ERDeeds: A MOBILE APPLICATION TO LEARN THE ENTITY RELATIONSHIP DIAGRAM

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DECLARATION

"I declare that this project report title "ERDeeds: A Mobile Application to Learn The Entity Relationship Diagram (ERD) based on SK Form 4" is the result of my own research except as cited in the references"

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SUPERVISOR'S DECLARATION

"I hereby declare that I have read this project report and in my opinion this project report is sufficient in terms of scope and quality for the award of Bachelor of Software Engineering (Educational Software) with Honours"

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ABSTRACT

Entity Relationship Diagram (ERD) is the conceptual model of database design which serves as a visual starting point for database architecture. Database design represents structural diagrams of information systems. Thus, it needs to be constructed comprehensively. It was included in the ASK and SK curriculum which was introduced in 2017. Many students and even teachers are struggling in learning this topic as the content of this topic in form 3, form 4 and form 5 were using different notation. Hence, ERDeeds, a mobile application using the Project-Based Learning (PBL) and Computational Thinking (CT) approach, offers ERD problem solving efficiently. It aims to help teachers and students in learning ERD and understand ERD concept and development interactively anywhere at any time. Evolutionary prototyping methodology was adopted in developing this app. The evaluation of ERDeeds shows that an average score of 76% was given based on the analysis using System Usability Scale (SUS). Respondents found this application was easy to use for users. It was also found that this application was well integrated with various functions. The findings revealed that this mobile app can be improved by including more multimedia tools, questions, and activities. This application has a great potential to be used by anyone who intends to learn about ERD, as the concept remains the same at any level of study.

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CHAPTER 1

INTRODUCTION

1.1 Introduction

Malaysia aims to produce students who are equipped with knowledge and skills in science and technology as part of its efforts to attain a developed nation status. (Kaur, Gopinathan & Raman., 2020). The Ministry of Education (MOE) aims to improve the fundamental reform of Science, Technology, Engineering, and Mathematics (STEM) education to increase the enrolment of students in the STEM field (Ministry of Education Malaysia, 2013; Pau & Siti, 2018). The government has emphasised on the importance of science and technology since the 1970s. An enrolment policy of 60:40 (for upper secondary school students – Form 4 and Form

5) was developed in 1967 and implemented in 1970 to fulfil the future demand of a developing country (Edy, Ihsan, & Lilia, 2017). The purpose of education is to help the learner reach their own potential and it seems important to set goals to ensure achievement of the goals.

Recent initiatives in several countries, mainly driven by the United States and the UK, aim to foster computer science standards at schools and to formally educate their computer science teachers, demonstrating that computer science (CS) is increasingly accepted as a regular school subject (Hubwieser, et al, 2014). However, the implemented curriculum in computer science contains a variety of didactical concepts, goals, and learning contents, creating an inconsistent situation. (Elena, et al, 2015).

1.2 Background Studies

Asas Sains Komputer (ASK) or Basic of Computer Science has been introduced and rebranded in school by the new curriculum standard (KSSM) since 2017 and contains one of the important topics which is Entity Relationship Diagram, a data model that is used to represent all the relations between data elements. Entity relationship diagrams are commonly used for conceptual data modelling in database design (Ravi, Shikha, Rishabh, & Santwana, 2020). In model-based software engineering, conceptual models not only serve as a design blueprint of an information system, but furthermore may enable code generation (Brambilla, Cabot, & Wimmer, 2017). ASK's main objective is to polish and develop students with computational thinking knowledge and skills by teaching them this topic. However, since it is newly introduced, the difficulties learners experience in this class initiated the identification of several problems. This has caused students to rely on digital resources that are now available to support educational needs as a part of their learning process since they can hardly find books or resources on ERDs. An example of this is the educational mobile applications, which in recent years have been massively developed and have generated multiple downloads for students to use.

Today, database systems play a large part of our everyday lives especially with the importance of the growing concept of database and storing information and keeping the

information in a way secured in the database. A data model is used to represent all the relations between data elements. Database technology nowadays has transformed into the most popular technology area, which serves a better way on how data is managed in the organization worldwide. The rapid changes and the increased ways that data is managed creates an opportunity for database developers and companies to produce current technology related to databases (Nor Anisah, & Mageswary, 2020). Database technology makes a bigger move and transition from hierarchical databases to a network database and relational database technologies.

There are different kinds of data models: conceptual data models, logical data models, and physical data models, each with its own function. Data models are used to describe data and how it is kept in a database, as well as to establish the link between data pieces. The first data model will be the Conceptual Data Model which specifies what will be included in the system that typically, business stakeholders and data architects construct this model. The goal of developing a conceptual data model is to define entities, their attributes and their relationship which also includes the building of ERD. Next, the Logical Data Model describes how the system impartial of DBMS, should be implemented. The aim is to introduce a technical map of rules and data structures. Lastly, the Physical Data Model explains how the system will be developed utilising a certain DBMS system. It provides database abstraction and aids in schema generation. This is due to the abundance of macro provided by a Physical Data Model. By duplicating database column keys, constraints, indexes, triggers, and other RDBMS characteristics, the physical data model also aids in visualising database structure. The goal is to actually implement the database.

The importance of ERD in the system development has given opportunities for many people by using them as a step in their project. An ERD is intuitive and lets them contribute their business knowledge to the design. Thus, both business and technical people should be able to understand a logical data model, at least at a high level. The ERD provides a common language they can use to communicate about database design.

Krajcik and Shin in 2019 propose that the principles of Project-Based Learning (PBL) provide opportunities for students to participate in Computational Thinking (CT). PBL focuses on learning by doing active constructions using science ideas and practices where students can create computational models collaboratively through defining a phenomenon, and then, testing,

debugging, and refining their own scientific understandings about the relationships and processes of phenomena they notice in the world.

Mobile applications have been making everyone more convenient, especially for students. They can just easily search up any apps that include quick notes and past year exams of any subjects. Furthermore, learning your way through online has been easier as it did not require students to carry heavy bags filled with books. They can just simply carry a phone that can store more notes. Hence, it is important for students that were introduced with new subjects to be able to simply do their tasks using technology to achieve a lot of things in the future. Next, students can also be exposed to the basic concept of database development which is data modelling before developing a database, so students might have a great basis on data modelling concept, techniques and tools used (Nor Anisah, & Mageswary, 2020). It emphasizes the specific concepts that need to be adhered to in order to develop a database.

1.3 Problem Statement

Lau in 2019 mentioned that the Minister of Education revealed that there is a worrying downtrend of students taking up STEM subjects which has dropped from 48% in 2012 to 44% in 2017. Malaysian students are hesitant to learn STEM and this has caused a low uptake of STEM related courses at the tertiary level (Arrifin, et al., 2018). Students have low interest in undertaking this subject because the teaching method was simply too theoretical (Kaur, Gopinathan & Raman., 2020). At present, there is no current system that specifically focuses on teaching ERD, especially for form 4 students who are taking the subject Computer Science at their school.

Since the early of 2020, the world has been shocked with a virus that puts the whole world into a pandemic that forces most people to be working or studying from home, especially students. Malaysia was also included. The Covid-19 pandemic led to the emergence of new norms in human life, especially among students who were not allowed to come to school at all to reduce the risk of infection and the spreading of the virus (Siti, & Mardzelah, 2020). This has forced every school to accommodate an online teaching schedule that is as comprehensive

as their original face-to-face sessions (Dujaili, & Mohammed, 2020). Thus, Home-based teaching and learning (PdPR) was introduced when schools were ordered to close due to the Covid-19 pandemic. It involves teaching and learning methods beyond online learning platforms. This has caused the teachers to be more creative and flexible to come up with a variety of materials for the students' needs to catch up with their studies. With the problem of not having a face-to-face class between the teachers and the students, the students need sufficient material for them to fully understand about a topic.

Moreover, learning ERD is actually a new thing not only for the students but also for the teachers as it was first introduced in 2016 in Malaysian Curriculum for ASK. This would cause a lot more confusion that leads to distraction for students. They would need to catch up on a lot of things in order to pass this subject. The difficulties learners experience in this class initiated the identification of the problem. The main obstacles include understanding, interpreting and compiling ERD that needs to be implemented as database tables before the construction of Structured Query Language queries can commence (Smit & Botes., 2017). Thus, it is clear that the reduction in students selecting for STEM subjects at the upper secondary level has resulted in a decline in students enrolling in STEM courses at the university level, causing the demand for STEM graduates to outnumber the supply. Malaysia's ambitions to acquire developed-nation status may be hindered as a result of this.

1.4 Objectives

These are the objectives that will be achieved from the project:

1. To design an appropriate user interface of the prototype for the mobile apps to learn ERD
2. To develop a prototype for the mobile apps for people to learn ERD.
3. To evaluate the usability of the developed prototype.

1.5 Research Question

Q1: What is the suitable user interface design of the prototype for students to learn ERD?

Q2: What are the suitable tools for this project's prototype development?

Q3: How to evaluate the developed prototype?

1.6 Scope

The scope for this study is to focus on secondary school students especially form 4 students. The development will be running to solve the problem statement that was mentioned earlier. The content of the system would be based on chapter 2: Database from the Sains Komputer (SK) Form 4 textbook which includes a subtopic which is the Entity Relationship Diagram by using Project-Based Learning and Computational Thinking.

1.7 Project Significance

The significance of developing this project will benefit a lot of people especially form 4 students who are currently enrolled in Computer Science and will be completing their SPM Project which will account for 30% of their final grade. Firstly, students can use the mobile application to practice their knowledge in constructing ERD comprehensively in an interesting way. They can easily manage their time in solving the quizzes or watching the tutorial videos that were included in the app. The application can also be used for parents as a guidance for their children. As this subject is still new for both students and teachers.

1.8 Conclusion

This chapter will conclude the introduction for the ERDeeds application.The study is aimed at creating a mobile application for learning ERD. The application will help students understand ERD. It gives the assessment at the end of the lesson. Students can access the lesson at any time and from any location. The learners can change the topic of the application at any time. The application was created to assist teachers and students in learning entity relationship diagrams as a study tool.