

The Effectiveness of Biology PTechLS Module in a Rural Secondary School in Malaysia

Norlidah Alias, Dorothy DeWitt, Saedah Siraj

Mohd Nazri Abdul Rahman, Rashidah Begum Gelamdin & Rose Annah Abd Rauf

Abstract— The PTechLS module combines learning styles with the use of technology to increase students' learning experience, especially in learning abstract concepts. The PTechLS module prototype was developed by Alias (2010). The aim of this study is to evaluate the effectiveness of the implementation of the Biology PTechLS module in a rural secondary school in Malaysia. The PTechLS module was implemented from year 2012 to year 2014. The study adopted the exploratory implementation design which incorporates a quasi-experimental research design. 37 students agreed to participate in this study. In addition, a retrospective usability evaluation of the implementation of the PTechLS module, with two Biology teachers as the users was conducted. The findings of this study showed that there were significant difference in the pre-test and post-test scores. This indicates that students' achievement score could improve after using the Biology PTechLS module. The interview with the teachers showed that the Biology PTechLS module could be used as a resource. In addition, further improvements of the PTechLS module were suggested. Hence, there is possibility that the Biology PtechLS Module could be used in other secondary schools in rural areas in Malaysia to improve students' achievement and interest in Biology.

Index Terms— Biology education, Exploratory implementation design, Learning Styles, Technology.

I. INTRODUCTION

The global learning landscape of the twenty-first century is being transformed and shaped by the uptake of digital communication tools and online-networked applications, along with the changing characteristics, needs, and demands of students. Learning is also shifting toward more self-directed, self-regulated learning, supported by the socially based tools and technologies of the Web 2.0 movement [14]. Teaching strategies that try to match learning

styles with a particular technology can enhance the learning experience of students [1][2][3].

Students receive and process information in different ways, which means that they have different learning styles or preferences [7]. In addition, identifying the unique learning styles of students is essential to ensure that students are engaged in learning [9][12][26]. Specifically, active-style learners prefer to be engaged in teamwork. Such learners learn new information well through actively discussing, applying, working together and explaining to other learners. On the other hand, reflective learners absorb the new information better by independent working, thinking of the question, quietly studying. Learners with sensing or intuitive learning styles perform better by leveraging learning materials with more examples than theories. Sensing-style learners understand better if the new information can be connected to their past concrete experiences and daily lives. It is hard for sensing-style learners to understand abstract concepts. On the other hand, intuitive-style learners have the ability to comprehend abstract materials and they are more creative than sensing-style learners. They dislike learning materials that give away too many details [24].

Therefore, this study found that when the instructions given by the teacher is in line with students' learning styles, student achievement will increase along with motivational and affective components [5][8][13][19]. Learning style is defined as how a student tries to concentrate, process and retain information during a learning process [6]

Past studies showed that matching specific topics in Physics to technology and learning styles can enhance students' grasp of a concept [10][18][22]. Physics pedagogical module (PTechLS) was developed by Alias [1] to enhance learning of abstract concepts in physics by matching learning styles with the right technology. This module is then carried out to 120 students in schools in urban areas in the Klang Valley [2] involving 30 students of every learning style (visual / verbal, active / reflective). The results of this study suggested that this module is effective for students of visual learning style, active, reflective but less suitable for verbal students. Researchers also compared the effectiveness of Physics module according to gender. The findings show that the Physics module is suitable for students with oral and reflective learning style is effective for female students, but less suitable for male students. This module is then extended and implemented in a rural school in Negeri Sembilan, a state in Malaysia.

This article will focus on the effectiveness of the Biology PtechLS module to improve student achievement in a Felda Learning Center in the Jempol district, Negeri Sembilan. The Biology PTechLS module has been implemented for two years from 2012 to 2014. In addition, the usability evaluation was also carried out involving two

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N. Alias is a senior lecturer at Faculty of Education, University of Malaya, Kuala Lumpur, Malaysia (e-mail: dnmorlidah@um.edu.my).

D. Dewitt is a senior lecturer at Faculty of Education, University of Malaya, Kuala Lumpur, Malaysia (e-mail: dorothy@um.edu.my).

S. Saedah is a Professor at Faculty of Education, University of Malaya, Kuala Lumpur, Malaysia (e-mail: saedah@um.edu.my).

M. N. Abdul Rahman is a senior lecturer at Faculty of Education, University of Malaya, Kuala Lumpur, Malaysia (eiy.nazri@gmail.com)

R. B. Gelamdin is a PhD student at Faculty of Education, University of Malaya, Kuala Lumpur, Malaysia (rashidahgelamdin68@yahoo.com)

R. A. Abdul Rauf is a senior lecturer at Faculty of Education, University of Malaya, Kuala Lumpur, Malaysia (rose_annah@um.edu.my)

Biology teachers who are involved in the implementation of the PTechLS module.

A study conducted by Rashid [17] found that the most dominant learning styles in the rural areas students is auditory, followed by kinesthetic and visual. The study also showed a significant relationship between rural students' learning styles and motivation. The findings of this study differ from Yahaya and Abdul Majid [25], which shows that the most dominant rural students' learning styles is visual. The study also found that there was a significant relationship between learning styles and achievement in rural areas students.

In addition, previous studies also showed that academic achievement was associated to students' learning styles. According to Wan Hamid [23], there are a variety of learning ways such as to understand, discuss, self-learning, group learning and so on. Each individual has their own learning style. Therefore, excellent students have their own effective learning styles.

Studies conducted by researchers within and outside the country similarly highlighted the effective use of technology to the learning styles to improve student achievement, particularly in rural areas. For example, a study by Mohamed, Mohamad Judi, Mohd Noor and Mohd Yusof [15], shows the level of ICT among rural students is low but the mastery of basic ICT skills is moderate. Thus, the efficiency of teachers to adapt the use of technology with students learning style could improve students' achievement.

However, the study by Lai [11] showed a lack of opportunities to use ICT becomes a barrier to access digital services among students in Malaysia, especially in rural areas. The findings show that students lack with digital skills due to the technology that is non user-friendly, less ICT training and social support services.

II. THE STUDY

The aim of this study was to evaluate the effectiveness and usability of Biology PTechLS Module to improve students' achievement in Felda Learning Center in Jempol District in Negeri Sembilan. This study aims to answer the following research questions:

- Do Biology PTechLS Module effective in improving achievement among Grade 10 students?
- What are the teacher's perspectives on usability of Biology PTechLS Module to Grade 10 students?

A. Scope and limitations

In this study, the samples were 37 students in rural secondary school in Negeri Sembilan. In this study only one topic in Biology has been designed in the Biology PTechLS module for Grade 10, entitled "Nutrition". This topic has been identified as a topic involving abstract concept which is difficult for students to understand. The scope is over two learning styles namely, active and reflective. This study is limited to only one rural school in a district in Negeri Sembilan and the findings can not be generalized to other schools in Malaysia.

III. METHODOLOGY

A. Method

Modules and instruments to measure the pre- and post-test have been developed by an expert in Biology education. Biology module comprises of learning activities which is supported by the linkage (WebQuest, Youtube) corresponding to the learning styles of the students. Post-test has been carried out to the top students a week after the treatment was given. Data were analyzed using SPSS and t-test was performed.

In addition, assessment on Biology PTechLS module from teachers retrospective was determined by interviewing both the teachers using semi structured interview protocol, two weeks after the implementation of the module. The interview was transcribed and cross- checked by both of the respondents.

B. Instrumentation

Instruments used include pre- and post-test, semi structured interview protocol to get feedback on the usability of the module. Pre and post test were designed to assess whether the objective of the production of the module is achieved.

IV. RESULTS AND DISCUSSION

T-test (one sample) was used to compare pre- and post-test scores of students who have used Biology PtechLS Module.

TABLE 1: T-TEST OF GRADE 10 STUDENTS BIOLOGY SCORE

Construct	Test	N	Mean	SD	t	Sig. value
Form Four Biology Students	Pre-test	37	40.76	16.49		
	Post-test	37	53.42	16.87	13.95	0.00

* Significant at $p < .05$

T-test (One Sample) was performed to compare Pre and Post Test scores after the implementation of Biology PTechLS module showed there are significant differences in the scores of the Pre test (Mean = 40.76; SD = 16.49) and post test (Mean = 53.42; SD = 16.87; $t(df) = 13.95, p < 0.05$). This indicates that the implementation Biology PtechLS module may have an impact of students' achievement.

A. Teachers Retrospective Evaluation of Biology PtechLS Module

The transcript of the interviews with two teachers after using the Biology PtechLS module was analysed based on emergent themes. The results indicate that the module provided an opportunity for students to master abstract biology concepts

and increase students' interest towards learning biology based on individual's learning style.

Caters to different types of learners

The two biology teachers were very satisfied with the implementation of the Biology PtechLS module because it provides the space and opportunity for students based on learning styles.

From the interview analysis, Teacher A explained:

"In my opinion, PtechLS module really helps students master the subject... because they can explore and learn from the information in the links provided. This means that students were given the opportunity to find, understand and correlate information obtained by using the module."

The module assists in the delivery of instruction for different types of learners. Teacher B states:

"Overall, PtechLS module helped me a lot in the process of delivering teaching, and particularly in addressing the problem of student diversity due to different learning styles. So the Biology PtechLS Module provides the opportunity for students to explore and learn on their own."

Mastering Abstract Biological Concepts

Students are able to master abstract concepts in biology after using the PtechLS module.

Teacher B explained:

"Students were able to master the topics with abstract concepts much faster than when we teach normally after using PtechLS module compared to the traditional chalk and talk method, indirectly, this increases students motivation and maintains the students focus in the classroom."

Students' interest in Biology

Analysis of the interviews with both the biology teachers showed that the Biology PtechLS module can improve students' interest in the biology subject.

Teacher A explained:

"Moreover, the strength of the module to students, the students will be more interested in Biology. This is because when student understand a topic which they study, it increases students interest to further explore these topics through the links provided in the module".

There was a disadvantage noted by the teachers during the evaluation. The teachers' indicated that the Biology PtechLS modules were somewhat unsuitable as most of the learning resource materials which were linked to the module was in English. The lessons in class was conducted in the Malay language. The teachers advocated the module should be fully developed in the Malay language, including the links to web resources. In addition, these should be supported by additional reading resources.

V. IMPLICATIONS AND CONCLUSION

The Biology PtechLS module is effective as evidenced by the significant increase in student achievement after its implementation. However, it does not specify whether this increase is due to the module only, or whether other factors such as extra lessons in the classroom or extra classes contributed to the increase in test scores. Effectiveness of the module may indicate that the module is suitable for students who are active and reflective learners. Similar studies that have been conducted have also shown that the PtechLS Physics module effective to students' with active, reflective, visual and verbal learning style [1][4]. However, it is still uncertain if this module will prove to be effective for other learning styles than the one used in this study. Further research should be conducted to investigate this concern.

In addition, the effectiveness of the module was only measured by students' achievement. The assessment is similar to past studies conducted by Alias [1] and Sahasrabudhe and Patnaik [20]. Other additional factors such as motivation, critical thinking skills, and social interaction can be measured to determine the effectiveness of the module. Usability evaluation proves that the teachers, who were the implementers of the module, found that the module can be used for teaching according to students' learning styles, and can be used for students to master science concepts. In addition, students' interest can also be improved.

Teachers are important agents of change and their perceptions are important for the success of the module implementation. In this study, the teachers showed that they agreed with the usability of the modules and understand the benefits towards the students. However, they stated that the content was inappropriate because of language used (English) was quite challenging for students.

Overall, the findings this study showed that the matching of learning styles with activities, using appropriate technology benefited the students. The discussions were conducted among teachers on how to deal with different learning styles while conducting activities in the classroom. This awareness will assist teachers in designing the teaching activities; taking into consideration the students different individual learning styles. Therefore, the researchers suggest that further studies should be conducted to determine whether this Biology PtechLS Module is effective to different environments of learning, and whether it can be used by other rural secondary schools from other areas in Malaysia. In short, this project was able to identify relevant technologies for teaching to different learning styles so that students can master the science abstract concept. In future, it is hopes that teachers and students will be able to use ICT tools suitable for the learning according to the students learning style.

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Dr. Norlidah Alias has obtained her PhD in Curriculum Design and Development from the University of Malaya, Kuala Lumpur, Malaysia in 2010. She actively researches and publishes in the areas of Pedagogical Module based on technology and learning styles, homeschooling, collaborative mobile learning and Gerontology. She is especially known for her Pedagogical module based on technology and learning styles, which have reframed current ways of teaching abstract Science Concepts by matching learning styles with technology. Her homeschooling research is the first of its kind in Malaysia. Her works are published in top tier Malaysian and International journals including Journal of Educational Tehnology and Society (ETS), Eurasian Journal Mathematics, Science and Educational Technology (EJMSET), Educational Technology Research & Development (ETR&D) and The Turkish Online Journal of Educational Technology (TOJET). She has also published books on Pedagogical Module based on Technology and Learning Styles, Pendidikan Alternatif Homeschooling, Design and Developmental Research: An Emergent Trend in Educational Research and Kurikulum: Satu Disiplin yang Dinamik. The current publications are as listed:

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Dr. Dorothy DeWitt is a Senior Lecturer in the Curriculum and Instructional Technology Department, University Malaya. She was formerly with the Educational Technology Division (ETD), Ministry of Education, Malaysia, where she was involved in the Smart School Pilot Project in managing the development of digital materials, as later for the management and promotion of innovation in instruction. Her interests are in instructional design, new technologies for knowledge management, and collaborative mobile learning. Her publications included academic articles in ISI-ranked publications and journals such as Journal of Educational Tehnology and Society (ETS), Eurasian Journal of Mathematics, Science and Educational Technology (EJMSET), and Educational Technology Research & Development (ETR&D), as well as books and chapters in books on collaborative mobile learning and developmental research. She has been involved in research in collaborative and mobile learning since 2007, and is looking at designs of instructional systems that encourage problem-solving, communication and collaboration using new learning tools and technologies. Her PhD thesis explored the possibility of collaborative learning using mobile technologies for a mobile learner to enable learning to occur anywhere and at any time; using the collaborative mLearning framework. Her publications include:

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Prof. Dr. Saedah Siraj is a Professor at Department of Curriculum and Instructional Technology, Faculty of Education, University of Malaya, Kuala Lumpur Malaysia. Her areas of expertise include; curriculum and instruction, curriculum design and evaluation, family and children development, future curriculum, and M-learning.

Dr. M. N. Abdul Rahman is a senior lecturer at Faculty of Education, University of Malaya, Kuala Lumpur, Malaysia .

R. B. Gelamdin is a PhD student at Faculty of Education, University of Malaya, Kuala Lumpur, Malaysia.

R. A. Abdul Rauf is a senior lecturer at Faculty of Education, University of Malaya, Kuala Lumpur, Malaysia.