

# Effectiveness of the Biology PTechLS Module in a Felda Science Centre

Norlidah Alias [1], Dorothy DeWitt [2], Mohd Nazri Abdul Rahman [3], Rashidah Begum Gelamdin [4], Rose Amnah Abd Rauf [5], Saedah Siraj [6]

[1] drnorlidah@um.edu.my  
Department of Curriculum & Educational Technology, Faculty of Education, University of Malaya, Kuala Lumpur, Malaysia.

[2] dorothy@um.edu.my  
Department of Curriculum & Educational Technology, Faculty of Education, University of Malaya, Kuala Lumpur, Malaysia.

[3] mnazri@siswa.um.edu.my  
Department of Curriculum & Educational Technology, Faculty of Education, University of Malaya, Kuala Lumpur, Malaysia.

[4] rashidahbegumgelamdin68@yahoo.com  
Department of Mathematics and Science Education, Faculty of Education, University of Malaya, 50603, Kuala Lumpur, Malaysia

[5] rose\_amnah@um.edu.my  
Department of Mathematics and Science Education, Faculty of Education, University of Malaya, 50603, Kuala Lumpur, Malaysia

[6] saedah@um.edu.my  
Department of Curriculum & Educational Technology, Faculty of Education, University of Malaya, Kuala Lumpur, Malaysia.

## 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 Norlidah Alias (2010). The aim of this study is to evaluate the implementation effectiveness of the Biology PTechLS module in a Felda Learning Centre in the district of Jempol in Negeri Sembilan, Malaysia. The PTechLS module was implemented from 2012 to 2014. The study employs a quasi-experimental design involving 37 students. In addition, a retrospective usability evaluation of the PTechLS module implementation was conducted, with two Biology teachers as the users. The findings of this study show 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 Biologi 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 achievement and interest in Biology.

**Keywords:** *PtechLS module, Biology, Quasi Experiment, Usability Evaluation.*

## INTRODUCTION

The strategy of matching learning style with certain technology enhances students learning experience (Norlidah Alias, 2010; Norlidah Alias & Saedah Siraj, 2012; Norlidah Alias, Dorothy DeWitt, & Saedah Siraj, 2013). Identifying a learner's unique learning style is important in ensuring that learners are engaged in learning (Graf, Kinshuk, & Liu, 2009; Larkin-Hein & Budny, 2001; Yang & Tsai, 2008; Naimie, Siraj, Ahmad Abuzaid, & Shagholi, 2010). It has been observed that when instruction is aligned with the learners' learning styles, learning achievements will increase together with affective and motivational advantages (Aviles & Moreno, 2010; Franzoni & Assar, 2009; Lau & Yuen, 2010; Saeed, Yang, & Sinnapan, 2009).

Learning style defines how a learner concentrates, processes and retains information during learning (Dunn, 1990). Previous research shows that matching the Physics topic to technology and learning styles can improve students' mastery of concepts (Hein, 1997; Ross & Lukow, 2004; Tsoi, Goh, & Chia, 2005). A Physics pedagogical module based on learning style and appropriate technology (PTechLS) was developed by Norlidah Alias (2010) to enhance the learning of abstract concepts in Physics by matching learning style with

appropriate technology. The module was later implemented with 120 students in urban schools in the Klang Valley (Norlidah Alias & Saedah Siraj, 2012) with 30 participants of each learning style (visual/verbal, active/reflective). The results of the study suggested that the module is effective for visual, active, reflective but not for verbal learners. The researchers also compared the module effectiveness according to gender. The verbal and reflective modules were effective for female learners but not male learners. The module was later extended to other science subjects such as Biology and Chemistry and further implemented in a rural school in Negeri Sembilan. This article will focus on the effectiveness for improving students' achievement and the usability of the implemented Biology PTechLS module in a Felda Learning Centre in Jempol District in Negeri Sembilan. The PTechLS module was implemented for two years from 2012 to 2014. In addition, usability evaluation involving user retrospective was conducted with two Biology teachers who were involved in implementing the PTechLS module.

### The Aim Of Research

The aim of this research is to evaluate the effectiveness for improving students' achievement and the usability of the Biology PTechLS module in a Felda Learning Centre in the Jempol District in Negeri Sembilan. This study seeks to answer the following research questions:

- Are the Biology PTechLS modules effective for improving students' achievement among Form 4 students?
- What is the teachers' perspective of the usability of the Biology PTechLS for Form Four students?

### Scope And Limitations

In this study, a sample size of 37 students at a rural secondary school in the state of Negeri Sembilan was selected as the population to reflect the proportion of the Malay community in Malaysia.

In this study only two topics in Biology were investigated. The Biology PTechLS module was developed for the Form Four topics of Respiration and Nutrition. These topics were identified as they involved abstract concepts which were difficult for the students. The scope of the study is limited to only two particular learning styles. Furthermore, the study is limited to only one rural school in a district in Negeri Sembilan and the findings cannot be extended to other schools.

### METHODOLOGY

In this research, the quasi experimental approach with one group (treatment) design was adopted. The school is in a rural district in Negeri Sembilan which caters mostly to the FELDA (Federal Land Development Authority) settlers' children from nearby villages, was proposed by the Education Unit of FELDA. The treatment group ( $n = 37$ ) was exposed to pretest prior to the learning using Biology PTechLS Modules under the Nutrition topic in Form Four Biology subject for two weeks. Prior to this, the students were grouped according to their learning styles after they had sat for the Index of Learning Style (proposed by Felder-Silverman) test.

The module and the instrument to measure the pre and posttest were developed by a Biology Education expert. The Biology module comprises learning activities supported by links (webquest, YouTube) which suit the learning styles of the students. A post-test was administered on the students one week after the treatment ended. Data gathered were analyzed using SPSS and a *t*-test.

In addition, a usability evaluation of the Biology PTechLS Module from teachers' retrospective was obtained by interviewing the two teachers involved using a semi-structured interview protocol, two weeks after the module implementation. The interviews were transcribed and then cross checked by both the respondents.

### Instruments

The instruments involved pre and post-tests as well as a semi-structured interview protocol for the module usability evaluation. The pre and post-tests were designed to evaluate whether the module objectives could be achieved.

**RESULTS AND DISCUSSION**

**t-Test (One-Sample)**

A t-test (One Sample) was used to compare test scores for the pre and post test of students who have used the Biology PtechLS module.

**Table 1: T-test of test scores of Form Four Biology students**

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

\*Significant at  $p < .05$

A t-test (One Sample) performed to compare Pre and Post Test scores after implementation of the 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,  $p < .05$ ). This indicates that the implementation PtechLS Biology module may have an impact of students' achievement.

**Teachers' Retrospective Evaluation of Biology PtechLS Module**

The transcripts of interviews with two teachers after implementation of the PtechLS Biology module were analyzed based on emergent themes. The results indicate that the module provided an opportunity for students to master abstract biology concepts and increased students' interest in learning biology based on their individual learning style.

*Caters to different types of learners*

The two biology teachers were very satisfied with the implementation of the PtechLS biology 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 modules assist in delivery of instruction for different types of learners. Teacher B stated:

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.

*Improving 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 linked to the module were in English. The lessons in class were 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.

## **IMPLICATION AND CONCLUSIONS**

This module was effective as proven by the significant increase in achievement. It was not noted whether this increase was due to the module alone, or whether other factors such as extra lessons in class or extra tuition classes contributed to the gains in test scores.

The module effectiveness may indicate that the module was suitable for active and reflective learners. Studies done have shown the PTechLS module for Physics was effective for students' with active, reflective, visual and verbal learning styles (Norlidah Alias, 2010; Norlidah Alias, Saedah Siraj, Dorothy Dewitt, Mohammad Attaran, & Abu Bakar Nordin, 2013) and the module has been extended to Biology. However, it is not certain if the module would prove to be effective for other styles and further studies are required to investigate this possibility.

The module effectiveness was only measured according to student achievement. The measure of achievement when teaching according to learning styles is similar to studies done by Norlidah (2010) as well as Sahasrabudhe and Kanungo (2014). Other additional factors such as motivation, critical thinking skills, and social interactions could be measured to determine the module effectiveness.

The usability evaluation proved that the teachers, who were the module implementers, found that the module was suitable for teaching according to the individual students' learning styles, and could be used for students to master science concepts. In addition, students' interest improved.

Teachers are important change agents and their perception is important for the success of the module. The teachers seem to accept the usability of the module and note the advantage for students. However, they noted that it was unsuitable because of the language.

This paper has described an effort to evaluate the effectiveness of the implementation of the Biology PTechLS module in a Felda Learning Centre in the Jempol District in Negeri Sembilan. The PTechLS module was implemented for two years from year 2012 to year 2014 involving 37 Form Four students.

The impact of the project will be that matching the learning style of the student to the activities, using the appropriate technology tool will benefit the students. Discussion was conducted among the teachers on how to address the different learning styles during face to face activities in the classroom. This awareness will assist teachers in designing activities which will address the individual learning styles. Therefore, the researchers suggest that further research could be done to determine if Biology PtechLS Module was effective in different domains of learning, and whether it could be used by other rural secondary schools in different districts in Malaysia.

The impact of this project will be to identify the technology relevant for teaching for different learning styles in order for students to master abstract concepts in science. Teachers and students will then be able to utilize appropriate ICT tools for learning according to their individual learning styles.

## **ACKNOWLEDGEMENTS**

Funding of this research work is generously supported by the Knowledge Transfer Grant (KTP07-2012B), Ministry of Education, Malaysia.

## REFERENCES

- Aviles, R. M. H., & Moreno, A. H. (2010). Creating the conditions for educational change: Learning styles and gender. *International Journal of Learning and Change*, 4(3), 252-262.
- Dunn, R. (1990). Understanding the Dunn and Dunn Learning Styles Model and the need for individual diagnosis and prescription. *Reading, Writing and Learning Disabilities*, 6, 223-247.
- Franzoni, A. N., & Assar, S. (2009). Student Learning Styles Adaptation Method based on teaching strategies and electronic media. *Educational Technology & Society*, 12(4), 15-29.
- Graf, S., Kinshuk, & Liu, T.-C. (2009). Supporting teachers in identifying students' learning style in Learning Management System: An automatic student modelling approach. *Educational Technology & Society*, 12(4), 3-14.
- Hein, T. L. (1997). *Digital video, learning styles and students understanding of kinematics graph*. Doctoral thesis, Kansas State University.
- Larkin-Hein, T., & Budny, D. D. (2001). Research on learning style: Applications in the physics and engineering classrooms. *IEEE Transactions on Education*, 44(3), 276-281.
- Lau, W. W. F., & Yuen, H. K. (2010). Promoting conceptual change of learning sorting algorithm through the diagnosis of mental models: The effects of gender and learning styles. *Computers & Education*, 54, 275-288.
- Naimie, Z., Siraj, S., Ahmad Abuzaid, R., & Shagholi, R. (2010, October). Hypothesized Learners' Technology Preferences based on Learning Style Dimensions. *TOJET: The Turkish Online Journal of Educational Technology*, 9(4).
- Norlidah Alias. (2010). *Pembangunan Modul Pedagogi berasaskan teknologi dan gaya pembelajaran Felder-Silverman Kurikulum Fizik Sekolah Menengah*. [Development of pedagogical module based on technology and learning style for Secondary School Physics Curriculum] Unpublished doctoral thesis, University of Malaya.
- Norlidah Alias, & Saedah Siraj. (2012, October). Design and Development of Physics Module Based on Learning Style and Appropriate Tcehnology by Employing Isman Instructional Design Model. *TOJET: The Turkish Online Journal of Educational Technology*, 12(4).
- Norlidah Alias, Dorothy DeWitt, & Saedah Siraj. (2013). *Development of Science Pedagogical Module based on learning styles and technology*. Pearson Malaysia.
- Norlidah Alias, Saedah Siraj, Dorothy DeWitt, Mohammad Attaran, & Abu Bakar Nordin. (2013). Evaluation on the Usability of Physics Module in a Secondary School in Malaysia: Students' Retrospective. *The Malaysian Online Journal of Educational Technology*, 1(1), 44- 53.
- Ross, C. M., & Lukow, J. E. (2004). Are Learning Styles a Good Predictor for Integrating Instructional Technology into a Curriculum? *Journal of Scholarship of Teaching and Learning*, 4(1). Retrieved from <http://www.iupui.edu/~josotl/2004vol4no1/RossLukow.pdf>

- Saedah Siraj, & Nabihah Badar. (2005). Malaysian secondary students' preference in learning Physics: Implication to the teaching strategies. *The International Journal of Learning*, 10, 3559-3572. Retrieved from <http://www.Learning-Journal.com>
- Saeed, N., Yang, Y., & Sinnapan, S. (2009). Emerging Web technologies in Higher Education. A case of incorporating blogs, podcasts and social bookmarks in a Web Programming Course based on students' learning styles and technology preferences. *Educational Technology & Society*, 12(4), 98-109.
- Sahasrabudhe, V., & Kanungo, S. (2014). Appropriate media choice for e-learning effectiveness: Role of learning domain and learning style. *Computer & Education Journal*, 76, 237-249.
- Tsoi, M. F., Goh, N. K., & Chia, L. S. (2005). Multimedia learning design pedagogy: A hybrid learning model. *US-China Education Review*, 2(9), 59-62.
- Yang, F.-Y., & Tsai, C.-C. (2008). Investigating university student preferences and beliefs about learning in the Web-based context. *Computers and Education*, 50(4), 1284-1303.