

The Effectiveness of Learning Patterns in Preschool Using Augmented Reality Applications

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Abstract: *The issue of the use of gadgets and technology in the field of early childhood education is often a matter of debate among experts in this field. Students' achievement in the subject of Mathematics is actually closely related to students' mastery of learning Early Mathematics while in preschool. The study's main purpose was to develop a pattern learning module for Early Mathematics using Augmented Reality (AR). The methodology used is the TUP Bednarik Consumer Assessment Model. Overall, it was found that there was a gap in student mastery in the pattern title where students mastered the exercises in the form of simple pattern rules compared to incremental pattern rules.*

Keywords: Augmented Reality, patterns, Early Mathematics, TUP Bednarik, simple patterns, and increment patterns

1. Introduction

Memorized teaching techniques for Mathematics subjects need to be given a new lease of life by recognizing the abilities of students to be helped by teachers so that learning sessions become interesting and effective and students can apply Mathematics methods in their daily lives. The current technological boom is no longer undeniable and includes its impact on the world of education. The injection of technological elements and the use of the internet in education are among the things that are given attention (Naquiah Nahar, 2017). The use of technology can help to stimulate children to build their knowledge during the learning process.

In general, the development of Early Mathematics modules is mostly more focused on the elements of cultivating the interest of Early Mathematics in students and the numeracy problems that exist among students. However, the focus on the development of interactive modules and meeting the needs of students should also be taken into account. Therefore, Augmented Reality elements are included in the modules in this study. Accordingly, based on the above description the researcher has developed an Early Mathematics module based on the concept of reverse learning by integrating technological elements through the use of AR for students.

2. Literature Survey

This section describes the technology in 21st-century teaching and learning and is followed by a description of Augmented Reality (AR) along with the Bednarik TUP Model.

2.1 Model TUP Bednarik

TUP Bednarik Usability Model is used to obtain the effectiveness of the application to end-users. Therefore, all the selected theories are related and mutually supportive in the development of this module. Researchers perform effectiveness (experimental) evaluation and consumerism evaluation through the TUP Consumer Evaluation model

(Bednarik, 2014). This TUP model focuses more on aspects of the learning environment than the three main elements of technology, usability, and pedagogy. The usability aspect used by Bednarik focuses on the usability of learning software. In this study, researchers use an Augmented Reality application as learning software for EM-Flip module. As for the pedagogical aspect, Bednarik chose the theory of constructivism. This is because he focuses on a student-centered orientation. In this study, the pedagogical aspect used by the researcher is the aspect of learning activities in the module on the topic of patterns.

2.2 Augmented Reality (AR)

The application used in this study is Augmented Reality (AR). AR is a technology that combines two-dimensional and three-dimensional virtual objects into one real three-dimensional (3D) environment and then exhibits these virtual objects into the real world (Danakorn, Bilal & Noor Dayana, 2013). AR is the ability to replicate computer graphics into the real world (Billinghurst, 2002). This makes the lack of empty space available during the learning session into a meaningful educational experience for the student. AR technology is not only used in education but also in health, military, sports, and manufacturing that promote products. Researchers found that the Early Mathematics modules developed for use in preschool are more geared towards training using paper and pencil. There is no doubt that there are modules that combine the use of AR applications but they are more geared toward subjects such as Early Science and Literacy. The development of the Early Mathematics module combined with this AR application also takes into account some important theories that influence its development process. AR technology actually reduces the gap or barrier between the real world and what computers produce so that we can see, hear, and feel. Therefore, in Malaysia, in the process of achieving targets and guiding to master the skills in the LINUS program, the use of pictorial words is one of the most frequently used measures and it plays an important role in teaching students for LINUS mastery. Based on the Word Inductive Model, pictorial words are a key factor in achieving literacy skills as well as

aided by phonetic and structural properties which can improve students' input and output skills.

3. Problem Definition

The main issue that is given attention is the level of students' mastery of the topic of patterns in the subject of Early Mathematics. Patterns are one of the topics covered in the Early Mathematics curriculum. Among the past studies that have been conducted related to the title of a pattern is on the need for students to master the concept of pattern or pattern to enable them to develop this concept at a higher level (Perry, MacDonald, Amy, Gervasonni, Ann, 2015). A study conducted by Sharifah Norul Akmar and Nor Adlina (2014) has discussed the importance of pattern topics as a link to higher levels in Mathematics subjects such as multiplication, multiplication operations, and division. The researcher has stated five different dimensions and pattern arrangements based on the instrument adapted from the study by Gadzichowski (2012) which contains 25 items. The results of the study have found that students have difficulty in recognizing and connecting some specific pattern rules.

A new standard enacted by the National Council for Teachers of Mathematics (2000) in the United States has stated that students who master patterns will be more proficient in other skills involving objects, shapes, and numbers. Some opinions and views from researchers also emphasize matters related to the importance of teaching the topic of patterns. Among them, Economopolous (1998) argues that students are able to recognize the repetition, addition, or subtraction of an object through the topic of patterns. Papic (2007) states that the early development of algebraic thinking can be nurtured through the knowledge and skills of pattern recognition. In addition, there are also several factors that have caused difficulty in applying the title of this pattern to students as they learn in the classroom (Marina, Papic and Mulligan, 2015). According to the Ministry of Education Malaysia (2012), there are almost 54000 students who in year one are still unable to master numeracy skills such as not recognizing the concept of pre-numbers, basic operations, and so on. While there are more than 110, 000 students who are in year 4 still have not mastered the skills set by the ministry. It was found that previous studies have focused on the study of the effectiveness of specific topics as well as the importance of teaching pattern topics in schools. However, there are still gaps in the development of interactive modules, especially for pattern titles based on the content of the KPSK curriculum.

4. Research Methodology

To study the effectiveness of the study, the researchers used the Bednarik TUP Model which involved three groups of respondents, namely teachers, students, and parents. In the implementation stage, the modules are handed over to the respondents based on the needs of the study findings. The model involved unstructured questionnaires and questions were openly supplied to provide an opportunity for researchers to obtain information more comprehensively with 60 teacher respondents, 60 parent respondents, and 30 student respondents. Three types of instrument forms can be

used i.e. either questionnaires, open-ended questions, or optional answers. The checklist is divided into three parts, namely technology, usability, and pedagogy.

5. Result in Discussion and Conclusion

The assessment instrument uses the Bednarik TUP model (technological aspects, usability aspects, and pedagogical aspects). Findings from teachers through pedagogical aspects showed that six items of the questionnaire gave similar feedback and the use of modules was formulated as interesting, able to build students' ideas, involved two-way communication, and students were found to be more proficient in group activities 1.

While the findings from the parents through the aspects of technology and consumerism have found that AR applications attract students to explore the topic of patterns and interaction. However, there are constraints from parents when they have to provide two devices at the same time, namely one device to scan the QR code and use the second device for the AR application itself. Next are the findings from the students. The EM-Flip module provides two group activities, namely group activity 1 and group activity 2. In group activity 1, students are required to connect the pattern shapes that have been given. The findings showed a good percentage of scores for this activity where 72% of the students had mastered the simple pattern rule and 61% had mastered the addition pattern rule. In group activity 2, students are required to construct their own simple pattern and addition. Findings for this activity have shown that 66% of the students mastered the simple pattern activity. However, as many as 85% of students are and have not mastered the activity of building their own pattern of increase. Overall, it was found that the students were more proficient in the exercises in the form of simple pattern rules compared to the addition pattern rules.

In Group Activity 1, students are able to perform this activity correctly where the respondent is required to connect the given pattern. The resulting pattern shows a clear sequence of simple and incremental pattern rules. The results of the shape patch activity also give an idea of the students' level of understanding of the connection of this pattern. Furthermore, the findings of Group Activity 2 showed different results when students were required to produce their own simple patterns and additions from the beginning. The results of this group activity clearly show that students still have constraints in terms of object selection and arranging simple patterns and additions. This finding is quite interesting because this activity involves the level of creativity and group work of students individually and in groups.

As a contribution to the field of knowledge, especially educational pedagogy, this study was implemented by including elements of technology and student creativity through four main constructs of the module, namely content constructs, teaching strategies, student activities, and assessment. All four of these main constructs were developed taking into account the concept of reverse learning where the main focus is given to student-centered activities in the classroom. Teachers also have the

opportunity to evaluate activities that stimulate and encourage students' high-level thinking skills. Student-centered activities through appropriate teaching strategies should be a practice in the classroom especially introduced when students are in the early stages of schooling. This practice will become a habit for students as they move into a more formal learning environment and are easier to implement against them. It is a weakness in the learning session if many students focus too much on the teacher's instructions instead of learning independently and student-centered.

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Author Profile



Haliza Idris is Principal at Sekolah Tinta, Selangor, Malaysia. In addition: 1) has 18 years of experience in the educational field from the preschool level, primary, secondary and higher institution; 2) has presented papers in international conferences; 3) Actively involves in the educational audit such as SKiPS and Malaysian Qualification Audit

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