disagree**	**Strongly disagree**	**Mean**
the interface was user friendly by being easy to navigate through the objects of the application	47(74.6%)	16(25.4%)	0	0	0	4.65
The mobile application was simple and convenient to operate	51(81%)	12(19%)	0	0	0	4.65
The mobile application didn't overload, but attracted the learner's attention and focus.	45(71.4%)	17(27%)	1(1.6%)	0	0	4.66
The mobile application was simple and intuitive to use. Its design was aesthetically attractive, pleasant and fun to use	44(69.8%)	19(30.2%)	0	0	0	4.7
The mobile application provided useful, appropriate and meaningful means to increase the user productivity in both groups and individually	47(74.6%)	16(25.4%)	0	0		4.68
The mobile application offered various forms and tools to support the user	42(66.7%)	19(30.2%)	2(3.2%)	0	0	4.7
The mobile application was tailored to the individual user	41(65.1%)	17(27%)	2(3.2%)	1(1.6%)	2(3.2%)	4.65
mobile application was available and accessible when needed	44(69.8%)	19(30.2%)	0	0	0	4.69
The mobile application was easy and fast to install at any appropriate device or system	46(73%)	17(27%)	0	0	0	4.71

The mobile application needed minimal effort and time to maintain its efficient operation.	50(79.4 %)	13(20.6 %)	0	0	0	4.64
response time for the mobile application was fast and appropriate	45(71.4 %)	17(27 %)	1(1.6 %)	0	0	4.7
The mobile application incorporated current, updated security technologies	41(65.1 %)	20(31.7 %)	1(1.6 %)	1(1.6 %)	0	4.65
The mobile application supported multiple levels of security for different users and resources	43(68.3 %)	17(27 %)	3(4.8 %)	0	0	4.65

4.10 Pedagogical requirements

The majority of students 74.6% noted the content quality was valid trustworthy and accurate. M-jishirikishe Mobile based SRS helped the students fully participates and be active in class 73% strongly agreed. In addition, 74.6% noted that the content delivery was simple, modular and flexible. Also, the interface was easy to navigate as observed by 77.8% of the students. Further, the mobile app was intuitive, logical and appropriate as rated by 73% of the students. Therefore, it is evident that the system enabled met the pedagogical requirements of active participation of students in class as well as meeting the economical requirements.

Table 4.11

Pedagogical requirements

Statements	**strongly agree**	**agree**	**uncertain/not applicable**	**disagree**	**strongly disagree**	**mean**
Content Quality was valid trustworthy and accurate	47(74.6%)	16(25.4%)	0	0	0	4.66
Using the mobile application for my learning helped me participate actively in class	46(73%)	17(27%)	0	0	0	4.7
Content delivery was simple, modular and flexible	47(74.6%)	16(25.4%)	0	0	0	4.68
The interface of the mobile application was easy to navigate	49(77.8%)	14(22.2%)	0	0	0	4.7
Mobile application was intuitive, logical and appropriate structure for the learners	46(73%)	17(27%)	0	0	0	4.65
Using the mobile application for learning Promoted and supported the learner in active classroom participation	44(69.8%)	19(30.2%)	0	0	0	4.69
The mobile application Achieved the intended results and benefits at the lowest possible cost	44(69.8%)	19(30.2%)	0	0	0	4.71

This section presents the overall regression model of the evaluation of the mobile system by the students. The (r^2=*.952)* and (*adjusted* r^2 was *.91).* A strong size effect is presented by the model. It implies that 95% of the variations in effectiveness of student mobile based

system are explained by the independent variables presented above. It therefore means there is a strong positive relationship between the independent variables and the adoption of the mobile response system from student's evaluations. The model summary table below shows the results.

Table 4.12

Regression model summary

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.976[a]	.952	.907	.128

The analysis of variance table below shows that the model is significantly useful in determining the positive evaluation and adoption of a student mobile system *F, (30, 32) =21.254, p<.01).* Anova table below show the results.

Table 5.3

Anova

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	10.369	30	.346	21.254	.000[b]
	Residual	.520	32	.016		
	Total	10.889	62			

4.11 Effectiveness of a mobile-based system

An evaluation was done from the dean, Cod and Lecturer on the effectiveness of the student mobile response system. The instructors agreed that they were comfortable using a mobile device in classroom. The mobile application easy to operate, improved their ability to teach and therefore useful for teaching. The system was found to be fun since it enabled full and active participation of the student's n class and therefore deemed beneficial. The lecturer, Cod and Dean, agreed that the system had a clear design, and was visually appealing and pleasant. Additionally, the interface was user friendly easy to navigate, simple and convenient to operate. Further they agreed that the mobile application provided increased user productivity and had appropriate tools to support the user.

The staff noted that the mobile application was tailored to available and supported fast installation appropriate device or system. The mobile application needed minimal effort and time to maintain its efficient and fast operation, with fast response time. It also incorporated current, updated security technologies while supporting many levels of security.

The lecturers, Cod and dean noted that the content quality was valid trustworthy and accurate and helped students to actively participate in class. They also agreed that the content delivery should was simple, modular flexible and easy to navigate. The mobile application was intuitive, logical and appropriate structure for the learners and promoted and supported the learner in active classroom participation. They also agreed that the mobile application used low cost to achieve the intended results and benefits.

4.12Discussion of the results

This section discusses the results of this study. The discussion is arranged in the order of objectives of this study and compares the results with the literature reviewed earlier.

4.13 Attitudes, subjective norms and perceived behavioral controls after M-Jishirikishe Usage

This study sought to determine the attitudes, subjective norms and perceived behavioral controls in use of mobile-based response systems for in-classroom learning. Attitude toward the behavior referrers to the individual assessment of either the behavior carried out to be carried out. This behavior can be determined based on two different beliefs i.e., behavioral belief and outcome evaluation. Behavioral belief refers to the outcome of carrying out the behavior whereas outcome evaluation refers to whether the individual deems the behavior to be carried out either as positive or negative (Ulker & Ciftci, 2020). Most students enjoyed M-jishirikishe mobile response system as they found it easy to operate and fun to use. Students noted that the software enabled them to learn. These results agreed with those of Kocak (2022) who found that students were motivated and encouraged to learn using Socrates application. The students had a positive attitude towards the *M-Jishirikishe mobile* based SRS since they perceived it to have positive benefits for their learning. These results agreed with those of Voith et al. (2018)who found that the learners liked the mobile based response system compared with the older method of teaching English language as it increased their engagement and led to improved achievement of the leaning outcomes. Similarly, the positive attitude of students towards a mobile-based SRS is in complete agreement with (Wood, 2020).

The instructors also noted that the application was effective since they were comfortable using a mobile device in classroom. They noted that the mobile application easy to operate improved their ability to teach and therefore improved their teaching. These results coincide with those of Wang and Tahir (2020) who noted that the instant feedback they received after sending the quizzes was very essential elements. The so crate software was able to give them immediate responses from the student once submitted. The instructor was able to explain the correct ones, evaluate the learner's level of understanding, discuss and frame future lectures better. Wang and Tahir (2020) claim that the SRS application benefits and positive effects on student learning, for instance provision of immediate feedback, enhancing active participation in class and improving students' retention rate (Wang & Tahir, 2020). However, via interviews the instructors cited challenges or weaknesses of the application which were similar to the ones identified by (Al Sunni and Latif, 2020) where the lecturers found socrative app requiring a lot of time in preparation of sessions. This similarly agreed with Knight and Wood 2021, proposition that a lecturer has to spend sufficient time before in preparation of content before actual class delivery. Therefore, using *M-Jishirikishe* would ensure quality since the trainers are able to plan their lessons in advance and enhance quality content delivery benefiting the students and the university at large. However, despite the time spent in preparation, the instructors noted that use *M-Jishirikishe* during a lecture leads to the lecturer having a shorter period to deliver course content. This agreed with the finding of (AlSunni & Latif, 2020)

4.14 The requirements evaluation after M-Jishirikishe Usage

M-Jishirikishe met the technical/design requirement for expectations by the students and

instructors. Both the students and the instructors in this study found the mobile based response system easy to navigate, simple and convenient to operate. This means that they positively evaluated the application as beneficial to achieving learning and teaching goals respectively. Interestingly the applications attracted the learner's attention and focus a finding that concurred with that of Kocak (2022) who noted that the system enhanced the students learning interest and eventually improved their academic performance. The students also found the application design, aesthetically appealing to the eye, supported installation that easy very easy and fast and was tailored to the students. It means that the student is prompted to make use of the system on any devise due to its ubiquitous aspect. These results of this study were justified by the claim of Ulker and Ciftci (2020) who found that the beliefs, positive or negative judgement and outcomes evaluations explains how confident and how much control a student have on adopting (SRS) application. For instance, *M-Jishirikishe* is tailored to the student and teacher needs and it increased the student productivity as well as supporting supported many security levels depending on different users. The response time was also fast and appropriate. These finding coincides with the finding by Wang and Tahir (2020) who noted that student felt secure, more engaged by use of Socrates which improved individual students learning experience and recorded improved performance.

M-Jishirikishe mobile based SRS helped the student fully participate and be actively involved in classroom activities. This result concurred with that of Wood (2020) who found that the student response systems enable students to participate actively in class privately by ensuring other students don't know which student asked which question or

provided which answer (Wood, 2020). The results of this study indicated that M-Jishirikishe mobile based SRS Content was Quality, valid, simple, modular and flexible.

4.15 The effectiveness of a mobile-based system

The students felt their learning experience was improved using M-Jishirikishe mobile based SRS in their classes. Not only did the mobile application enable students to effectively work as groups but it improved their ability to learn and therefore, they appraised the system as useful in their learning. Similarly, In Cambridge University, SRS was used facilitating formative assessment, conducting polls and providing synchronous feedback to the lecturer. This improved the learning achievement by supporting high interaction and participatory leaning among the students (Calderón-Garrido et al., 2022). The instructors also agree that using the M-Jishirikishe mobile based SRS for learning helped students participate actively in class. These results agreed with those of Wood (2020)who found out that SRS reporting improved interaction among students and boosted their comprehension rate. Our results reflect previous study by Kocak (2022) who compared Socrative with an ordinary SRS. The learners noted better participation in class and improved classroom dynamics for Socrative compared to a traditional SRS (Wang and Tahir, 2020). Therefore, Using the mobile application for learning Promoted and supported the learner in active classroom participation this agreed with the finding of (López-Jiménez et al., 2021) who noted that the SRS plays an important role in helping the students to self-regulate their performance by developing the capacity of each individual student (López-Jiménez et al., 2021). However, the study by Wang and Tahir (2020) noted that use of SRS enabled retention of the content taught and improvement of

performance. Finally, the study agrees with other research that indicates that the involvement of students and teachers in the design of a student response system may improve attitude by the stakeholders in adopting the system and increase its effectiveness (Wood, 2020).

4.16 Summary results and findings

In summary the study found that the student and the instructors had a positive attitude towards the *M-Jishirikishe mobile based SRS* student's mobile response system. They perceived the system to be useful and beneficial in learning and teaching. The system also possessed the important technical, functional, economical social cultural and economic requirements. On evaluation the students enjoyed the system as it enabled active and full participation in classroom activities. The instructors also observe that the system improved feedback and speed of response upon submission of quizzes. The system is therefore was found very beneficial in enhancing quality of teaching and knowledge transfer to students.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.0 Introductions

This section presents the summary of the study, conclusions and recommendations of this study.

5.1 Summary

The general objective was to design and test the effectiveness of a mobile-based student class response system in supporting learning within large classrooms for Kenyan universities. This study aimed to determine attitudes, subjective norms and perception of the ease or difficulty in use of mobile-based response systems for in-classroom learning. Also, to determine the requirements for a mobile-based student response system and also to test the effectiveness of a mobile-based student class response system. As the outcome of this study the system was developed and tested using Iterative enhancement model/ incremental model which involved, design, development, implementation and testing. The M-jishirikishe mobile based student response system has been evaluated and found to be effective. The study was anchored on Theory of planned behavior which explained the student and instructor's attitude and behavior towards adoption of the M-jishirikishe mobile based student response system. The literature review supported the results of this study that showed that M-jishirikishe mobile based student response system is beneficial in enhancing and supporting response in large classes. The instructors showed that the

system enabled quick feedback and turnaround time between submission and receiving of results. The student response system enabled the students to actively participate in classroom by asking and answering questions in an easy way. The instructors also benefited since it improved delivery time and quality learning.

5.2 Conclusion

The students have positive attitudes, subjective norms and perceived behavioral controls in use of mobile-based response systems for in-classroom learning. The students had sufficient extent of control to make decision to adopt m-learning

The most essential technical/ design requirements included visually appeal, and pleasant interface, interface that attract the learner's attention and focus and supporting persons with special needs. The system met all these requirements and was appraised as beneficial. The student noted that the search module should provide complete, accurate and relevant results. The system needs to be well tailored to the individual students having various levels of control. The M-jishirikishe mobile based student response system is required to survive at most extreme situations keeping on its integrity. The system supposed to be fast and appropriate meaning that the students don't experience any delays. The system should have capacity to support addition of learners and instructors and should have many security levels to support different types of users.

The pedagogical requirements that were very essential are that the content must be Quality was valid trustworthy and accurate, simple modular and flexible as well as easy to navigate. Most essentially the system should support the learner in active classroom participation. The application needs to be aesthetically appealing to the learner and

increase leaner's interest and focus.

The findings from the students indicated that the system was effective in supporting classroom interaction. The students observed that the *M-jishirikishe mobile based student response system* increased their active participation in class and enhanced their active participation group work. It improved their learning experience. Similarly, the instructors noted that the application enabled fully active participation of shy students and improved quality of delivery.

5.3 Recommendations

This study recommends Universities to adopt M-jishirikishe mobile based student response system which support many users in academic including the Deans, Cod's and the Lecturer. The study also recommends the lecturers to use M-jishirikishe mobile based student response system to enhance active and full participation by asking and answering questions in an easy way, to best meet the needs of the diverse student population. And finally, the researcher recommends that continuous development to improve technical and pedagogical requirements is made occasionally to enhance ease of use among different users.

5.4 Recommendations for further study

The study recommends another study be carried evaluating the relationship between the use of M- M-jishirikishe mobile based student response system and student performance. Also, evaluation of effectiveness of M-jishirikishe mobile based student response system on ODel Student, Online and distance learners' participation.

There is also need evaluation of M-jishirikishe mobile based student response system on

use on Tvet institutes and junior secondary schools in Kenya.

REFERENCES

Adkins-Jablonsky, S. J., Shaffer, J. F., Morris, J. J., England, B., & Raut, S. (2021). A Tale of Two Institutions: Analyzing the Impact of Gamified Student Response Systems on Student Anxiety in Two Different Introductory Biology Courses. *CBE—Life Sciences Education*, *20*(2), 1-12. https://doi.org/10.1187/cbe.20-08-0187

Al Sunni, A., & Latif, R. (2020). Determining the effectiveness of a cell phone-based student response system. *Journal of Taibah University Medical Sciences*, *15*(1), 59–65. https://doi.org/10.1016/j.jtumed.2019.12.002

Ault, M. J., & Horn, C. K. (2018). Increasing Active Engagement: Guidelines for Using Student Response Systems. *Journal of Special Education Technology*, *33*(3), 207–216. https://doi.org/10.1177/0162643418775745

Barbaro, J., & Yaari, M. (2020). Study protocol for an evaluation of ASDetect—A Mobile application for the early detection of autism. *BMC Pediatrics*, *20*(1), 1-11. https://doi.org/10.1186/s12887-019-1888-6

Bosnjak, M., Ajzen, I., & Schmidt, P. (2020). The Theory of Planned Behavior: Selected Recent Advances and Applications. *Europe's Journal of Psychology*, *16*(3), 352–356. https://doi.org/10.5964/ejop.v16i3.3107

Calderón-Garrido, D., Ramos-Pardo, F., & Suárez-Guerrero, C. (2022). The Use of Mobile Phones in Classrooms: A Systematic Review. *International Journal of Emerging Technologies in Learning (IJET)*, *17*(1), 194–209. https://doi.org/10.3991/ijet.v17i06.29181

Compton, M., & Allen, J. (2018). Student Response Systems: A rationale for their use and

a comparison of some cloud-based tools. *Compass: Journal of Learning and Teaching*, *11*(1), 1-10. https://doi.org/10.21100/compass.v11i1.696

Dwanoko, Y. S., & Arin, F. F. S. (2021). Implementation of User Centered Design methodology for designing information systems introduction to culture based on mobile applications. *IOP Conference Series: Materials Science and Engineering*, *1098*(6), 062004. https://doi.org/10.1088/1757-899X/1098/6/062004

Gachanja, F., Mwangi, N., & Gicheru, W. (2021). E-learning in medical education during COVID-19 pandemic: Experiences of a research course at Kenya Medical Training College. *BMC Medical Education*, *21*(1), 612-622. https://doi.org/10.1186/s12909-021-03050-7

Ismail, N.-S. N., BintiMustafa, S. Z., Yunus, F., & AbdWarif, N. B. (2020). Internet of Things (IoT) Smart Rubber Scale (SRS) System Using Arduino Platform. *2020 IEEE International Conference on Automatic Control and Intelligent Systems 1*(I2), 45–50. https://doi.org/10.1109/I2CACIS49202.2020.9140209

Jokhio, A. A., Raza, S. S., Younus, M., & Soomro, A. H. (2020). Teaching Writing Skills in University Large Classes In Pakistan: Issues, Challenges and Solutions. *JEELS Journal of English Education and Linguistics Studies*, *7*(1), 1-11. https://doi.org/10.30762/jeels.v7i1.1355

Kemuma, J. H. (2021). *Relationship between Problematic Smartphone Use and Psychological Distress Among University Students- a Case Study of Mount Kenya University, Kiambu County* [Master Thesis, University of Nairobi]. Kenya. http://erepository.uonbi.ac.ke/handle/11295/160801

Kocak, O. (2022). A systematic literature review of web-based student response systems:

Advantages and challenges. *Education and Information Technologies*, *27*(2), 2771–2805. https://doi.org/10.1007/s10639-021-10732-8

Korucu Kis, S., & Kartal, G. (2019). No pain no gain: Reflections on the promises and challenges of embedding reflective practices in large classes. *Reflective Practice*, *20*(5), 637–653. https://doi.org/10.1080/14623943.2019.1651715

Kumar Basak, S., Wotto, M., & Bélanger, P. (2018). E-learning, M-learning and D-learning: Conceptual definition and comparative analysis. *E-Learning and Digital Media*, *15*(4), 191–216. https://doi.org/10.1177/2042753018785180

Lê, J. K., & Schmid, T. (2022). The Practice of Innovating Research Methods. *Organizational Research Methods*, *25*(2), 308–336. https://doi.org/10.1177/1094428120935498

Lee, Y.-C. (2022). SRS: Spatial-tagged radio-mapping system combining LiDAR and mobile-phone data for indoor location-based services. *Advanced Engineering Informatics*, *52(*1), 101-560. https://doi.org/10.1016/j.aei.2022.101560

López-Jiménez, J. J., Fernández-Alemán, J. L., García-Berná, J. A., López González, L., González Sequeros, O., Nicolás Ros, J., Carrillo de Gea, J. M., Idri, A., & Toval, A. (2021). Effects of Gamification on the Benefits of Student Response Systems in Learning of Human Anatomy: Three Experimental Studies. *International Journal of Environmental Research and Public Health*, *18*(24), 24-30. https://doi.org/10.3390/ijerph182413210

Luo, P., Luo, M., Li, F., Qi, X., Huo, A., Wang, Z., He, B., Takara, K., Nover, D., & Wang, Y. (2022). Urban flood numerical simulation: Research, methods and future perspectives. *Environmental Modelling & Software*, *156(*1), 105-478.

https://doi.org/10.1016/j.envsoft.2022.105478

M'mboga, A, D. B. (2021). Revisiting education reform in Kenya: A case of Competency Based Curriculum (CBC). *Social Sciences & Humanities Open, 3*(1), 100-107. https://doi.org/10.1016/j.ssaho.2021.100107

Mohajan, H. K. (2018). Qualitative research methodology in social sciences and related subjects. *Journal of Economic Development, Environment and People, 7*(1), 1-11. https://doi.org/10.26458/jedep.v7i1.571

NietoGarcía, M., & Sit, J. (2022). Students' recalled desirability of using game-based student response systems (gsrss): a user experience (ux) perspective. *Marketing Education Review*, *1*(1), 1–13. https://doi.org/10.1080/10528008.2022.2117989

Ogot, M., & Onyango, G. M. (2022). Does Universities' Research Output Aligned to National Development Goals Impact Economic Productivity? Evidence from Kenya. *Journal of Asian and African Studies*, *1*(1), 00219096221080196. https://doi.org/10.1177/00219096221080196

Oyoo, B. (2019). *Exploring the challenges faced by teachers in the teaching of mathematics in large classes: A case of a secondary school in Kisumu County, Kisumu west sub-County in Kenya.* [Masters *T*heses, Agha Kan Univesity]. Kenya. https://ecommons.aku.edu/theses_dissertations/1035

Rodríguez, M. F., Nussbaum, M., Yunis, L., Reyes, T., Alvares, D., Joublan, J., & Navarrete, P. (2022). Using scaffolded feedforward and peer feedback to improve problem-based learning in large classes. *Computers & Education*, *182*(1), 104446. https://doi.org/10.1016/j.compedu.2022.104446

Roshan, A. S., Mushfiqe, Gurbaz, M. Q., & Rahmani, S. (2022). The Effects of Large

Classes on English Language Teaching. *Integrated Journal for Research in Arts and Humanities*, *2*(2), 2-23. https://doi.org/10.55544/ijrah.2.2.20

Shahzad, F., Xiu, G., Shafique Khan, M. A., & Shahbaz, M. (2020). Predicting the adoption of a mobile government security response system from the user's perspective: An application of the artificial neural network approach. *Technology in Society*, *62*(1), 101-278. https://doi.org/10.1016/j.techsoc.2020.101278

Snyder, H. (2019). Literature review as a research methodology: An overview and guidelines. *Journal of Business Research*, *104*(1), 333–339. https://doi.org/10.1016/j.jbusres.2019.07.039

Ulker-Demirel, E., & Ciftci, G. (2020). A systematic literature review of the theory of planned behavior in tourism, leisure and hospitality management research. *Journal of Hospitality and Tourism Management*, *43*(1), 209–219. https://doi.org/10.1016/j.jhtm.2020.04.003

Voith, L. A., Holmes, M. R., & Duda-Banwar, J. (2018). Clicking Toward Better Grades: The Use of Student Response Systems in Social Work Education. *Journal of Social Work Education*, *54*(2), 239–249. https://doi.org/10.1080/10437797.2017.1283268

Wang, A. I., & Tahir, R. (2020). The effect of using Kahoot! For learning – A literature review. *Computers & Education*, *149*(1), 103818. https://doi.org/10.1016/j.compedu.2020.103818

Wettstein, S. G. (2018). *Self-paced, Active Problem-Solving Using Immediate Feedback (IF-AT; Scratch-off) Forms in Large Classes*. http://scholarworks.montana.edu/xmlui/handle/1/15162

Wood, A. (2020). Utilizing technology-enhanced learning in geography: Testing student response systems in large lectures. *Journal of Geography in Higher Education*, *44*(1), 160–170. https://doi.org/10.1080/03098265.2019.1697653

Yuriev, A., Dahmen, M., Paillé, P., Boiral, O., & Guillaumie, L. (2020). Pro-environmental behaviors through the lens of the theory of planned behavior: A scoping review. *Resources, Conservation and Recycling*, *155*(1), 104660. https://doi.org/10.1016/j.resconrec.2019.104660

APPENDICES

Appendix 1 Pilot study interview questions for students

Before the pilot study, the respondents were informed that the exercise was absolutely voluntary in the sense that no one would be forced to participate against their will and also that their identitywould be anonymous for the sake of confidentiality.

The pilot study picked the 3 categories of most common challenges faced by students in large classes from a study made by (Robertson, 2020)

1. Do you own a smartphone? Yes ☐ No ☐
2. As a student in large classroom, which of the below problems associated with large classes do you face?
a. Fear of asking and answering questions
b. Problem with assessment and feedback from the lecturers
c. Challenges Performing practical based exercises due to limited computers/ lack of resources

Appendix 2 Pilot Study interview questions for lecturers:

Before the pilot study, the respondents were informed that the exercise was absolutely

voluntary in the sense that no one would be forced to participate against their will and also that their identitywould be anonymous for the sake of confidentiality.

The pilot study picked the 4 categories of most common challenges faced by teachers in largeclasses from a study made by (Robertson, 2020)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	active classroom participation	48	68.6	68.6	68.6
	lack of resources	11	15.7	15.7	84.3
	course assessment and feedback	11	15.7	15.7	100.0
	Total	70	100.0	100.0	

Own_smartphone

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	yes	67	95.7	95.7	95.7
	no	3	4.3	4.3	100.0
	Total	70	100.0	100.0	

Usemobileinclass

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	yes	68	97.1	97.1	97.1
	no	2	2.9	2.9	100.0
	Total	70	100.0	100.0	

a. Difficulty individualized learning

b Difficult to manage the class

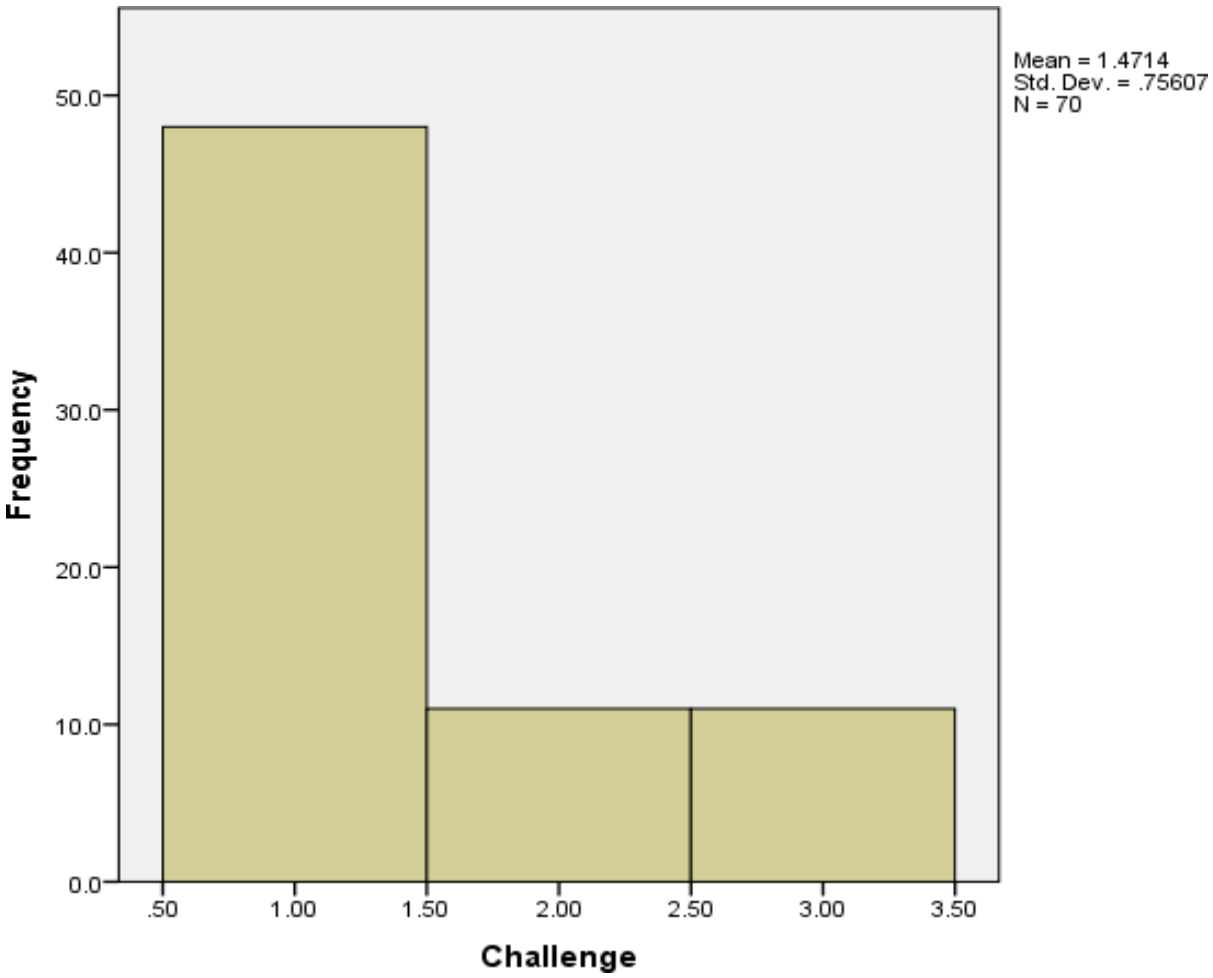
c. Pressure to increase student's throughput due to limited interaction

d. Would you be open to the use of smart Phones in Classroom if they were to sortany of the above problems?

Yes No

e. Difficulty in appropriate assessment and feedback

Appendix 3 SPSS Pilot study for students Frequency Bar graph



Individualized_learning

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	3	60.0	100.0	100.0
Missing	System	2	40.0		
Total		5	100.0		

Managing_class

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	2	40.0	100.0	100.0
Missing	System	3	60.0		
Total		5	100.0		

Increasing_throuput

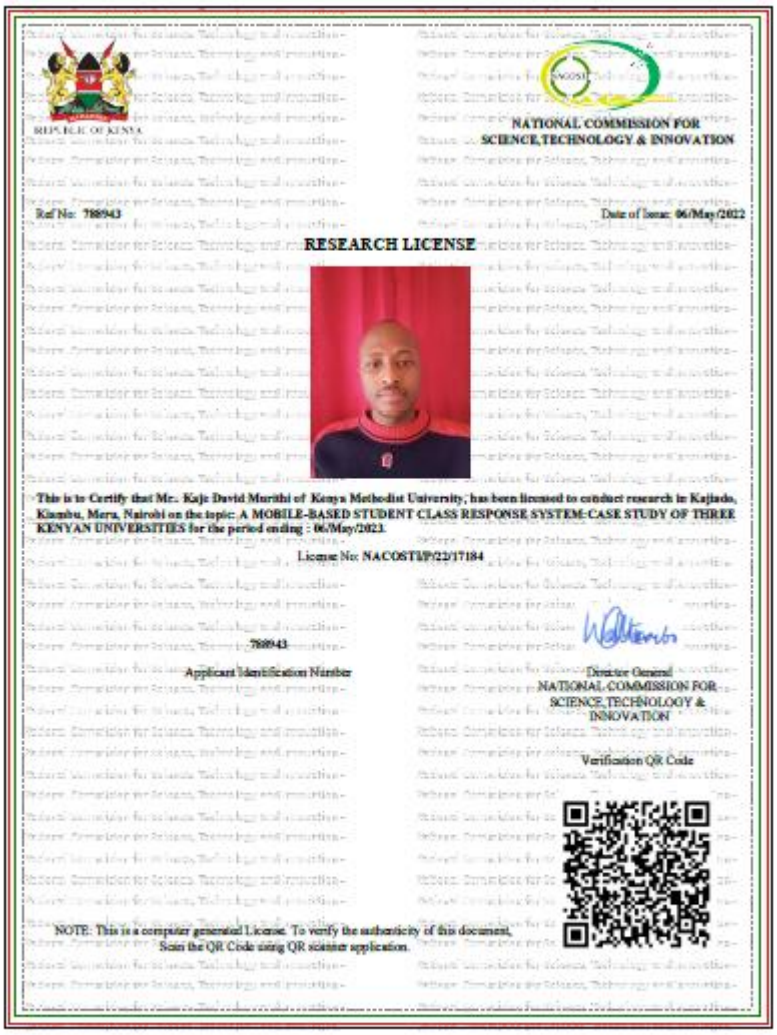
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	4	80.0	100.0	100.0
Missing	System	1	20.0		
Total		5	100.0		

assesment_feedback

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	1	20.0	100.0	100.0
Missing	System	4	80.0		
Total		5	100.0		

Appendix 4 SPSS Pilot study for Lecturers Frequency tables

Appendix 5 NACOSTI Permit



REPUBLIC OF KENYA

NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Ref No: 788943

Date of Issue: 06/May/2022

RESEARCH LICENSE

This is to Certify that Mr.. Kaje David Murithi of Kenya Methodist University, has been licensed to conduct research in Kajiado, Kiambu, Meru, Nairobi on the topic: A MOBILE-BASED STUDENT CLASS RESPONSE SYSTEM:CASE STUDY OF THREE KENYAN UNIVERSITIES for the period ending : 06/May/2023.

License No: NACOSTI/P/22/17184

788943

Applicant Identification Number

Director General
NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY & INNOVATION

Verification QR Code

NOTE: This is a computer generated License. To verify the authenticity of this document, Scan the QR Code using QR scanner application.

Appendix 6 Questionnaires

Appendix 6.8.1 Students Questionnaire

A MOBILE-BASED STUDENT CLASS RESPONSE SYSTEM: CASE STUDY OF THREE KENYAN UNIVERSITIES STUDENTS' QUESTIONNAIRE

Please tick here to indicate your informed consent to participate in this study ☐

Name of institution: _____

Course name: _____

Unit name: _____

Gender: **Male** ☐

Female ☐

Part A: Attitude towards Usage of Mobile Learning in Classrooms

		strongly agree	agree	uncertain/ not applicable	disagree	strongly disagree
1.	I have a sufficient extent of self-confidence to make decision to adopt m-learning	☐	☐	☐	☐	☐
2.	I would have more opportunities to create knowledge in my coursework with a mobile device	☐	☐	☐	☐	☐
3.	I am confident about using a mobile device for my courses	☐	☐	☐	☐	☐
4.	I would be comfortable to use a mobile device in my courses	☐	☐	☐	☐	☐
5.	I would be able to control the pace of learning in my classes with a mobile device	☐	☐	☐	☐	☐
6.	I have a sufficient extent of knowledge to use m-learning	☐	☐	☐	☐	☐
7.	Using m-learning in my coursework is a wise idea	☐	☐	☐	☐	☐
8.	I believe that mobile devices would be useful for my learning	☐	☐	☐	☐	☐
9.	Using m-learning in my coursework would be a pleasant experience.	☐	☐	☐	☐	☐
10.	I believe that using mobile devices would allow me get my work done more quickly.	☐	☐	☐	☐	☐
11.	I believe that using mobile devices would improve my ability to learn.	☐	☐	☐	☐	☐

12.	I believe that mobile devices would be easy to operate	☐	☐	☐	☐	☐
13.	I believe that mobile devices would be easy to use	☐	☐	☐	☐	☐
14.	I believe it would be easy to access course material with my mobile device	☐	☐	☐	☐	☐

Part B: Subjective Norms for Mobile Phone Usage in Classroom

		strongly agree	agree	uncertain/ not applicable	disagree	strongly disagree
1.	I think other students in my classes would be willing to adapt a mobile device for learning	☐	☐	☐	☐	☐
2.	Most people who are important to me would be in favour of using a mobile device for university courses	☐	☐	☐	☐	☐

Part C: Perceived Behavioral Controls for Mobile Phone Usage in Classroom

		strongly agree	agree	uncertain/ not applicable	disagree	strongly disagree
1.	I intend to adopt a mobile device for teaching	☐	☐	☐	☐	☐
2.	I have a sufficient extent of control to make decision to adopt m-learning	☐	☐	☐	☐	☐
3.	I plan to participate in m-learning if introduced	☐	☐	☐	☐	☐
4.	I predict I would use a mobile device for my courses	☐	☐	☐	☐	☐
5.	I plan to use a mobile device if a course has mobile learning functions	☐	☐	☐	☐	☐
6.	I would be able to actively share coursework material with a mobile device	☐	☐	☐	☐	☐

D. Requirements for a students' response system

The requirements in this section are divided into four Main Categories I.e. Pedagogical requirements, social cultural requirements, economic requirements and Technical requirements

i) Pedagogical requirements

		Very Important	Important	Somehow Important	Not very Important	Not Important at all
1.	Content Quality should be valid trustworthy and accurate	☐	☐	☐	☐	☐
2.	Should motivate the learner to actively participate in class	☐	☐	☐	☐	☐
3.	Content delivery should be simple, modular and flexible	☐	☐	☐	☐	☐
4.	Should be easy to navigate	☐	☐	☐	☐	☐
5.	Should have intuitive, logical and appropriate structure for the learners	☐	☐	☐	☐	☐
6.	There should be few navigation levels in order the learner not to be lost.	☐	☐	☐	☐	☐
7.	Should allow feedback to the learner at the right quantity at the right moment	☐	☐	☐	☐	☐
8.	Content Quality should be valid trustworthy and accurate	☐	☐	☐	☐	☐
9.	Should motivate the learner to actively participate in class	☐	☐	☐	☐	☐
10.	Content delivery should be simple, modular and flexible	☐	☐	☐	☐	☐
11.	Should be easy to navigate	☐	☐	☐	☐	☐

ii) Social-Cultural requirements

	strongly agree	agree	uncertain/ not applicable	disagree	strongly disagree
1. Should not discriminate with respect to age, gender or health issues and should support tolerance and learning.	☐	☐	☐	☐	☐
2. Should promote and support the learner in active classroom participation	☐	☐	☐	☐	☐
3. Should enhance the learner's self-efficacy, self-esteem, confidence, and commitment hence motivating the learner	☐	☐	☐	☐	☐
4. There should be no secret monitoring and recording of the learner's transactions without the learner's knowledge.	☐	☐	☐	☐	☐
5. The privacy and intellectual property of the learner should be assured in a way that no one without proper authorization will have access to his information	☐	☐	☐	☐	☐

iii) Economical requirements

	strongly agree	agree	uncertain/ not applicable	disagree	strongly disagree
1. Should achieve the intended results and benefits at the lowest possible cost	☐	☐	☐	☐	☐
2. Should be various types of Contracts, Service Level Agreement or Licenses to choose from. For example, a diversification may be respect to the number of participants, the content quantity, the features, etc. Important parameters to consider are their flexibility, duration, visibility, awareness and discounts	☐	☐	☐	☐	☐

iv) Technical and Functional requirements

		strongly agree	agree	uncertain/ not applicable	disagree	strongly disagree
1.	The interface should be visually appealing and pleasant	☐	☐	☐	☐	☐
2.	The interface should have a clear design.	☐	☐	☐	☐	☐
3.	The interface should be user-friendly	☐	☐	☐	☐	☐
4.	The interface should be easy to navigate through the objects of the website	☐	☐	☐	☐	☐
5.	Should be simple and convenient to operate	☐	☐	☐	☐	☐
6.	It should neither distract nor cognitively overload the learner. Rather, it should attract the learner's attention and focus.	☐	☐	☐	☐	☐
7.	Should be simple and intuitive to use. Its design should be aesthetically attractive, pleasant and fun to use	☐	☐	☐	☐	☐
8.	Should be easy, simple and intuitive to navigate. They should be accurate and consistent.	☐	☐	☐	☐	☐
9.	Should provide useful, appropriate and meaningful means to increase the user productivity.	☐	☐	☐	☐	☐
10.	Should be as usable as possibly by as many people as possible regardless of age, ability or situation.	☐	☐	☐	☐	☐
11.	Should support persons with special needs (e.g. screen magnification/ zooming)	☐	☐	☐	☐	☐

	strongly agree	agree	uncertain/ not applicable	disagree	strongly disagree
12. Should offer various forms and tools to support the user.	☐	☐	☐	☐	☐
13. The search module should provide complete, accurate and relevant results	☐	☐	☐	☐	☐
14. Should be tailored to the individual user such that a user may have various levels of control over it for personalization purposes.	☐	☐	☐	☐	☐
15. Functions should be useful and suitable for the educational objectives, the learner and the situation	☐	☐	☐	☐	☐
16. Should always be available when needed and should survive at most extreme situations keeping on its integrity.	☐	☐	☐	☐	☐
17. Should be easy and fast to install at any appropriate device or system.	☐	☐	☐	☐	☐
18. Should need minimal effort and time to maintain its efficient operation.	☐	☐	☐	☐	☐
19. Its response should be fast and appropriate meaning that the user shouldn't experience any delays	☐	☐	☐	☐	☐
20. Should be easy to increase the number of supported learners, data, mobility patterns, areas, and services.	☐	☐	☐	☐	☐
21. Should incorporate current, updated security technologies	☐	☐	☐	☐	☐
22. Should support multiple levels of security for different users and resources	☐	☐	☐	☐	☐

Staff Questionnaire

A MOBILE BASED STUDENT CLASS RESPONSE SYSTEM: A CASE OF KENYAN UNIVERSITIES DEANS, CODS'S AND LECTURERS' QUESTIONNAIRE

Please tick here to indicate your informed consent to participate in this study ☐

Name of institution: _____

Unit name: _____

Part A: Attitude towards Usage of Mobile Learning in Classrooms

		strongly agree	agree	uncertain/ not applicable	disagree	strongly disagree
1.	I have a sufficient extent of self-confidence to make decision to adopt m-learning	☐	☐	☐	☐	☐
2.	I would have more opportunities to create knowledge in my units with a mobile device	☐	☐	☐	☐	☐
3.	I am confident about using a mobile device for teaching	☐	☐	☐	☐	☐
4.	I would be comfortable to use a mobile device in my courses	☐	☐	☐	☐	☐
5.	I would be able to control the pace of learners in my classes with a mobile device	☐	☐	☐	☐	☐
6.	I have a sufficient extent of knowledge to use m-learning	☐	☐	☐	☐	☐
7.	Using m-learning in classroom for teaching purposes is a wise idea	☐	☐	☐	☐	☐
8.	I believe that mobile devices would be useful for my teaching	☐	☐	☐	☐	☐
9.	Using m-learning in teaching would be a pleasant experience.	☐	☐	☐	☐	☐
10.	I believe that using mobile devices would allow me get my work done more quickly.	☐	☐	☐	☐	☐
11.	I believe that using mobile devices would improve my ability to teach.	☐	☐	☐	☐	☐

12.	I believe that mobile devices would be easy to operate	☐	☐	☐	☐	☐
13.	I believe it would be easy to access course material with my mobile device	☐	☐	☐	☐	☐

Part B: Subjective Norms for Mobile Phone Usage in Classroom

		strongly agree	agree	uncertain/ not applicable	disagree	strongly disagree
1.	I think other lecturers in my university would be willing to adapt a mobile device for learning	☐	☐	☐	☐	☐
2.	Most people who are important to me would be in favour of using a mobile device for university courses	☐	☐	☐	☐	☐
3.	I think my students would be in favour of utilizing m-learning in their course work	☐	☐	☐	☐	☐
4.	Most people who are important to me think it would be easy to use mobile device for university courses	☐	☐	☐	☐	☐

Part C: Perceived Behavioral Controls for Mobile Phone Usage in Classroom

		strongly agree	agree	uncertain/ not applicable	disagree	strongly disagree
1.	I intend to adopt a mobile device for teaching	☐	☐	☐	☐	☐
2.	I have a sufficient extent of control to make decision to adopt m-learning	☐	☐	☐	☐	☐
3.	I plan to participate in m-learning if introduced	☐	☐	☐	☐	☐
4.	I predict I would use a mobile device for my courses	☐	☐	☐	☐	☐
5.	I plan to use a mobile device if a course has mobile learning functions	☐	☐	☐	☐	☐
6.	I would be able to actively share coursework material with a mobile device	☐	☐	☐	☐	☐

D. Requirements for a students' response system

The requirements in this section are divided into four Main Categories I.e. Pedagogical requirements, social cultural requirements, economic requirements and Technical requirements

i) Pedagogical requirements

	Very Important	Important	Somehow Important	Not very Important	Not Important at all
1. Content Quality should be valid trustworthy and accurate	☐	☐	☐	☐	☐
2. Should motivate the learner to actively participate in class	☐	☐	☐	☐	☐
3. Content delivery should be simple, modular and flexible	☐	☐	☐	☐	☐
4. Should be easy to navigate	☐	☐	☐	☐	☐
5. Should have intuitive, logical and appropriate structure for the learners	☐	☐	☐	☐	☐
6. There should be few navigation levels in order the learner not to be lost.	☐	☐	☐	☐	☐
7. Should allow feedback to the learner at the right quantity at the right moment	☐	☐	☐	☐	☐
8. Content Quality should be valid trustworthy and accurate	☐	☐	☐	☐	☐
9. Should motivate the learner to actively participate in class	☐	☐	☐	☐	☐
10. Content delivery should be simple, modular and flexible	☐	☐	☐	☐	☐
11. Should be easy to navigate	☐	☐	☐	☐	☐

ii) Social-Cultural requirements

		strongly agree	agree	uncertain/ not applicable	disagree	strongly disagree
1.	Should not discriminate with respect to age, gender or health issues and should support tolerance and learning.	☐	☐	☐	☐	☐
2.	Should promote and support the learner in active classroom participation	☐	☐	☐	☐	☐
3.	Should enhance the learner's self-efficacy, self-esteem, confidence, and commitment hence motivating the learner	☐	☐	☐	☐	☐
4.	There should be no secret monitoring and recording of the learner's transactions without the learner's knowledge.	☐	☐	☐	☐	☐
5.	The privacy and intellectual property of the learner should be assured in a way that no one without proper authorization will have access to his information	☐	☐	☐	☐	☐

iii) Economical requirements

		strongly agree	agree	uncertain/ not applicable	disagree	strongly disagree
1.	Should achieve the intended results and benefits at the lowest possible cost	☐	☐	☐	☐	☐
2.	Should be various types of Contracts, Service Level Agreement or Licenses to choose from. For example, a diversification may be respect to the number of participants, the content quantity, the features, etc. Important parameters to consider are their flexibility, duration, visibility, awareness and discounts	☐	☐	☐	☐	☐

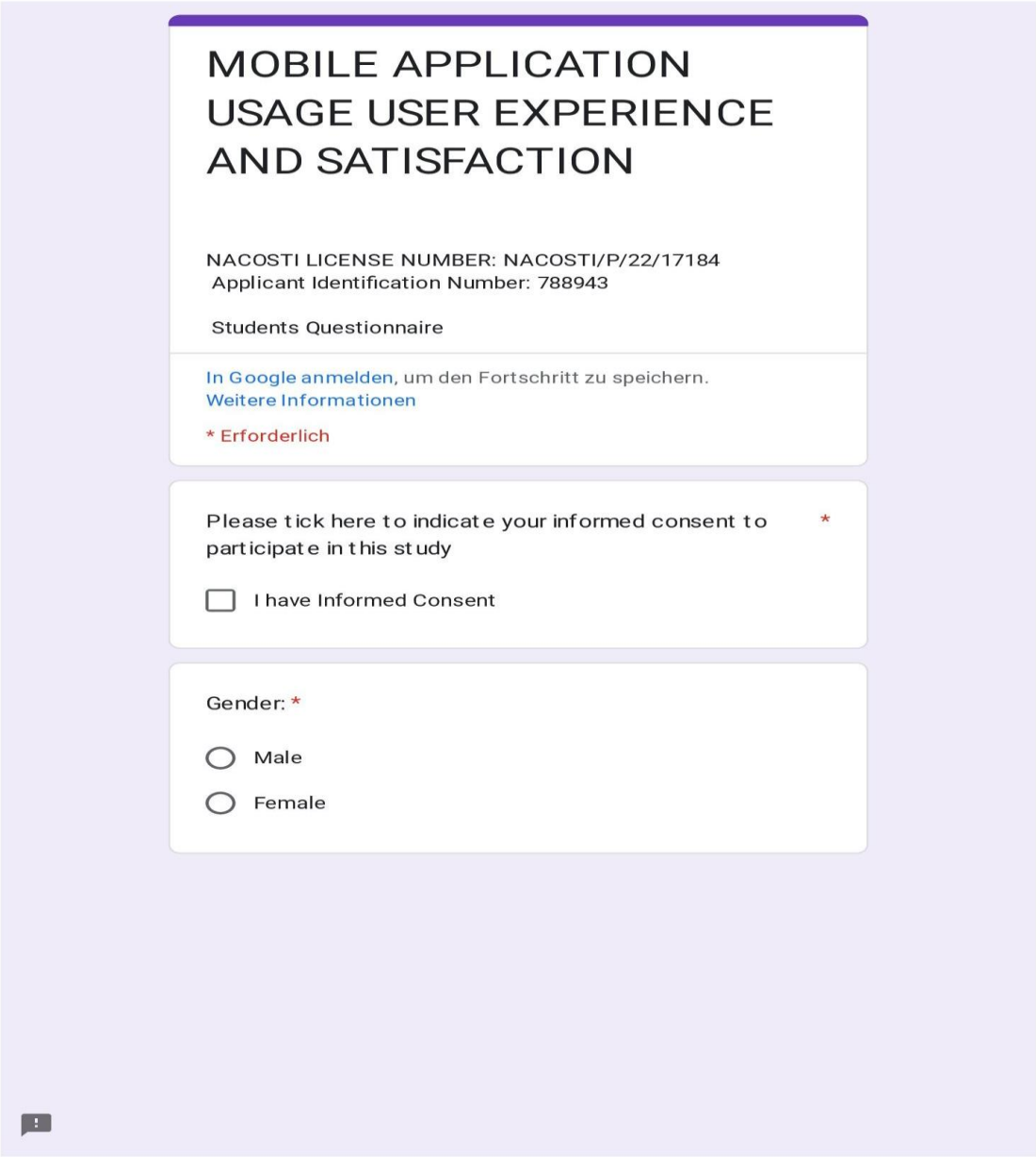
iv) Technical requirements and Functional Requirements

		strongly agree	agree	uncertain/ not applicable	disagree	strongly disagree
1.	The interface should be visually appealing and pleasant	☐	☐	☐	☐	☐
2.	The interface should have a clear design.	☐	☐	☐	☐	☐
3.	The interface should be user-friendly	☐	☐	☐	☐	☐
4.	The interface should be easy to navigate through the objects of the website	☐	☐	☐	☐	☐
5.	Should be simple and convenient to operate	☐	☐	☐	☐	☐
6.	It should neither distract nor cognitively overload the learner. Rather, it should attract the learner's attention and focus.	☐	☐	☐	☐	☐
7.	Should be simple and intuitive to use. Its design should be aesthetically attractive, pleasant and fun to use	☐	☐	☐	☐	☐
8.	Should be easy, simple and intuitive to navigate. They should be accurate and consistent.	☐	☐	☐	☐	☐
9.	Should provide useful, appropriate and meaningful means to increase the user productivity.	☐	☐	☐	☐	☐
10.	Should be as usable as possibly by as many people as possible regardless of age, ability or situation.	☐	☐	☐	☐	☐
11.	Should support persons with special needs (e.g. screen magnification/ zooming)	☐	☐	☐	☐	☐

	strongly agree	agree	uncertain/ not applicable	disagree	strongly disagree
12. Should offer various forms and tools to support the user.	☐	☐	☐	☐	☐
13. The search module should provide complete, accurate and relevant results	☐	☐	☐	☐	☐
14. Should be tailored to the individual user such that a user may have various levels of control over it for personalization purposes.	☐	☐	☐	☐	☐
15. Functions should be useful and suitable for the educational objectives, the learner and the situation	☐	☐	☐	☐	☐
16. Should always be available when needed and should survive at most extreme situations keeping on its integrity.	☐	☐	☐	☐	☐
17. Should be easy and fast to install at any appropriate device or system.	☐	☐	☐	☐	☐
18. Should need minimal effort and time to maintain its efficient operation.	☐	☐	☐	☐	☐
19. Its response should be fast and appropriate meaning that the user shouldn't experience any delays	☐	☐	☐	☐	☐
20. Should be easy to increase the number of supported learners, data, mobility patterns, areas, and services.	☐	☐	☐	☐	☐
21. Should incorporate current, updated security technologies	☐	☐	☐	☐	☐
22. Should support multiple levels of security for different users and resources	☐	☐	☐	☐	☐

Appendix 7

Students M-Jishirikishe Evaluation Questionnaire



MOBILE APPLICATION USAGE USER EXPERIENCE AND SATISFACTION

NACOSTI LICENSE NUMBER: NACOSTI/P/22/17184
Applicant Identification Number: 788943

Students Questionnaire

In Google anmelden, um den Fortschritt zu speichern.
Weitere Informationen

* Erforderlich

Please tick here to indicate your informed consent to participate in this study *

☐ I have Informed Consent

Gender: *

○ Male

○ Female

Attitude and user Evaluation after Usage of Application *

	Strongly Agree	Agree	Uncertain/not applicable	Disagree	Stror Disag
I was comfortable using a mobile device in classroom	○	○	○	○	○
Using the mobile application in my classwork was a wise idea	○	○	○	○	○
The mobile application was useful for my learning	○	○	○	○	○
Using mobile application improved my ability to learn	○	○	○	○	○
The mobile application was easy to operate	○	○	○	○	○
I intend to use the application for my future classes	○	○	○	○	○
Usage of the mobile application helped me and my	○	○	○	○	○

classmates to effectively work as groups					
Usage of the mobile application in classroom was fun and interactive	○	○	○	○	○
I would encourage other institutions to adopt usage of the mobile application in class	○	○	○	○	○
Usage of the mobile application in classroom had positive benefits	○	○	○	○	○

*

	Strongly Agree	Agree	Uncertain/ Not Applicable	Disagree	St Dis
The interface of the mobile application had a clear design, and was visually appealing and pleasant	○	○	○	○	
The interface was user friendly by being easy to navigate through the objects of the application	○	○	○	○	
The mobile application was simple and convenient to operate	○	○	○	○	
The mobile applicationneither distracted nor cognitively overloaded the learner. Rather, it attracted the learner's attention and focus.	○	○	○	○	
The mobile application was simple and intuitive to use. Its design was aesthetically attractive, pleasant and fun to use	○	○	○	○	
The mobile application provided useful,	○	○	○	○	

appropriate and meaningful means to increase the user productivity.				
The mobile application offered various forms and tools to support the user.	○	○	○	○
The mobile application was tailored to the individual user	○	○	○	○
The mobile application was available and accessible when needed and should survive at most extreme situations keeping on its integrity.	○	○	○	○
The mobile application was easy and fast to install at any appropriate device or system.	○	○	○	○
The mobile application needed minimal effort and time to maintain its efficient operation.	○	○	○	○
The response time for the mobile application was fast and appropriate meaning that the	○	○	○	○

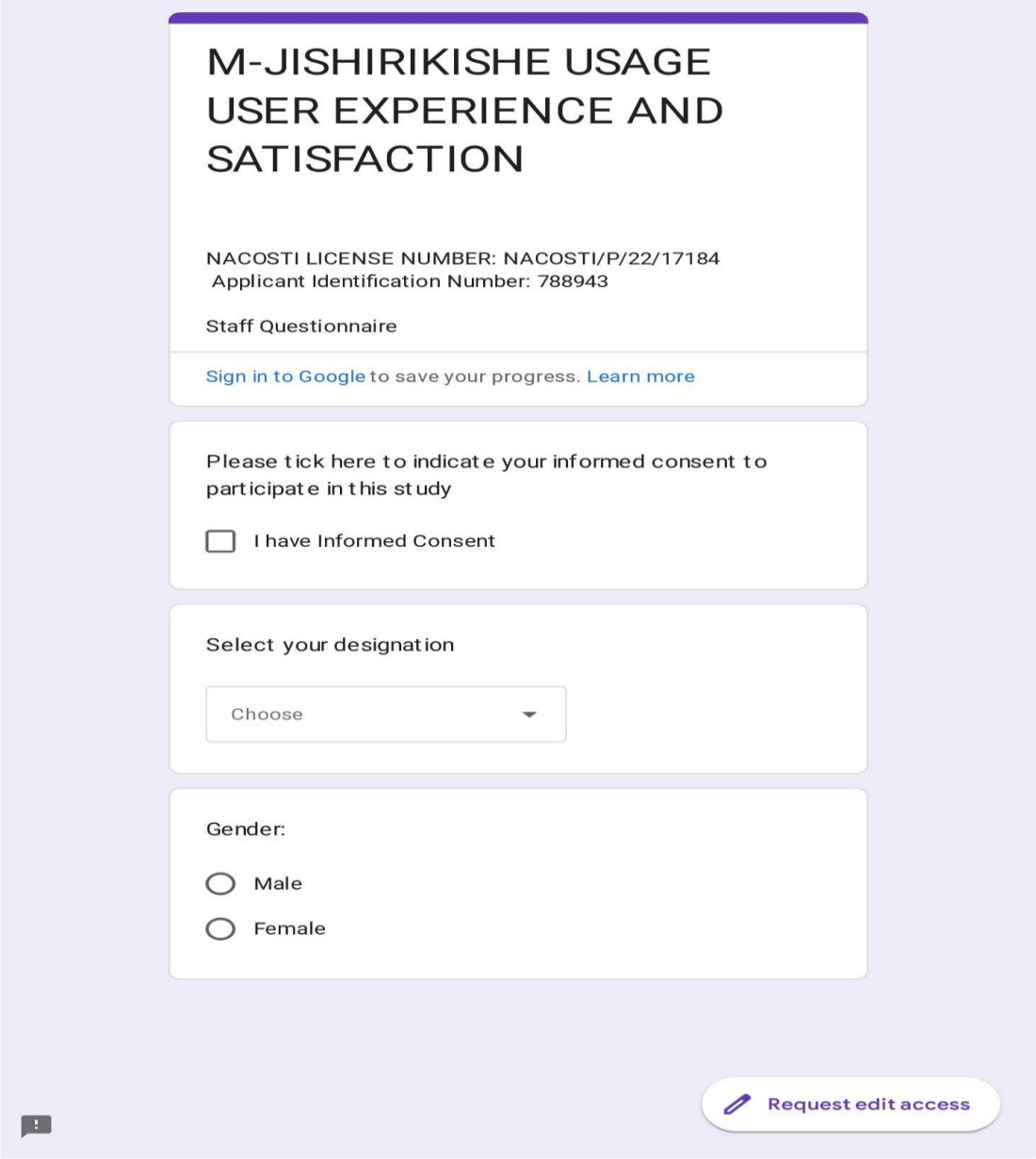
user didn't experience any delays				
The mobile application incorporated current, updated security technologies	○	○	○	○
The mobile application supported multiple levels of security for different users and resources	○	○	○	○
Content Quality was valid trustworthy and accurate	○	○	○	○
Using the mobile application for my learning helped me participate actively in class	○	○	○	○
Content delivery should was simple, modular and flexible	○	○	○	○
The interface of the mobile application was easy to navigate	○	○	○	○
The mobile application was intuitive, logical and appropriate structure for the learners	○	○	○	○
Using the mobile application for learning	○	○	○	○

Promoted and supported the learner in active classroom participation	
The mobile application Achieved the intended results and benefits at the lowest possible cost	○ ○ ○ ○

Senden

Alle Eingaben löschen

Staff M-Jishirikishe Evaluation Questionnaire



M-JISHIRIKISHE USAGE USER EXPERIENCE AND SATISFACTION

NACOSTI LICENSE NUMBER: NACOSTI/P/22/17184
Applicant Identification Number: 788943

Staff Questionnaire

Sign in to Google to save your progress. Learn more

Please tick here to indicate your informed consent to participate in this study

I have Informed Consent

Select your designation

Choose

Gender:

Male

Female

Request edit access

Attitude and user Evaluation after Usage of Application

	Strongly Agree	Agree	Uncertain/not applicable	Disagree	Stror Disag
I was comfortable using a mobile device in classroom	○	○	○	○	○
Using the mobile application in my class was a wise idea	○	○	○	○	○
The mobile application was useful for my teaching	○	○	○	○	○
Using mobile application improved my ability to teach	○	○	○	○	○
The mobile application was easy to operate	○	○	○	○	○
I intend to use the application for my future classes	○	○	○	○	○
Usage of the mobile application helped me and my students to	○	○	○	○	○

effectively work as groups					
Usage of the mobile application in classroom was fun and interactive	○	○	○	○	○
I would encourage other institutions to adopt usage of the mobile application in class	○	○	○	○	○
Usage of the mobile application in classroom had positive benefits	○	○	○	○	○

	Strongly Agree	Agree	Uncertain/ Not Applicable	Disagree	St Dis
The interface of the mobile application had a clear design, and was visually appealing and pleasant	○	○	○	○	
The interface was user friendly by being easy to navigate through the objects of the application	○	○	○	○	
The mobile application was simple and convenient to operate	○	○	○	○	
The mobile applicationneither distracted nor cognitively overloaded the learner. Rather, it attracted the learner's attention and focus.	○	○	○	○	
The mobile application was simple and intuitive to use. Its design was aesthetically attractive, pleasant and fun to use	○	○	○	○	
The mobile application provided useful, appropriate and	○	○	○	○	

meaningful means to increase the user productivity.				
The mobile application offered various forms and tools to support the user.	○	○	○	○
The mobile application was tailored to the individual user	○	○	○	○
The mobile application was available and accessible when needed and should survive at most extreme situations keeping on its integrity.	○	○	○	○
The mobile application was easy and fast to install at any appropriate device or system.	○	○	○	○
The mobile application needed minimal effort and time to maintain its efficient operation.	○	○	○	○
The response time for the mobile application was fast and appropriate meaning that the user didn't	○	○	○	○

experience any delays				
The mobile application incorporated current, updated security technologies	○	○	○	○
The mobile application supported multiple levels of security for different users and resources	○	○	○	○
Content Quality was valid trustworthy and accurate	○	○	○	○
Using the mobile application for my learning helped me participate actively in class	○	○	○	○
Content delivery should was simple, modular and flexible	○	○	○	○
The interface of the mobile application was easy to navigate	○	○	○	○
The mobile application was intuitive, logical and appropriate structure for the learners	○	○	○	○
Using the mobile application for learning Promoted and	○	○	○	○

supported the learner in active classroom participation				
The mobile application Achieved the intended results and benefits at the lowest possible cost	○	○	○	○

Submit

Clear form

This form was created inside Kenya Methodist University. Report Abuse

Google Forms

Request edit access