POLITEKNIK UNGKU OMAR

INNOVATION OF LAB WORK USING QR CODE FOR TEACHING AND LEARNING AT PUO

MUHD HAIKAL HAKIMI BIN DESA

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Report submitted in partial fulfilment of the requirement of the award of the Diploma of Civil Engineering Department

CIVIL ENGINEERING DEPARTMENT

SESSION 1 2023/2024

STATEMENT OF AUTHENTICITY AND PROPRIETARY RIGHTS

PROJECT TITLE:

INNOVATION OF LAB WORK USING QR CODE FOR TEACHING AND LEARNING AT PUO

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2. I acknowledge that the 'Above Project' and the intellectual property in it are the result of my original work/design without taking or copying any intellectual property from other parties.

3. I agree to release ownership of the intellectual property of 'the said Project' to 'the said Polytechnic' in order to fulfill the requirements for awarding me a Civil Engineering Diploma.

Made and truly acknowledge by the said;

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MUHD HAIKAL

HAKIMI BIN DESA

In front of me, DR. PANBARASI A/P GOVINDASAMY

(Identification:)

As Project Supervisor on the date: 11/12/2023)

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5. I acknowledge that the 'Above Project' and the intellectual property in it are the result of my original work/design without taking or copying any intellectual property from other parties.

6. I agree to release ownership of the intellectual property of 'the said Project' to 'the said Polytechnic' in order to fulfill the requirements for awarding me a Civil Engineering Diploma.

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8. I acknowledge that the 'Above Project' and the intellectual property in it are the result of my original work/design without taking or copying any intellectual property from other parties.

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In front of me, DR. PANBARASI A/P GOVINDASAMY

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As Project Supervisor on the date: 11/12/2023)

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DR. PANBARASI A/P GOVINDASAMY

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11. I acknowledge that the 'Above Project' and the intellectual property in it are the result of my original work/design without taking or copying any intellectual property from other parties.

12. I agree to release ownership of the intellectual property of 'the said Project' to 'the said Polytechnic' in order to fulfill the requirements for awarding me a Civil Engineering Diploma.

Made and truly acknowledge by the said;

(INTAN QUISTINA BT RAMLI)

(Identification : 030405-05-0020)

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INTAN QUISTINA BT RAMLI

In front of me, DR. PANBARASI A/P GOVINDASAMY

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As Project Supervisor on the date: 11/12/2023)

…….

DR. PANBARASI A/P GOVINDASAMY

APPRECIATION

First and foremost, we express gratitude to the Almighty for His abundant grace, enabling us to successfully compile the documents for the Final Year Project. We are appreciative that this proposal could be accomplished within the designated timeframe.

We would like to extend our thanks to Ungku Omar Polytechnic, particularly the Department of Civil Engineering, semester 5 students with the opportunity to apply the knowledge acquired during our time at Ungku Omar Polytechnic (PUO).

Furthermore, we acknowledge and appreciate the support of our project supervisor, Dr. Panbarasi A/P Govindasamy, who offered valuable advice and guidance in generating innovative ideas. Our heartfelt thanks also go to the lecturers of the Civil Engineering Department and those from other departments who have imparted knowledge to us, either directly or indirectly.

ABSTRAK

Kod Respons Pantas (QR) boleh mengembangkan pengalaman pembelajaran dan menyediakan tugasan tulen yang berlaku dalam tetapan dunia sebenar. Dengan kod QR yang dibenamkan dalam persekitaran, pelajar boleh mendapatkan maklumat kontekstual atau mengetahui lokasi. Kod QR juga boleh memperkayakan bahan berasaskan kertas supaya bahan tersebut memberi perkhidmatan kepada pelbagai jenis pelajar. Di samping itu, kod QR membenarkan pelaksanaan sistem berdasarkan paradigma seperti pembelajaran tepat pada masa dan kolaboratif Objektif produk ini adalah untuk memperkenalkan inovasi dalam bidang bantuan pendidikan, memanfaatkan teknologi termaju, terutamanya penggunaan QR. kod. Produk ini berfungsi sebagai alternatif untuk aktiviti pengajaran dan pembelajaran, melengkapkan kaedah tradisional dengan berkesan. Cabaran yang wujud ialah pelajar kontemporari mencari rujukan yang mudah diakses dan mudah, selalunya menggunakan cetakan helaian makmal sebagai bahan penting. Dengan inovasi ini, pelajar boleh menggunakannya dengan lancar, menyumbang kepada penjimatan tenaga dan mengurangkan kos yang berkaitan dengan mencetak helaian makmal. Selain itu, pendekatan inventif ini dapat membantu para pendidik, terutamanya semasa sesi pengajaran. Sebagai pengganti bahan pembelajaran konvensional, inovasi ini membantu para pendidik dalam menjelaskan prosedur eksperimen, penggunaan formula dan kaedah pengiraan. Pembangunan produk inovatif ini menggabungkan teori dan fakta praktikal, selaras dengan konseptualisasinya. Projek ini menggunakan Pakej Statistik untuk Sains Sosial (SPSS) dan Linktree untuk menganalisis data dan menangani cabaran yang dihadapi dalam 1 penggabungan kandungan ke dalam kod QR. Keputusan yang diperolehi daripada purata SPSS menunjukkan projek melebihi 0.001 kerana bukti analisis ini adalah berdasarkan nilai signifikannya bermula dari 0.001 hingga 0.005. Hasil yang telah diperolehi daripada pakar juga memberi lebih sokongan terhadap projek ini yang menggambarkan projek ini mudah digunakan oleh pensyarah dan pelajar. Secara ringkasnya, inovasi kod QR dalam konteks pengajaran dan pembelajaran ini menunjukkan keberkesanan yang ketara, sambil mengiktiraf bidang untuk diperhalusi dan potensi kemajuan dalam pengajaran dan pembelajaran Makmal Geoteknik di PUO.

ABSTRACT

Quick Response (QR) codes can expand the learning experience and provide authentic tasks that take place in real-world settings. With the QR code embedded in the environment, students can obtain contextual or location-aware information. QR codes can also enrich paper-based materials so that the material serves different types of learners. In addition, QR codes allow the implementation of systems based on paradigms such as just-in-time and collaborative learning The objective of this product is to introduce innovation in the realm of educational aids, leveraging cutting-edge technology, notably the use of QR codes. This product serves as an alternative for teaching and learning activities, complementing traditional methods effectively. The prevailing challenge is that contemporary students seek easily accessible and straightforward references, often resorting to printing lab sheets as essential materials. With this innovation, students can seamlessly utilize it, contributing to energy conservation and reducing the costs associated with printing lab sheets. Moreover, this inventive approach can aid educators, particularly during teaching sessions. As a substitute for conventional learning materials, this innovation assists educators in elucidating experimental procedures, formula utilization, and calculation methods. The development of this innovative product incorporates practical theories and facts, aligning with its conceptualization. The project uses Statistical Package for Social Sciences (SPSS) and Linktree to analyze data and address challenges encountered in 1 the incorporation of content into the QR code. The results obtained from the SPSS average shown that the project was more than 0.001 as the proof of this analysis is based on its significant value starting from 0.001 until 0.005. The result that had been obtained from the experts also give more support towards this project which describe that this project was easy to use for lecturers and students. In summary, the QR code innovation in this teaching and learning context demonstrates notable efficacy, while acknowledging areas for refinement and potential advancement in teaching and learning Geotechnical Laboratory at PUO.

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CHAPTER 1
INTRODUCTION

1.1 INTRODUCTION

There is a growing consensus that engineering education needs to change to meet the changing demands on the profession. Not only must engineering graduates be knowledgeable in traditional content areas and competent in applying standard problem-solving procedures, but they must also have passion, adaptability and an eagerness to learn. Successful graduates need to be innovators, effective collaborators in interdisciplinary and multicultural environments, excellent communicators, leaders, and lifelong learners. Engineering education is not alone in needing to rethink the educational strategies that best prepare students for success. Based upon research emerging from the learning sciences, Sawyer's description of a successful college graduate (in any field) has much in common with the National Science Board (NSB) report. Sawyer writes that to be successful in the knowledge age, graduates will need to develop a deep and integrated understanding of complex subjects; possess excellent communication skills; be able to participate in demanding discourse in multicultural environments; possess a capacity for lifelong learning; and most importantly, have the capability to work creatively with ideas to generate new theories, products and knowledge (Ellis, 2012).

Quick Response (QR) codes can expand the learning experience and provide authentic tasks that take place in real-world settings. With the QR code embedded in the environment, students can obtain contextual or location-aware information. QR codes can also enrich paper-based materials so that the material serves different types of learners. In addition, QR codes allow the implementation of systems based on paradigms such as just-in-time and collaborative learning (Jenni & Marja, 2014).

1.2 PROBLEM STATEMENT

Analysis of the surveys and interview transcripts showed that seven of the students interviewed believed that the problem-based environment helped them better understand course concepts relative to traditional laboratory instruction, whereas the same number found them to be equally effective (Domin, 2007).

In modern society, innovation technologies expand to almost every field of human activity, including such a wide field as education. Due to integrating innovation technologies into the educational process practice, this phenomenon gained special significance within improvement and modernization of the established educational system. Currently, the problem of active integration and wide application of innovation technologies in education is highly significant. Present study explores innovative technologies of learning in modern education (Stukalenko et.al, 2016).

QR codes are versatile. A piece of long multilingual text, a linked URL, an automated SMS message, a business card or just about any information can be embedded into the two-dimensional barcode. Coupled with moderate equipped mobile devices, QR Codes can connect the users to the information quickly and easily. The low technical barrier of creating and reading QR codes allows innovative educators to incorporate them into their educational endeavours. The operations to retrieve or store QR codes are incredibly simple and quick, and with mobile devices, make them the ideal educational tools for teaching and learning (Ching & Simon, 2010).

1.3 OBJECTIVE

The objectives of this study are:

1. To create lab work details using Qr Code.
2. To implement innovation in teaching and learning of lab work.
3. To get the verification from the experts on the impacts of the product.

1.4 SCOPE OF PROJECT

The scope of this project was specifically for the 4th semester students and lecturers of geotechnical subject only. The product that was used in this study is a video of how to conduct an experiment so that it can be used as a reference for students and lecturers at Ungku Omar Polytechnic (PUO). This product can be accessed via QR code more quickly and easily. There are 3 experiments that have been conducted, namely sieve analysis test, sand displacement test and compaction test. All these tests have been carried out and captured at the geotechnical laboratory of Ungku Omar Polytechnic (PUO). SSPS (Statistical Package for Social Science) is a software programme used by researchers in various disciplines for quantitative analysis of complex data. SPSS had been used for data analysis in this project. As the product was completed and tested, a questionnaire was distributed to the students. The feedback had been analyzed through SPSS. For the questionnaire, respondents were students from semester 3, 4, and 5. This product was verified by Puan Norasiah binti Ahmad from Geotechnical Engineering lecturers at Politeknik Ungku Omar (PUO).

CHAPTER 2
LITERATURE REVIEW

2.1 INTRODUCTION

The use of technology in education has become increasingly prevalent in recent years, with many educators exploring innovative ways to enhance student learning experiences and outcomes. In geotechnical engineering, laboratory work plays a crucial role in developing students' practical skills and understanding of theoretical concepts. However, traditional laboratory work can be time-consuming and may not always provide students with a comprehensive understanding of the subject matter. The use of QR codes in geotechnical engineering lab work is a relatively new and innovative approach that can provide students with additional resources and opportunities to engage with the material. This literature review aims to explore the effectiveness of using QR codes in geotechnical engineering lab work for teaching and learning. By synthesizing the existing literature on QR codes in geotechnical engineering lab work, this review aims to provide insights into the potential of QR codes as a tool for enhancing the teaching and learning of geotechnical engineering (Ellis, 2012).

QR codes are two-dimensional barcodes that can be scanned using a smartphone or tablet camera. They have become increasingly popular in recent years and have been used in various fields, including education. The use of QR codes in teaching and learning has been explored in several studies, with many researchers reporting positive outcomes. The purpose of this literature review is to examine the effectiveness of using QR codes for teaching and learning. Specifically, this review will focus on the impact of QR codes on student engagement and learning outcomes in various educational settings, including schools and higher education (Kim et.al, 2018).

2.2 GEOTECHNICAL LABORATORY

2.2.1 Sieve analysis test

Sieve analysis is a method that is used to determine the grain size distribution of soils that are greater than 0.075 mm in diameter. It is usually performed for sand and gravel but cannot be used as the sole method for determining the grain size distribution of finer soil. The sieves used in this method are made of woven wires with square openings The size of sediment particles can be measured by visual estimation or by use by a set of sieves. With experience, most geologists can visually measure grain size within accuracy of the Wentworth grade scale at least down to silt grade. Silt and clay can be differentiated by whether they are crunchy or plastic between one's teeth.

Claystones and siltstones are not amenable to size analysis from an optical microscope. Their particle size can be measured individually by electron microscope analysis. Boulder, cobbles, and gravel are best measured manually with a tape measure or ruler. Sands are most generally measured by sieving. The basic principle of this technique is as follows. A sand sample of known weight is passed through a set of sieves of known mesh sizes. The sieves are arranged in downward decreasing mesh diameters. The sieves are mechanically vibrated for a fixed period of time. The weight of sediment retained on each sieve is measured and converted into a percentage of the total sediment sample. This method is quick and sufficiently accurate for most purposes. Essentially it measures the maximum diameter of a sediment grain (Malewski, 2017).

2.2.2 Sand displacement test

Sand displacement tests are used to measure the in-situ density of natural or compacted soils using sand pouring cylinders. The in-situ density is typically used for highway or pavement design purposes to estimate the relative density of base course or subgrade materials. The test can be carried out using either a small or large sand pouring cylinder. Unless otherwise specified the large pouring cylinder method is ordinarily used. The tests are typically undertaken at ground level or the prepared formation level. In some

circumstances the test may be carried out in shallow trial pits or trenches excavated up to around 1m deep. If the side walls of the excavation are prevented from collapse either by digging a safe angle or by shoring with timber or support systems (Watanabe et.al, 2012).

2.2.3 Compaction test

Soil compaction is used to densify a soil by reducing the void space, or the amount of air, between soil particles. In other words, soil compaction occurs when soil particles are pressed together to reduce the space between them. The resulting highly compacted soils, with very few spaces, have a higher unit weight than non-compacted soils. Compaction decreases the likelihood of settlement after a building, roadway, runway or parking lot is constructed which could result in premature pavement failure, costly maintenance or repairs. Soil compaction is a crucial part of the construction process as it provides a strong working platform. A strong soil base is the foundation and all other parts of the project depend on its strength and performance, both during construction and once the pavement structure is in place (Mintek, 2020).

Soil compaction is necessary to increase the bearing capacity and stiffness of in-situ (natural state) or chemically modified soils. Compaction increases the shear strength of soils by adding friction from the interlocking of particles. Future settlement of soils is reduced by increasing the stiffness and eliminating voids creating a densified soil. The removal of voids reduces the chance of the soil settling or shrinking or expanding and it decreases water seepage that would lead to deleterious shrinking and swelling soil properties. Shrink / swell properties compromise the pavement structure thereby leading to premature failure of the pavement structure (Mintek, 2020).

2.3 TEACHING AND LEARNING

2.3.1 Effective teaching and learning with technology

Integration of Information, Communication, and Technology (ICT) will assist teachers with the global requirement to replace traditional teaching methods with technology-based teaching and learning tools and facilities. In Malaysia, ICT is considered as one of the main elements in transforming the country to the future development. The Ministry of Education, through the latest Education Blueprint (2013-2025), insights the importance of technology-based teaching and learning into the schools' national curriculum. Findings indicate that teachers' well-equipped preparation with ICT tools and facilities are one of the main factors in the success of technology-based teaching and learning. It was also found that professional development training programs for teachers also played a key role in enhancing students' quality learning (Aina & Kola, 2013).

2.3.2 Innovative modern techniques of teaching

Innovation theory in education is a new field of scientific pedagogic knowledge; it is a paradigm of inseparable unity and interconnection of the three main pedagogic processes in the field of education: creation of novelties, their mastering and application. In other words, the subject of innovation theory is the studies of integration of development, mastering and integration of novelties. Innovation theory in education is an innovative process in the educational system, innovative activity, novelty and innovative environment, in which the innovative processes take place. Innovative processes are considered in three main aspects – social-economical, psychological and organizational-regulatory. These aspects define the general climate and conditions, in which innovative processes take place and which either prevent or facilitate the innovative process. Moreover, the innovative process does not have a spontaneous nature, but rather it is consciously regulated. Integrating the novelties is a highly significant new function of management (Stukalenko et al, 2016).

2.3.3 Advantages of modern techniques experiment

In the new digital era, the teaching process is undertaking several important changes which have come to optimize it. The integration of the new technologies within the teaching process hints at promoting this century's requirements: achieving communication skills, developing creativity and stimulating intellectual curiosity, critical and systematic thinking, efficient management of information and media abilities, improving the capacity of interaction, identifying, composing and solving problems, increasing social responsibilities and the capacity of self-education and self-improvement. It is familiarized with a permanent need to discover ways of achieving progress at all the levels of our existence. As expected, evolution is based on an amount of knowledge that one should assimilate during school years, no matter the area of activity. Some of the advantages are class work can be scheduled around personal and professional work, reduces travel cost and time to and from school then learners may have the option to select learning materials that meets their level of knowledge and interest also self-paced learning modules allow learners to work at their own pace then increase up the flexibility to join discussions in the bulletin board threaded discussion areas at any hour, or visit with classmates and instructors remotely in chat rooms and also build up the different learning styles are addressed and facilitation of learning occurs through varied activities (Kapur & Radhika, 2019).

2.4 INNOVATION OF TEACHING AND LEARNING

2.4.1 QR code for education

QR codes are two-dimensional barcodes that can be easily scanned using a smartphone or tablet camera. The use of QR codes has become increasingly popular in education, providing quick and easy access to additional resources, information, and activities that can enhance student learning experiences. QR codes play a pivotal role in modern education by providing a streamlined and efficient means of accessing information. Their importance lies in the convenience they offer to students, teachers, and

administrators. By embedding QR codes in textbooks, worksheets, or educational materials, educators can create interactive learning experiences. Students can effortlessly scan these codes to access supplementary content, such as videos or quizzes, enriching their understanding of the subject matter.

Furthermore, QR codes contribute to sustainability efforts by reducing the reliance on printed materials, aligning with environmentally conscious practices. In the context of events and communication, QR codes simplify processes like participant registration and information dissemination. They also facilitate secure authentication, ensuring the integrity of processes like student identification. Overall, QR codes serve as a bridge between physical and digital spaces in education, fostering efficient communication, enhancing engagement, and promoting the seamless integration of technology into the learning environment.

Figure 2.1 Example of QR code

2.4.2 YouTube in Education

Although YouTube was created as a video-sharing service for the everyday user, the potential for educational use has not gone unnoticed. Over time, scores of colleges and universities have established a presence on YouTube by creating their own video-sharing web pages called YouTube channels. One of the obvious benefits of using YouTube in online education is that it provides online access to vast quantities of free public video on a broad spectrum of topics. It is a simple matter to link to or embed YouTube videos in online course content or discussion forums. Content management is also a benefit. Online educators can establish YouTube channels to collect, organize, host, and distribute video. YouTube videos may be grouped into one or more "Video Playlist Lessons," which are created by collecting videos into a playlist then typing a lesson plan into the playlist description area. Playlist lessons have been created to meet learning objectives across the cognitive, affective, or psychomotor learning domains in real-world online classrooms. Online educators may also create interactive video games, simulations, or tutorials by linking videos together through the Annotations tool on YouTube (Snelson, 2011).

2.5 SUMMARY

In today's higher education, the teaching and learning techniques provided by online learning platforms play a significant role. Numerous breakthroughs in teaching and learning methods have resulted from the digitalization of education. Education providers are producing and distributing content in a manner that reflects the natural ways that people choose to learn. As a result, learning has evolved into a much more captivating, and addictive experience. Lecturers change to become facilitators who guide students to the appropriate resources, respond to more difficult questions, and monitor their development.

Higher education online learning platforms and education providers can modernize their teaching and learning approaches with the support of wise technology use. To set up the infrastructure and tools to improve learning outcomes, one of the greatest strategies is to work in collaboration with an experienced digital technology.

CHAPTER 3
METHODOLOGY

3.1 INTRODUCTION

This chapter mentions each component involved in conducting this research from the population framework and sampling techniques. This chapter provides a detailed explanation of the selected analysis data and mode collection method.

3.2 RESEARCH FLOW

As shown in **figure 3.1**, the flowchart shows the work process that had been done for our project.

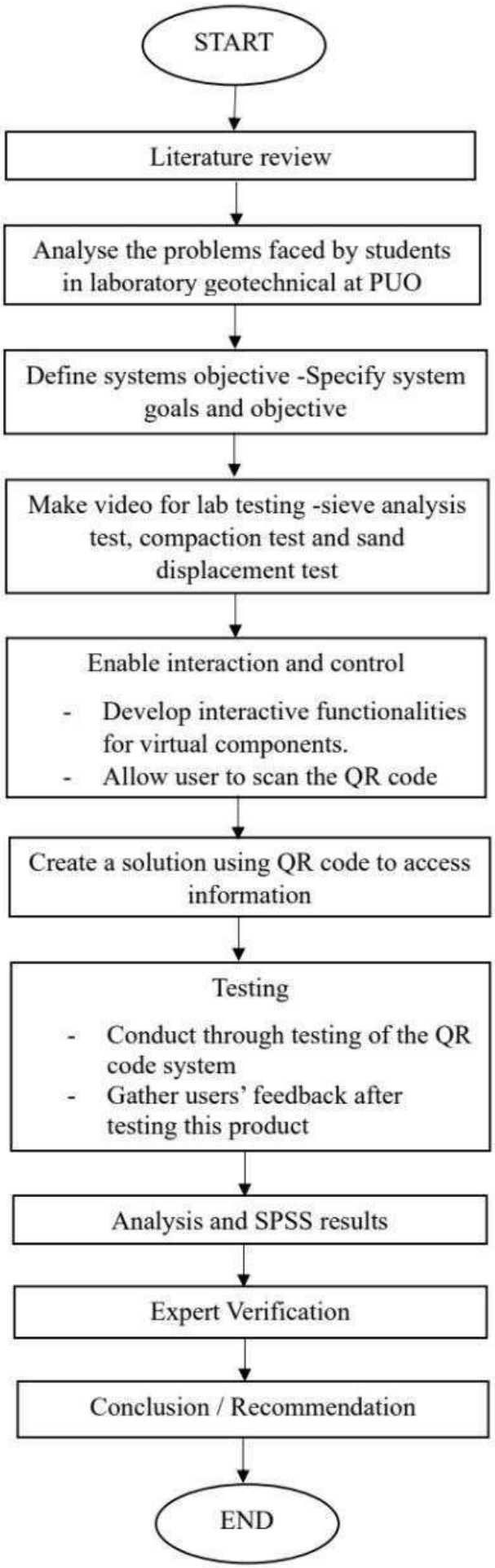

Figure 3.1 Flow Chart

3.3 PROJECT APPLICATION

3.3.1 YouTube Video

YouTube are online video repositories in which videos are made available. Users are able to download, view and share video clips on an extensive variety of content which includes film clips and instructional video. YouTube becomes social media when the videos are shared and comments and other forms of interaction occur on the site. Social media has been shown to be effective for learning and teaching. (DeWitt et.al, 2013)

Figure 3.2 YouTube application

All of the videos were taken at Geotechnical Engineering Lab, Politeknik Ungku Omar, Ipoh, Perak and uploaded in Youtube.

Figure 3.3 Sieve analysis

Date of Shoot : 7th September 2023

Time of shoot : 3.00 p.m.

Video Camera Used : Iphone 13 Pro Max

Figure 3.3 Sand Displacement

Date of Shoot : 14th September 2023

Time of Shoot : 3.10 p.m.

Video Camera Used : Iphone 12 Pro Max

Figure 3.4 Compaction

Date of Shoot : 22th September 2023

Time of Shoot : 2.00 p.m

Video Camera Used : Iphone 12 Pro Max

3.3.2 QR Code

QR code provides high data storage capacity, fast scanning, omnidirectional readability, and many other advantages including, error-correction (so that damaged code can also be read successfully) and different types of versions (Parabhoi et.al, 2017).

Nowadays, a QR code is applied in different application streams related to marketing, security, academics etc. and gain popularity at a really high pace. Day by day more people are getting aware of this technology and use it accordingly. The popularity of QR code grows rapidly with the growth of smartphone users and thus the

QR code is rapidly arriving at high levels of acceptance worldwide (Parabhoi et.al, 2017)

Figure 3.6 QR code application

3.3.3 Create Lab Work details using QR Code

In this context, the process or chronology in designing and developing our product which is QR Code is explained.

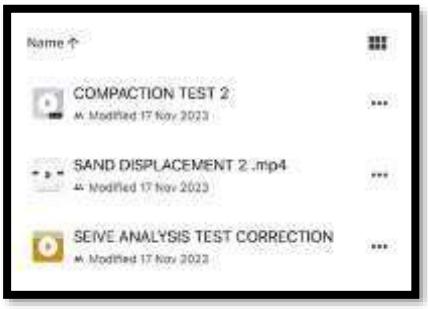

Figure 3.7 List of Lab work video records.

In figure 3.7, the video was recorded and performed by 3 experimental videos namely Sieve Analysis Test, Sand Displacement Method, and Compaction test.

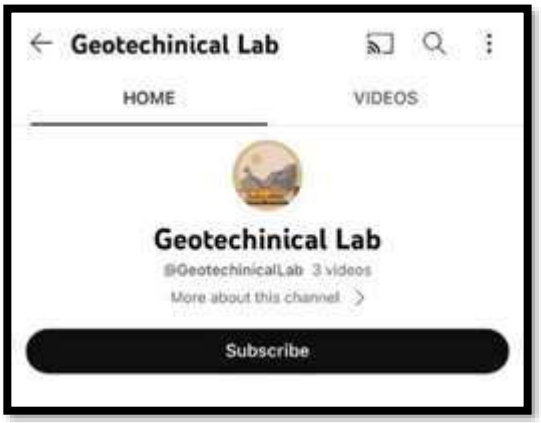

Figure 3.8 YouTube channel name

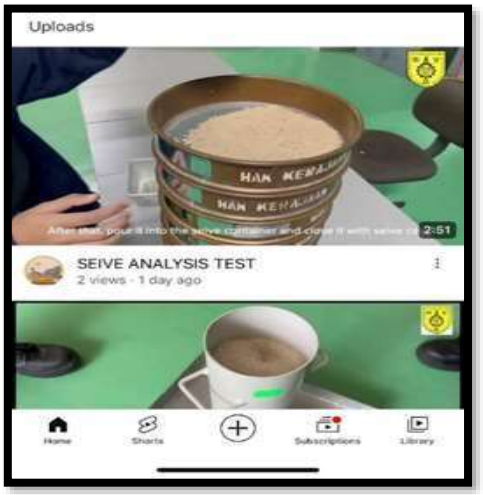

Figure 3.9 Videos uploaded in YouTube Channel

After the video recording is finished, the YouTube platform called Geotechnical Lab (Figure 3.8) was created to broadcast the videos that had been prepared for users (Figure 3.9)

Figure 4.0 Lab Sheets provide in Telegram

After that, as shown in figure 4.0 the telegram was used as a platform to put a Lab Sheet folder storage space for every experiment that had been recorded.

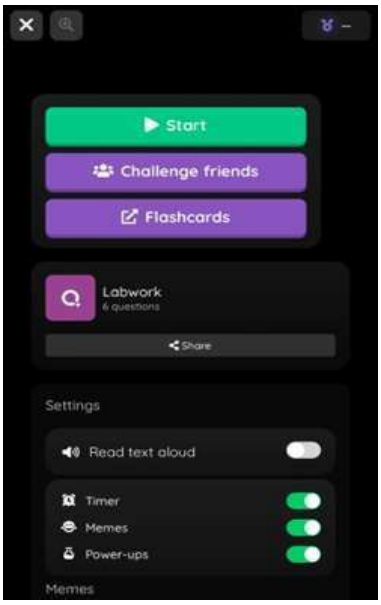

Figure 4.1 Quizzes on Quizizz software

Quizzes that had been also provided using the Quizizz application or website for students or users who will use it later.

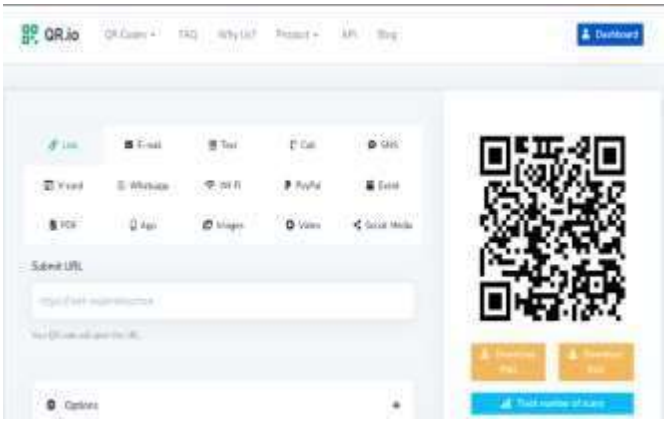

Figure 4.2 Contents in QR Code **Figure 4.3** Generate the QR code

After all of the content that has been prepared is complete, the QR Code was generated using the Linktree application and then inserted all the content that has been prepared into it.

3.3.4 Questionnaire

A questionnaire is a type of research tool used to gather data from respondents and consists of a series of questions or other prompts. Both qualitative and quantitative information can be gathered with a data collecting questionnaire.

The questionnaire for the product is an online survey, and has been delivered via Google Form to responders like lecturers in geotechnical engineering and fourth-semester students. The majority of the time and money spent using this strategy are efficient. Respondents can take their time when responding.

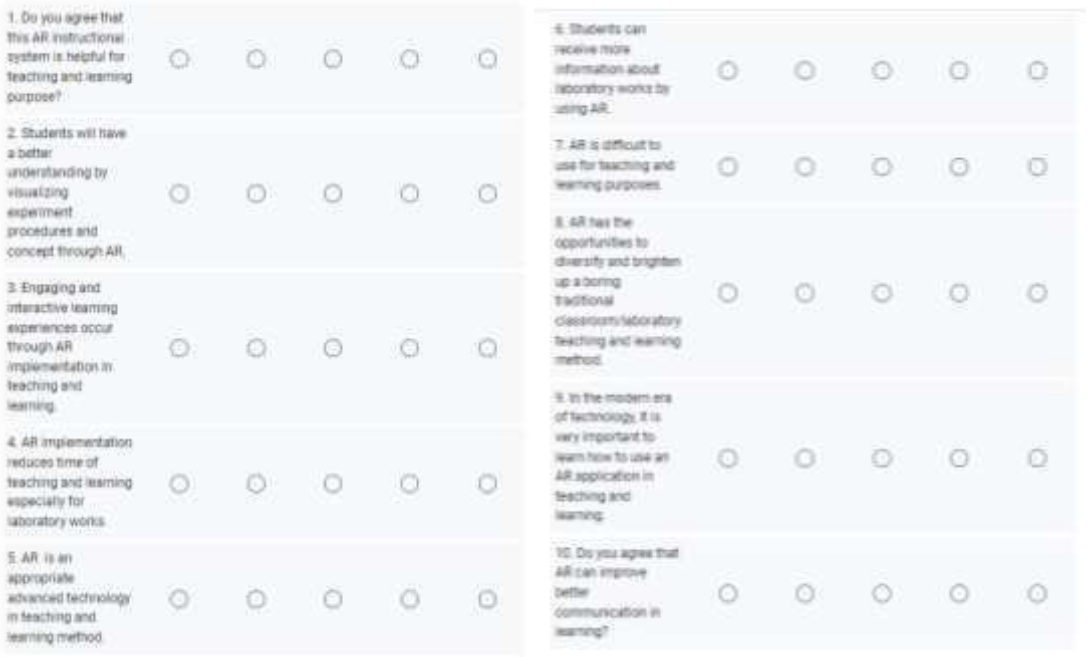

Figure 4.4 Questionnaire in Google Form

3.4 Gantt Chart

This is a gantt chart that shows the activities carried out throughout fyp 1 and fyp 2. During fyp 1, the title has been set which is labwork innovation using qr codes for teaching and learning at Puo. In addition, the introduction, literature and methodology have been done and the presentation of the defended proposal has also been carried out.

During fyp 2, several videos were recorded, namely sieve analysis test, sand displacement and compaction test. At this time, some questions related to the project were also distributed to Puo students. Finally, the final presentation with the industry panel was conducted for 1 day.

WEEK / ACTIVITY		W1	W2	W3	W4	W5	W6	W7	W8	W9	W10	W11	W12	W13	W14	W15
1	Student registration Final Year Project 1															
2	Project briefing form supervisor															
3	Identify the project title															
4	Determine the objective/scope of project															
5	Literature Review															
6	Designing the methodology of the project															
7	Preparation of slide for presentation															
8	Progress presentation															
9	Improvement in progress presentation															
10	Presentation Defend Proposal															
11	Correction and submission of the final project report															

Legend:

	Planning
	Actual

Figure 4.5 Gantt Chart FYP 1

WEEK / ACTIVITY		W1	W2	W3	W4	W5	W6	W7	W8	W9	W10	W11	W12	W13	W14	W15
1	Discuss and draft a storyboard															
2	FYP briefing and research references															
3	Record a video procedure of lab work															
4	Design an QR Code for geotechnical lab work															
5	Develop a method to obtain information via a QR Code															
6	Progress Presentation															
7	Improvement in progress presentation															
8	Distribute questionnaires to student and lecturer															
9	Analyze the significance using SPSS															
10	Preparation for the final presentation of the project															
11	Preparation for exhibitions															
12	Final project presentation															
13	Correction and submission of the final project report															

Legend

	Planning
	Actual

Figure 4.6 Gantt Chart FYP 2

3.5 SUMMARY

To summarize, this chapter discusses about the chronology and work process in completing the produced project. What can be summarized from this chapter is, the method used for the process of recording video and chronology to complete the planning and also what has happened in FYP 1 and FYP 2. Thus, what is described in this process is a form of support in terms of the analysis carried out using SPSS software. With the details that have been written in this chapter, it can also be described in more in-depth ways and about how this project came about. In addition, the projects carried out also get verification from experts and receive good feedback, and can also have a good impact on lecturers and especially on students.

CHAPTER 4

ANALYSIS DATA AND RESULT

4.0 INTRODUCTION

This chapter reviews the results and analysis of the data. After the compilation of the questionnaire and the results have been analyzed, this innovation is tested to show the impact on teaching and learning or not. The data analysis was performed based on the method that has been discussed in Chapter 3.

4.1 DATA ANALYSIS

4.1.1 Respon Rate

In this study, the questionnaire was distributed online through WhatsApp, Instagram and Telegram. Hence, the total response rate obtained is illustrated by the table 4.1 below.

Table 4.1: Overall Response Rate

Questionnaire (Google-form)	No. of respondent	Percentage (%)
Distributed	70	100
Returned (Valid)	70	100
Returned (In Valid)	0	0

Based on Table 4.1 above, the total number of distributed questionnaires were 70 which accumulated to 100% of the distributed questionnaire. In addition, out of 70 distributed questionnaire the researchers managed to collect back all the 70 completed questionnaire which accumulated to 100% of response.

4.2.1. Descriptive Frequency of Respondent

Based on table 4.2 and figure 4.1, The group of researchers identified that 45.7% of the respondent were male. The other 54.3% of the respondents were female.

Table 4.2: Frequency of Respondents Gender

Gender					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Female	32	45.7	45.7	45.7
	Male	38	54.3	54.3	100.0
	Total	70	100.0	100.0	

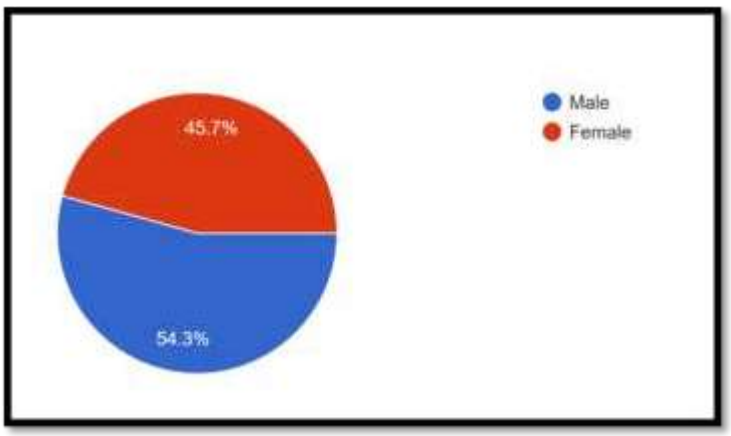

Figure 4.1: The results based on respondents gender at PUO

Based on table 4.3 and figure 4.2, The group of researchers identified that 82.9% of the respondents were in civil engineering. Majority of the respondents were from the same department.

Table 4.3: Frequency of Respondents Department

Department					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Civil Eng	58	82.9	82.9	82.9
	Electric	3	4.3	4.3	87.1
	Mechanic	9	12.9	12.9	100.0
	Total	70	100.0	100.0	

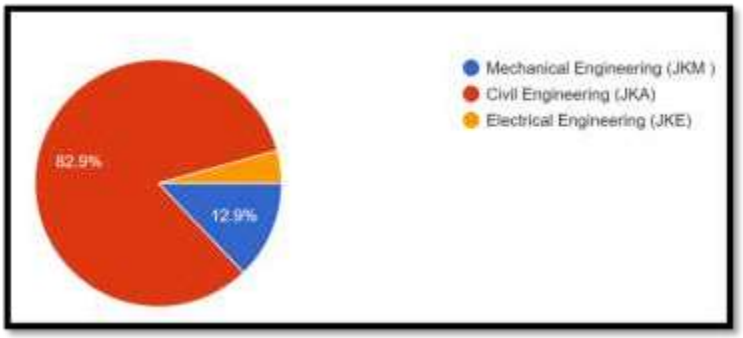

Figure 4.2 The results based on respondents department in PUO.

Referring to Table 4.4 and figure 4.3 majority of the respondent in Diploma level with 59 individuals with 84.3% of the distributed questionnaire.

Table 4.4: Frequency of Education Level

Education Level					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Bachelor	11	15.7	15.7	15.7
	Diploma	59	84.3	84.3	100.0
	Total	70	100.0	100.0	

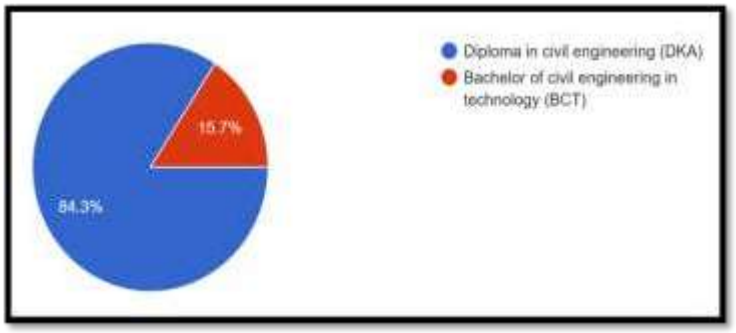

Figure 4.3 The results based on respondents education level in PUO.

Referring to table 4.5 and figure 4.4, majority of the respondent use smartphone for accessing educational application. Smartphone is the highest percentage which is recorded at 67.1% with 47 respondents.

Table 4.5: Frequency types of devices respondents

Type Of Device					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid		1	1.4	1.4	1.4
	Laptop	6	8.6	8.6	10.0
	Smartphone	47	67.1	67.1	77.1
	Tablet	16	22.9	22.9	100.0
	Total	70	100.0	100.0	

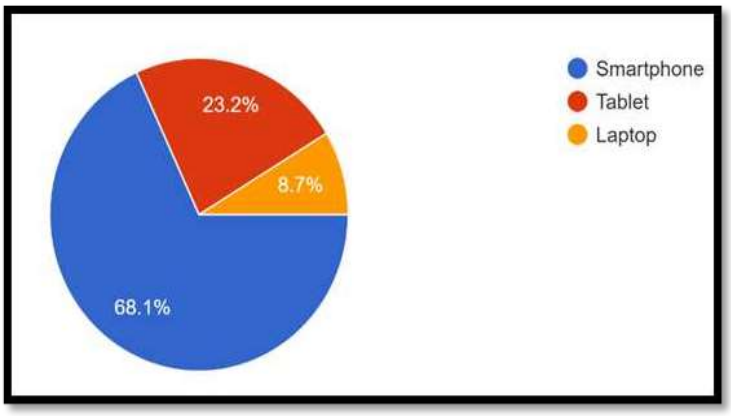

Figure 4.4 The results based on the type of devices that students use to access educational apps.

Based on Table 4.6, it can be seen clearly that most of the respondents in this survey were students which was recorded at 94.3% which converted into 66 respondents.

Table 4.6: Frequency of Position Respondents

Position					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid		1	1.4	1.4	1.4
	Lecturer	3	4.3	4.3	5.7
	Student	66	94.3	94.3	100.0
	Total	70	100.0	100.0	

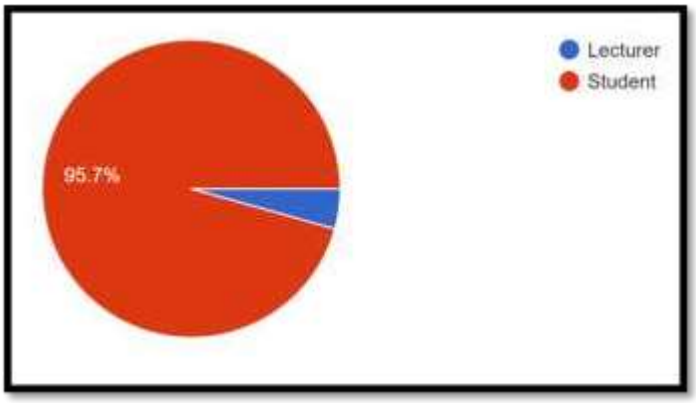

Figure 4.5 The results based on respondents' position in PUO.

Table 4.7 and figure 4.6, shows the semester of studies who were the respondents of this survey. The data clearly indicates that the majority of survey respondents came from semester 4 which is at 52.9% and followed with semester 5 which is at 34.3% and 12.9% of semester 3 respondents.

Table 4.7: Frequency of respondents semester

Semester					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Semester 3	9	12.9	12.9	12.9
	Semester 4	38	52.9	52.9	100.0
	Semester 5	24	34.3	34.3	43.0
	Total	70	100.0	100.0	

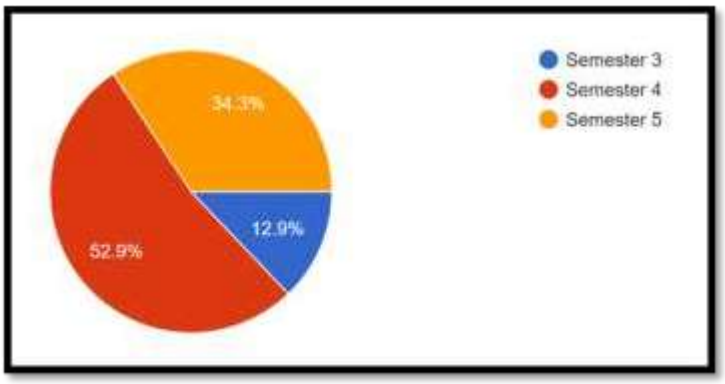

Figure 4.6 The results based on respondents' semester.

4.2 PARAMETER T-TEST

A parameter T-test was done with the 70 respondents who have submitted their response early in Google Form.

4.2.1 List of questionnaire question

Based on table 4.8 below, following are the questions contained in the questionnaire which was distributed to the students.

Table 4.8 Questionnaire question

No.	Questions
1.	Do you agree that this AR instructional system is helpful for teaching and learning purpose?
2.	Students will have a better understanding by visualizing experiment procedures and concept through AR.
3.	Engaging and interactive learning experiences occur through AR implementation in teaching and learning.
4.	AR implementation reduces time of teaching and learning especially for laboratory works.
5.	AR is an appropriate advanced technology in teaching and learning method.
6.	Students can receive more information about laboratory works by using AR.
7.	AR is difficult to use for teaching and learning purposes.
8.	AR has the opportunities to diversify and brighten up a boring traditional classroom/laboratory teaching and learning method.
9.	In the modern era of technology, it is very important to learn how to use an AR application in teaching and learning.
10.	Do you agree that AR can improve better communication in learning?

4.2.2 Analysis questionnaire using SPSS.

Based on table above, it shows that p-value is 0.002 for all the questions which is more than alpha value of > 0.001. It showed that innovation for teaching and learning using "QR Code" is significant.

Table 4.9 Significance value of responses

One-Sample Test						
	Test Value = 66.5					
	t	df	Significance		Mean Difference	95% Confidence Interval of the Difference
			One-Sided p	Two-Sided p		Lower
Q1	46.378	70	.002	.002	4.086	3.91
Q2	43.285	70	.002	.002	4.214	4.02
Q3	44.262	70	.002	.002	4.214	4.02
Q4	42.369	70	.002	.002	4.214	4.02
Q5	40.793	70	.002	.002	4.200	3.99
Q6	42.620	70	.002	.002	4.186	3.99
Q7	16.861	70	.002	.002	2.800	2.47
Q8	39.850	70	.002	.002	4.129	3.92
Q9	43.675	70	.002	.002	4.357	4.16
Q10	46.268	70	.002	.002	4.229	4.05

4.3 VERIFICATION FROM THE EXPERT LECTURER

Verifying innovation is crucial for ensuring its credibility and effectiveness. Expert lecturers play a vital role in this process by employing their specialized knowledge to assess and validate innovative ideas. Through a systematic approach, these experts evaluate the feasibility, functionality, and potential impact of innovations, providing valuable insights that contribute to the overall success and reliability of new concepts. Their rigorous analysis serves as a cornerstone for establishing trust in innovation within various fields.

Table 4.10 Comment from the expert lecturer

No.	NAME	COMMENT
1.	Pn. Norasiah Binti Ahmad	• QR Code can help lecturer in teaching and learning • Easy to use and user friendly

4.4 SUMMARY

To summarize, the analysis results from the SPSS software were found very significant because the value did not exceed 0.005. Moreover, analysing used the SPSS software has been found that this innovation is very useful in geotechnical laboratory at PUO for student and also lecturer. Besides of that, the distributed questionnaire has been completed by 70 respondents and all of them give a more valuable feedback. In addition, this innovation has also improved the way of teaching and learning to more efficiently compared to the traditional method.

CHAPTER 5

CONCLUSION AND RECOMMENDATION

5.1 CONCLUSION

The use of QR codes in laboratory work has proven to be a game changer in the field of teaching and learning. This technology has enabled a more engaging, efficient, and simplified laboratory experience, benefiting both educators and students. QR codes increase accessibility and engagement. Scanning QR codes with their mobile devices allows students to instantly obtain pertinent information, instructions, or supplemental materials. This immediate access to resources promotes a more dynamic and engaging learning environment, encouraging active engagement and deeper comprehension.

In conclusion, the use of QR codes in laboratory teaching and learning is a step forward towards a more efficient, engaging, and student-centered educational experience. As technology advances, incorporating innovations such as QR codes into the educational environment will surely contribute to the continuous improvement of teaching approaches and the general enhancement of the learning process.

5.2 RECOMMENDATION

5.2.1 Using QR Code to Track Attendance

Implementing QR codes to track attendance represents a forward-thinking innovation that can significantly enhance operational efficiency in various settings, such as events or educational institutions. This recommendation involves generating QR codes for students, streamlining the attendance process through quick and accurate digital scanning. The importance of this innovation lies in its ability to automate and modernize traditional attendance tracking methods. The automated nature of QR code scanning not only saves time for lecture but also reduces the likelihood of errors associated with manual data entry.

Students benefit from a more convenient and streamlined experience, as they can swiftly check in without the need for paper-based sign-in sheets. Moreover, the digital data collected can offer valuable insights for organizers, enabling them to make informed decisions based on real-time attendance information. Overall, the adoption of QR codes for attendance tracking aligns with contemporary technological trends, fostering efficiency, accuracy, and a more seamless experience for both organizers and participants.

5.2.2. Addition of standard operating procedure before, after and during experiment.

Incorporating standard operating procedures (SOPs) within the QR code innovation in engineering laboratories at Politeknik Ungku Omar (PUO) adds an extra layer of comprehensive benefits. Before an experiment, students could access pre-experiment SOPs by scanning the QR code, ensuring a thorough understanding of safety protocols and procedural guidelines. During the experiment, the QR code could provide real-time access to relevant SOPs, offering immediate guidance on equipment usage, safety measures, and data recording.

After the experiment, the same QR code could link to post-experiment SOPs, aiding students in proper equipment shutdown, cleanup procedures, and documentation practices. This integration not only enhances the efficiency of lab work but also promotes a culture of safety and adherence to standardized procedures. Instructors benefit from a standardized approach to experiment protocols, reducing the likelihood of errors or oversights. Overall, embedding SOPs within the QR code innovation ensures that students have access to crucial information at every stage of the experiment, contributing to a safer, more structured, and educationally enriching laboratory experience across all engineering disciplines at PUO.

5.2.3 Introduce this innovation to all engineering laboratory at PUO.

Innovations practiced in teaching and learning sessions can provide variations in various forms of cognitive and intellectual understanding. This change can also further improve students' understanding, especially when doing any lab work considering that technology and innovation can now develop in line with current thinking. Innovative teaching methods are not just about using the most advanced technology in the classroom or keeping up with the latest educational trends, it is also about using new teaching strategies that are more student-focused. This innovation encourages students

to proactively participate and interact with their classmates and the teacher during the lesson. Students need to work more, but in a way that better meets their needs and can help them grow faster.

Unlike traditional teaching, which focuses primarily on how much knowledge you can convey to your students, innovative teaching methods dig deeper into what students actually take away from what you teach in lectures. Some of purpose in this innovations are increased equalization or expansion of the opportunity to obtain and enjoy education in accordance with the will, ability and potential possessed (towards a more democratic conception of education), able to develop all human potential, not only the intellectual aspect, but also encompass all aspects of his personality in a round way also for moving from an individualistic conception of education towards a more cooperative conception; from a wasteful conception to a conception of education that is more effective, efficient and relevant to the needs of development.

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APPENDIX

APPENDIX A Verification form

KEMENTERIAN PENGAJIAN TINGGI
POLITEKNIK UNGKU OMAR
Jalan Raja Musa Mahadi
31400 Ipoh
PERAK, MALAYSIA
Vis : Menjadi institusi TVET premier yang diterajui industri
Mis : Menghasilkan graduan yang holistik, kompetem dalam teknologi dan berdaya kebolehkerjaan
Slogan : dreamIEG@PUO

POLITEKNIK MALAYSIA
UNGKU OMAR
Tel : 05-545 7622, 05-545 7656
Faks : 05-547 1162
Laman Web : www.puo.edu.my
Facebook : POLITEKNIK UNGKU OMAR (PUO)

Department of Civil Engineering

Expert verification of the Innovation of Lab work Using QR Code For Teaching and Learning at PUO.

Introduction:

Augmented reality (AR) is a technology that can be used to create effective and engaging technological solutions and learning resources. AR in education allows students to be immersed in realistic experiences which make the learning process more active, effective and meaningful. Implementation of AR in education enables users to interact with virtual and real-time applications that explain and demonstrate concepts through multimedia, computer-based simulations, animations and statistical software.

Objective:

1. To create lab work details using Blippar application, scanning QR codes and mobile application.
2. To implement the innovation in teaching and learning of lab work.
3. To analyze the significance of the innovation using SPSS.

QR CODE

Verified by,

Name : NORAZIAH BINTI AHMAD

Comments : O.K. can help lecturer in teaching and learning process. Easy to use and user friendly

Date: 23/11/2023

Signature:

NORAZIAH BINTI AHMAD
Pensyarah
JABATAN KEJURUTERAAN AWAM
POLITEKNIK UNGKU OMAR
31400 IPOH PERAK