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Research Article

LEVEL OF INNOVATION DIFFUSION CHARACTERISTICS ON ORTHOGONAL PROJECTOR KIT (OPK) AS A TEACHING AID FOR PLANS AND ELEVATION TOPIC

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ABSTRACT

This study aims to identify level of innovation characteristics in Orthogonal Projector Kit (OPK) based on Diffusion of Innovations Theory by Rogers (2003). This study is a quantitative exploratory study that used questionnaire as an instrument. This study was conducted in two schools, which allocated in Bera, Pahang and Sungai Buloh, Selangor. A total of 100 Form Five students had participated in this study. The questionnaire was used to measure the characteristics' level of relative advantage, compatibility, complexity, trialability and observability. The data collected were analysed using descriptive statistics, where mean, percentage and standard deviation were used. Result of this study found that students showed a high level of adoption of innovation in using OPK in learning Plans and Elevation topic, which acquired high level of relative advantage, compatibility, trialability, and observability while very low level of complexity. The relative advantage recorded the highest level compared to other characteristics. Based on the findings, further study should be conducted by involving teachers as respondents to get different perspectives on OPK.

INTRODUCTION

Rapidly growth of technology becomes a challenge in education system. Thus, evolution of teaching and learning should be aligned with technology's growth to create effective and interactive learning environment in the classroom (Siti Nurhafizah, 2014). Teacher should be innovative in their teaching method in order to create dynamic classroom environment and encourage active learning among students.

The success of learning in the classroom depends on the interaction between teacher and student. However, interaction between teacher and student becomes limited when it involves abstract concepts which are difficult to describe verbally. Therefore, teaching aids are used as a tool that helps teacher to deliver information to student effectively (Boggan, Harper, & Whitmire, 2010). By using appropriate teaching aids, teaching and learning process becomes more effective through active involvement among students and exchange ideas between teacher and students. These can increase interaction between teacher and student, then it will lead to a conducive learning environment (Mohd Musa, 2011).

In this regard, the Malaysian Ministry of Education (MOE) formulated the Primary School Standard Curriculum and the Secondary School Standard Curriculum that encourage teachers use teaching aids and technologies in their teaching process (Malaysian Ministry of Education, 2011, 2016). The use of teaching aids is to make teaching and learning process more effective and easy to understand by students (Zainudin, Tengku Suhashila, Najib, & Hamdan, 2007)

Generally, there are two types of teaching aids namely electronic media and non-electronic media (Aryuziyanti, 2004). Electronic media consist of computer, television, radio, video, slide projectors and interactive CDs. Meanwhile, non-electronic media consist of books, magazines, modules, charts and model that being used in teaching and learning process.

Technology such as computers, slide projectors and interactive CDs are highly encourage to be used in today's teaching method. However, findings from previous studies show that these three teaching aids are rarely used by teachers in their teaching method (Abdul Rahim & Hayazi, 2010; Fadzli & Ranjit, 2010; Zainudin *et al*., 2007). Therefore teacher need to be sensitive to technology growth that related with education system so that they are not outdated and no longer use chalk

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and talk in their teaching method (Ismail, 2012). Teachers also should realize that use of teaching aid facilitates them convey knowledge so they not too verbalistic as well as prevent student from being passive in classroom (Zainudin *et al*., 2007).

BACKGROUND OF STUDY

The development of technology globally has given a challenge to the Malaysian education system. The government has taken various steps to integrate information communication and technology (ICT) in education system which covers aspect of infrastructure, knowledge and training for teachers. In Malaysia Education Blueprint 2013-2025 (MEB), there have 11 shifts highlighted by MOE to produce positive change in the education system (Malaysian Ministry of Education, 2013). Each shift is made to bring impact on at least one of five successful educational systems which are access, quality, equity, unity and efficiency. For the five successes of the educational system, quality is the main focus that is concerned with every shift.

Among the shifts stated in MEB 2013-2025 is to utilize ICT for improving the quality of learning in Malaysia. Through this seventh shift, MOE supplies students with various ICT facilities to gain access to more extensive, engaging and interactive learning content information. ICT facilities will also be part of the need for students at school, with no significant gap between urban schools and rural schools.

The use of ICT in teaching and learning has begun to be strengthened from one level to the better. This can be seen through the provision of ICT materials such as computers, projector LCDs, digital cameras and CD ROMs that are being effective teaching aids to teachers. However, study by Al-Muz-Zammil and Abd Muezzam Shah (2009) shows the use of ICT materials are still at low level among teachers.

Mathematics is a subject that must be studied by students in Malaysia as it is one of the important subjects in producing a workforce that capable to meet the need of progressive nation. Mathematics is also a driving force for various evolution in science and technology (Bahagian Pembangunan Kurikulum, 2012). In the Mathematics syllabus of Form Five, there is a topic of Plan and Elevation that students should learn (Bahagian Pembangunan Kurikulum, 2013). This topic is a continuation of geometric topics that students have learned from Form 1 to Form 4. In this topic, students learn the concept of orthogonal projection and elevation and how to draw a sketch for every desired angle.

According to Irfan Naufal and Hazman (2007), in order to master the Plan and Elevation topic, students need to master the spatial visualization capability which is the ability to manipulate the image of a given object by rotating the image mentally and then imaging the object configuration of the image manipulation. In order to help and improve the spatial visualization among students, teachers are advised to use teaching aids such as geometric blocks in their teaching method (Irfan Naufal & Hazman, 2007). In addition, there are some software such as GeoGebra (Khor & Ruzlan, 2016), Geometer's Sketchpad (GSP) (Azlina & Lok, 2010; Noraini, 2007), three-dimension (3D) multimedia (Abdul Rashid, 2008; Irfan Naufal & Hazman, 2007) and visual animation (Ahmad Rizal, 2009; Siti Suhaila, 2015) which has been used as a teaching aids in order to improve level of student's spatial visualization. However, all these teaching aids are software that installed on computer and it is not a material that can be held by students. Thus student learning is limited to the visuals only shown on the computer screen and does not exist in the physical form that students can hold. Therefore, Orthogonal Projector Kit (OPK) as in Figure 1 is seen as innovative teaching aids because it not only the display visual on the computer screen, but it is also a material that can be held by the students. This coincides with Innovation Diffusion Theory (Rogers, 2003) under the relative advantage characteristic that states an innovation should have a better feature or function than existing product.

The Innovation Diffusion Theory by Rogers (2003) is a well-known theory and is often used in the study of the process of acceptance on innovation. This theory discusses how innovation is adopted by individuals then to be accepted and practiced entirely by the community (Zakaria, 2014). According to Sahin (2006), this theory is the most appropriate theory to examine the acceptance of technology uses in education. Rogers (2003) outlines four main elements in Innovation Diffusion Theory which is innovation, communication channels, time and social system. He also introduced five characteristics that can be used to measure the level of acceptance of innovation, relative advantages, compatibility, complexity, trialability and observability. Individual perceptions of these characteristics can be used to predict the level of acceptance of innovation.

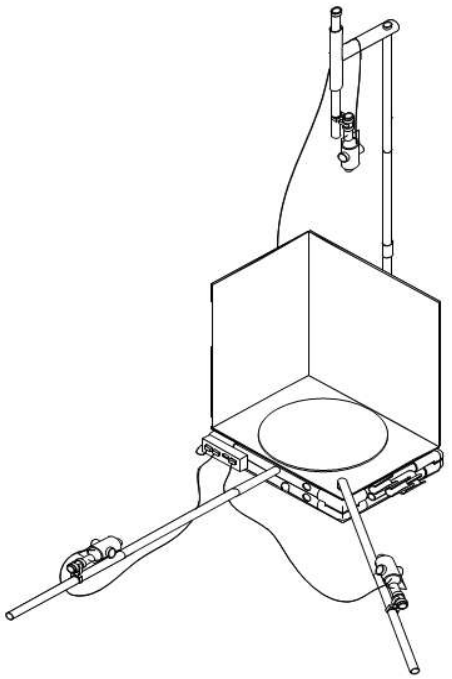

Figure 1 Orthogonal Projector

METHODOLOGY

This is a quantitative exploratory study that used questionnaire as a research instrument. Questionnaire was used to achieve the objective of study which was to identify the level of relative advantages, compatibility, complexity, triability and observability of the OPK. The questionnaire was modified

from Atkinson (2007), Ntemana and Olatokun (2012) questionnaires to be relevant to this study. The sample of this study consists of 100 Form Five students and they are giving ten minutes for answering the questionnaire. This questionnaire consists of 29 items and it has two parts. Part A contains respondents' demographic information which includes names, genders and ethnics. Part B contains 29 items represents the following innovation characteristics namely relative advantages, compatibility, complexity, trialability and observability. All items contains in Part B are closed questionnaire that using 5 point scale. The questionnaire uses Likert five point scale which is 1 'very disagree', 2 'disagree', 3 'uncertain', 4 'agree' and 5 'strongly agree'.

The questionnaire was given to three experts to measure the validity of the instrument. There are two mathematics teachers who have more than 10 years of experience and a mathematics tuition teacher who has 4 year of experience in teaching Plan and Elevation topic. According to Chua (2006), reliability values can be determine whether the measuring instrument used can provide accurate and consistent research findings. Therefore, the reliability of the questionnaire is tested through the implementation of pilot study as it can help the researcher to identify the feasibility of the study to be conducted. The result of pilot study shows that the Cronbach Alpha coefficient is 0.90 (> 0.71). This shows that the item for this questionnaire has a high level of reliability and this questionnaire can be used in actual study.

FINDINGS AND DISCUSSION

Respondents of this study consist of 55 female students and 45 male students. Majority of the respondents were Malays 98%, while there only 2% of India respondents. The relative advantage level for OPK is at a high level (M = 4.51, SD = 0.512). This indicates that students are more likely to use OPK than rather than using other teaching aids or traditional learning methods. This also proves that the students have fun, quicker and easier to learn Plan and Elevation topic by using OPK. Surry and Gustafson (1994) emphasize that the relative advantage characteristic is an important feature in the process of teaching preparation and it also essential for attracting the users when introducing an innovation.

The mean value of compatibility obtained for OPK is 4.25 (SD = 0.652) and it is at a high level. The value indicates that the students think that OP kit is appropriate for their learning in Plan and Elevation topic. The majority of respondents (59%) strongly agree that OP kit is suitable for use in learning Plan and Elevation topic. This coincides with the statement by Rogers (2003) that an innovation is said to be suitable for adoption when user feel that innovation meets their needs.

Complexity is a negative characteristic in Diffusion of Innovation theory, which the higher the level of complexity, it is more difficult for user to adopt the innovation. The mean value of complexity obtained for OPK is 1.93 (SD = 0.657) and it is at a very low level. This proves that students have no problem on using the OPK in their learning. The findings also show that respondents are to use OPK and computer at the same time. This is in line with findings of study by Rohani, Ahmad Shaharil and Abda Hamida (2015) that students are keen to use technology in their learning.

The analysis of trialability characteristic in OPK states that it at a high level and it shows a mean value of 4.01 (SD = 0.690). However, there are 3 items in the trialability construct that are at moderate level, which are 21st, 23rd and 24th item. This shows that there are still many students who are still unsure to explore the functions available on the OPK, they also not sure of the time required to try using the OPK and unable to correct the mistakes while using the OPK.

The mean value of observability obtained for OPK is 4.09 (SD = 0.640) and it shows that OPK has high level of observability characteristic. This proves that OPK can attract students to use it after they saw others are using it. Sonnenwald, Maglaughlin and Whitton (2001) state that observability characteristic also can be measures based on the extent on how much the user able to explain the effectiveness of the use of the innovation to others. The results of this study found that the ability of the students to tell their friends about the effectiveness of OPK is at a moderate level.

CONCLUSION

Overall, the OPK show a high level of innovation acceptance which is by obtaining a high level of relative advantage, compatability, trialability and observability as well as a very low level of complexity. This proves that students show a positive acceptance level towards the use of OPK and they are encouraged to use it in their learning of Plan and Elevation topic.

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