DESIGN AND DEVELOPMENT OF PHYSICS MODULE BASED ON LEARNING STYLE AND APPROPRIATE TECHNOLOGY BY EMPLOYING ISMAN INSTRUCTIONAL DESIGN MODEL

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ABSTRACT
The study was aimed at designing and developing a Physics module based on learning style and appropriate technology in secondary educational setting by employing Isman Instructional Design Model and to test the effectiveness of the module. The paper draws attention to the design principles which employs Isman Instructional Design Model. The prototype module was tested among two teachers and 14 participants. The findings from interviews with the teachers and students show a positive response in Physics when their learning styles are matched with appropriate technology. In the evaluation phase, two instruments were used to collect data for this study. The pre-posttest designed to identify students' achievement score and Felder Silverman's Learning Style Inventory to measure students' learning style. Findings from evaluation of the module conducted among 120 participants involving 30 participants of each learning style (visual/verbal, active/reflective) suggested that the module is effective for visual, active, reflective and not for verbal learners. The researchers also compared the effectiveness of the module according to gender. The verbal and reflective modules were effective for female learners and not for male learners. The findings from this study suggest that Isman Instructional Design Model which pays attention to instruction from the learner perspective than from content perspective is suitable in designing and developing Physics module based on learning style and appropriate technology in secondary educational setting in Malaysia. The findings of this study is also hoped to provide insights to promote teaching and learning of Physics based on learning style and appropriate technology.
Keywords: Isman Instructional Design Model; Learning styles; Appropriate technology

INTRODUCTION

Recent studies have indicated that secondary school students have difficulties in learning Physics (de-Marcos, Hilera, Barchino, Jimenez, & Oton, 2010; Heck & Ellermeijer, 2010; Mun, Hew, & Cheung, 2009). A key to success of science education is the use of technology tools which can greatly enhance a student's understanding of science concepts (Isman, Yaratan, & Caner, 2007). The educational technology tools can take a difficult to learn science concept and change it from abstract to concrete to make it easier to understand (Isman et al., 2007).

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). Scholars have indicated that a learner's behaviors such as cognitive, affective and psychology, act as indicators in perceiving, interacting and responding with the learning environment, and that some learners tend to emphasize some learning styles compared to others (Keefe, 1987; Kolb, 1984). Each learner has his or her own learning style. There exist numerous learning styles and learning style models (Yilmaz-Soylu & Akkoyunlu, 2002).

Felder and Silverman (1988) have created a learning style model that brings focus to the learning styles aspects among the Engineering students. After three years, a psychometric instrument which is Felder-Soloman's Index of Learning Styles was created. This model has classified the students into eight categories based on four dimensions: (visual/verbal, active/reflective, sequential/global, sensing/intuitive). In the context of this study, Felder Silverman Learning Style Model is used because the Index of Learning Style (ILS) Felder-Soloman provides a practical approach for determining the dominant learning style of students (Kinshuk & Lin, 2004). ILS was devised for engineering students. Physics is one of the components in engineering; hence the ILS is the most suitable instrument for this study. Local researchers have used the model to determine the learning style of Physics and Chemistry students (Ng Sook Chin, 2005; Saedah Siraj & Nabihah Badar, 2005).

The same scenario operates in Malaysia as the students have the weaknesses in mastering Physics and they assume that Physics is something that is abstract (Abdullah Nor, 1998; Shahanom Nordin, 1994). The analysis regarding the Malaysian Education Certificate *Sijil Pelajaran Malaysia* answers for Physics Paper 2 shows that the overall performance of the candidates in delivering the facts and Physics concepts is decreasing especially those students who are moderate and weak (Ministry of Education, 2007). The Physics concepts that are found difficult for the students to master are the concept of pressure, inertia, momentum, light, waves, density, and force (Ministry of Education, 2007). In the matter that involves Physics Pedagogy, the result from the study done by Kamisah Othman, Lilia Halim, and Subahan Mohd Meerah (2006) in determining the needs analysis of 1690 Science teachers, shows that the teachers need information on how technology should be integrated in their teaching skills. Until now little research have been done on the design and development of a pedagogical module based on technology and learning style for Form 4 Physics curriculum. Although studies have been conducted on the concepts, the learning styles and technology for Biology, not much has been done on the development of Physics module. On top of that, the local research is more focused on the method of survey and only a few studies on Chemistry, Biology and Science have used developmental research (Norizan Ahmad, 2005; Sabariah Othman, Rosseni Din, & Aidah Abdul Karim, 2000; Wong, 2005).

Previous research shows that matching the Physics concept, technology and learning styles can increase the students' mastery of concepts (Hein, 1997; Ross & Lukow, 2004; Tsoi, Goh, & Chia, 2005). It can be implied that the development of Physics module based on technology and learning style would attract students' interest in Physics. Hence, this study was aimed at designing and developing a Physics module based on learning style and appropriate technology by employing the Isman Instructional Design Model in secondary educational setting and to test the effectiveness of the module. This study does not compare the effect of traditional lesson to Physics module based on technology and learning style but rather draws attention to the design principles which employs Isman Instructional Design Model and the effectiveness of using Physics module based on technology and learning style.

THE AIM OF RESEARCH

The aim of this research is to design and develop a module based on learning style and appropriate technology according to Isman Instructional Design Model for Physics in the secondary educational setting and to test the effectiveness of the module. In order to achieve this aim, the researcher set two research objectives. The first objective is to describe the design and development of a module based on learning style and appropriate technology by employing the Isman Instructional Design Model. Next, the second objective of this research is to test the effectiveness of the module by pre/posttest designed and interviewing 14 students. This study seeks to answer the following research questions:

- Are modules based on learning style and appropriate technology which was developed by employing Isman model effective?
- Are modules based on learning style and appropriate technology which was developed by employing Isman model effective according to gender?

Significance of the Study

The results of the study can be used by educators to determine the effects of Isman model in the design and development of a module based on learning style and appropriate technology in secondary educational setting in Malaysia.

Scope and Limitations

In this study, a sample size of 120 students at an urban secondary school in the state of Selangor was selected as the population reflected the proportion of the multiracial communities in Malaysia. Students' modules designed, developed and tested in this study were only on visual, verbal, active and reflective modules, as suggested by the panel of experts.

Instruments

Two instruments were used in this study: First is the Index of Learning Styles (ILS) (Felder & Silverman, 1988) for identifying the students' learning styles. The survey instrument used was Learning Style Index (LSI) developed by Felder and Soloman (1988) which had been translated to Bahasa Malaysia by Nabihah Badar and Saedah Siraj (2005) and administrated to 120 form four students in the same district as this research. The instrument has a Cronbach alpha reliability score of .72. The second instrument is two multiple choice tests used for pretest and posttest. This test was designed to analyze students' achievement on "Charles's Law" and "Boyle's Law". There were 50 items in these two instruments. The content of the instrument was validated by three Physics teachers while the language was validated by two language teachers with more than 10 years working experience.

Theoretical Framework

Employing Isman Instructional Design Model in the Development of Physics Module based on learning Style and Appropriate Technology

The major goal of Isman Instructional design Model is to point up how to plan, develop, implement, evaluate and organize full learning activities effectively so that it will ensure competent performance by students (Isman, 2011). The theoretical foundation of the new model comes from behaviorism, cognitism and constructivism views. Firstly, Isman (2011) used realationship between stimulus and response, the reinforcement factor and designing environmental condition in behaviorism theory to motivate more in this model. Secondly, motivation, intellectual learning process, experiences and contents in Cognitivism theory are used in this model to motivate students to learn more in this model. This model is interested in how to store the information into long term memory, hence instructional activities are designed in this model. Isman model also uses constructivism which pays attention to personal applications. Isman model was implemented on 100 graduate students at the faculty of education at Eastern Mediterranean University in North Cyprus with the purpose to analyze the effects of the model on academic achievement (2005). The findings of the research indicates that Isman model was implemented successfully in instructional activities in the experimental group and affected academic achievement and so, it may be said that this model could be implemented to design instruction. Hence, the researchers aim to employ Isman model in the design and development of Physics module based on learning style and appropriate technology in Malaysian secondary educational setting and to test the effectiveness of the module. The Isman Instructional Design Model is described in a five-step systematic planning process. These are input, process, output, feedback and learning as shown in Figure 1.

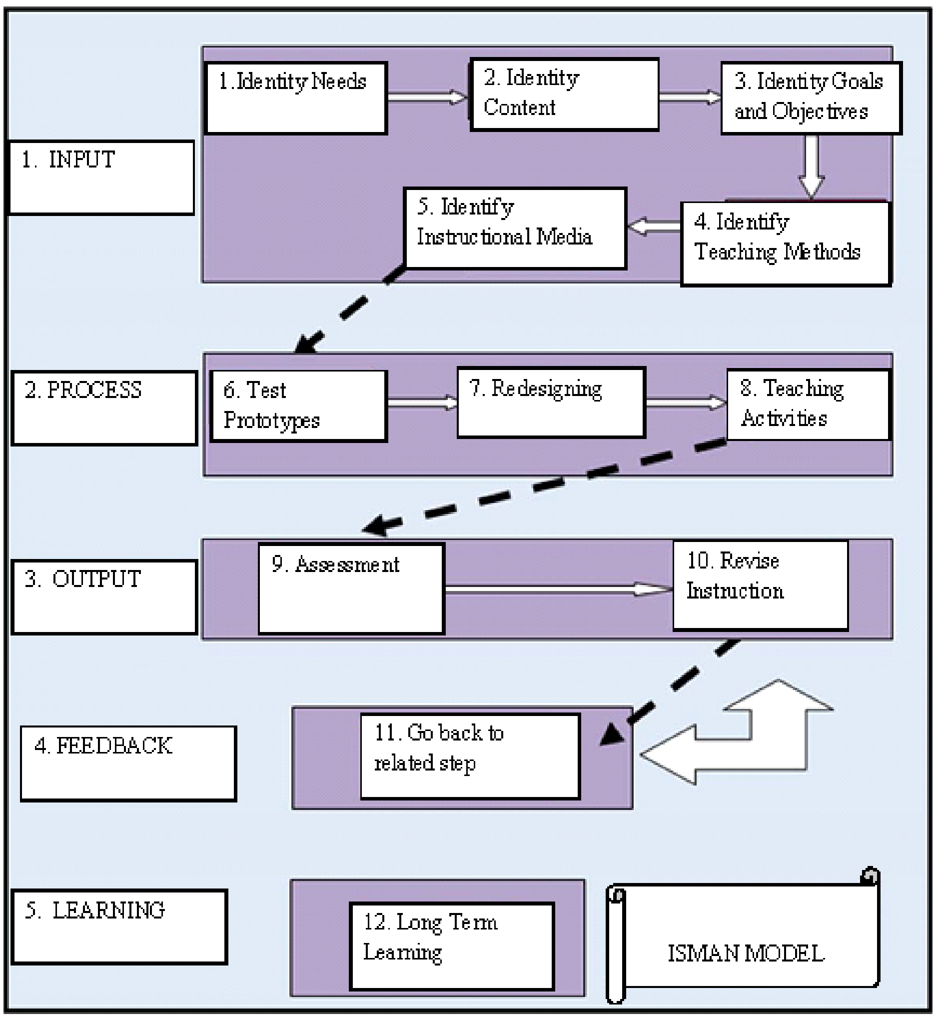

Figure 1: Isman Instructional Design Model (Isman, 2011, p.139)

The first step in the Isman model is input. The input step involves identify needs, identify contents, identify goal-objectives, identify teaching methods, identify evaluation materials, and identify instructional media. Isman (2005) states that the main goal of first step is to identify factors for input. In this research, we use a panel of experts to identify the input for the module including the needs of the module which is a Physics module based on learning style and technology, identify contents, goal and objectives, teaching methods, evaluation material and instructional media.

The expert panel comprises five criteria such as two Physics master teachers, one ICT master teachers, a Professor in Physics Education and a head of department of curriculum and ICT in a local university. The experts review suggested that the pedagogical module should be developed for four learning styles such as active, reflective, visual and verbal involving two gas laws such as “Charles’s Law” and “Boyle’s Law”. Next, the expert review suggested two modules to be developed; one each for teacher and student. The elements of the Physics module based on learning style are as follows:

Table 1: Active learning style elements for “Lesson 1 and Lesson 2: Gas Law”

Technology Tools	**Electronic Digital Resource**	**Teaching Technique**	**Activities**	**Exercises**
Laptop	Webquest	Group Project	Post answers in the blog	Do group work

Table 2: Reflective learning style elements for “Lesson 1and Lesson 2: Gas Law”

Technology Tools	**Electronic Digital Resource**	**Teaching Technique**	**Activities**	**Exercises**
laptop	Video clip	Individual drill	wiki	Produce mind map

Table 3: Visual learning style elements for “Lesson 1 and Lesson 2 : Gas Law”

Technology Tools	**Electronic Digital Resource**	**Teaching Technique**	**Activities**	**Exercises**
laptop	Webquest	Experiment/demonstration in pairs	wiki	Produce Power point

Table 4: Verbal learning style elements for “Lesson 1 and Lesson 2: Gas Law”

Technology Tools	**Electronic Digital Resource**	**Teaching Technique**	**Activities**	**Exercises**
Laptop	Video clip	lecture	tutorial	Present assignment

The webpage for the Physics module based on learning style and appropriate technology for teachers and students (visual, verbal, active and reflective) was designed. The contents of teachers’ lesson plan and students’ instruction of the lesson were integrated in the respective modules. Next, the teachers’ module and students’ module were uploaded and published in the internet server. An example of a students’ module is as shown in Figure 1.

The second step in the Isman model is process. The process step involves testing prototypes and redesigning of instruction and teaching activities. We also used the expert panel to redesign the website produced. The expert review suggested that the introduction of the module should be able to guide the teachers and students independently. Further the expert review also suggested that the blog for teachers should be made according to the students’ learning style. Lastly, the expert review suggested the implementation schedule for testing of the module.

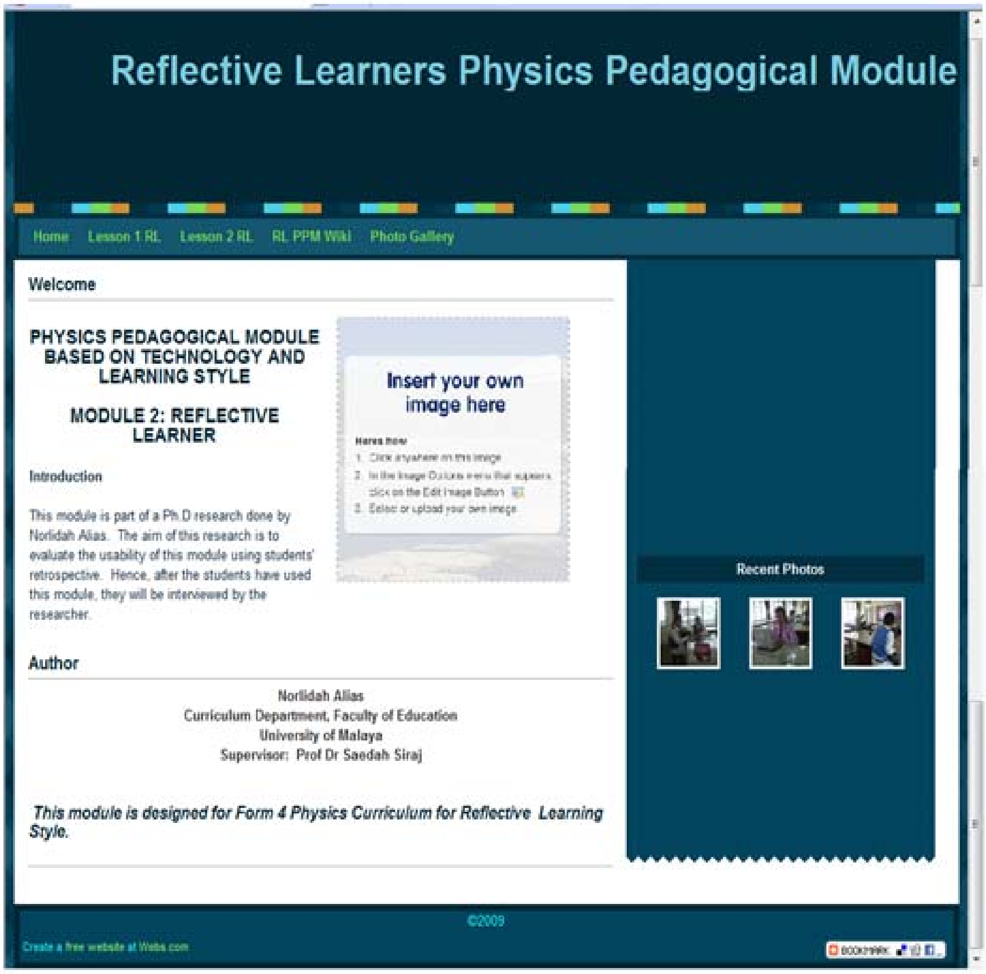

Figure 2: Main Page of Online Module for Reflective Learner Website.

The third step in the Isman model is output. The output process involves testing and analyzing results. To determine student learning, educational measurement and evaluation process should be implemented by teachers. In this research we tested the prototype by implementing the modules with two teachers and 14 students.

The fourth step in the Isman model is feedback. The feedback process involves revising instruction based upon the data collected during the implementation phase. If, during the phase, teacher finds that students are not learning what the plan wanted them to learn, or they are not enjoying the learning process, teacher will try to revise and improve some aspect of their instruction to enable the students to accomplish their goals. In this research, we revised the instruction according to the teachers' and students' comments.

The final step in the Isman model is learning. The learning process involves full learning. In this process, teachers want to ensure that their students have learned what the instructional plan wanted them to learn. This is when the pre/posttest was conducted to test the module effectiveness.

Employing of the Isman model to design and develop a Physics module based on learning style and appropriate technology is documented in work logs as illustrated in Table 5:

Table 5: Use of Isman model to design and develop a Physics pedagogical module

Steps	Work log	Descriptions
Step 1 Input	Identify needs Identify contents Identify goals-objectives Identify teaching methods	Designing Physics module based on learning style and technology by a panel of experts. Designing the webpage for teachers' module and students module for visual learners, verbal learners, active learners

	Identify evaluation materials Identify instructional media	and reflective learners.
Stage 2 Process	Testing prototypes Redesigning of Instruction Teaching activities	Using expert panel to redesign the website produced.
Stage 3 Output	Testing Analyze Results	Implementing the modules with two teachers and 14 students.
Stage 4 Feedback	Revise Instruction	Revise the comments given by students and teachers.
Stage 5 Learning	Learning	Pre/posttest was conducted to test the effectiveness of the module.

RESULTS

The effectiveness of the Physics module based on learning style and appropriate technology which was developed by employing the Isman model was analyzed across visual, verbal, active and reflective modules. Findings from the module evaluation conducted among 120 participants involving 30 participants of each learning style (visual/verbal, active/reflective) suggested that the module is effective for visual, active and reflective but not for verbal learners. Next, we also compared the effectiveness of the module according to gender. The module was effective for visual and active learners regardless of gender. However, the verbal and reflective modules were effective for female learners and not for male learners. A *t*-test was performed to determine if there were significant differences between the groups in the achievement scores. Table 6 to Table 9 shows the results of *t*-test comparison of pre/posttest achievement towards Physics module for visual learners, verbal learners, active learners and reflective learners respectively. In addition a *t*-test was also performed to determine if there were significant differences between genders among the groups in the achievement scores. Table 10 to Table 12 shows the results of *t*-test comparison of pre/posttest achievement in the Physics module for visual learners, verbal learners, active learners and reflective learners respectively according to gender.

The effectiveness of modules based on learning style and appropriate technology developed using Isman model

Findings from evaluation of the module conducted among 120 participants involving 30 participants of each learning style (visual/verbal, active/reflective) suggested that the module is effective for visual, active, reflective and not for verbal learners.

Table 6: t-Test comparison of pre/posttest achievement towards Physics module for Visual learners

	Pretest (n = 30)	Posttest (n = 30)	*t*-value	*p*	Effect size
Mean	53.37	56.23	6.11	< .05	0.73
SD	17.23	16.25			

Table 6 shows that there is a significant difference between pretest (mean = 53.37, SD = 17.23) and posttest (mean = 56.23, SD = 16.25) marks, t (29) = 6.11, $p < .05$. The mean scores indicate posttest have significant higher achievement towards Physics module for Visual Learner than pretest.

Table 7: *t*-Test comparison of pre/posttest achievement towards Physics module for Verbal learners

	Pre test (n = 30)	Post test (n = 30)	*t*-value	*p*	Effect size
Mean	52.97	53.80	0.960	>.05	0.06
SD	16.14	14.55			

Table 7 shows that there is no significant difference between pretest (mean = 52.97, SD = 16.14) and posttest (mean = 53.80, SD = 14.55) marks, t (29) = .96, $p > .05$. The mean scores indicate posttest does not have significant higher achievement towards Physics module for Verbal Learner than pretest.

Table 8: t-Test comparison of pre/posttest achievement towards Physics module for Active learners

	Pretest (n = 30)	Posttest (n = 30)	t-value	*p*	Effect size
Mean	52.07	55.03	5.55	< .05	0.69
SD	18.18	16.58			

Table 8 shows that there is a significant difference between pretest (mean = 52.07, SD = 18.18) and posttest (mean = 55.03, SD = 16.58) marks, t (29) = 5.55, p < .05. The mean scores indicate posttest have significant higher achievement towards Physics module for Active Learner than pretest.

Table 9: t-Test comparison of pre/posttest achievement towards Physics module for Reflective learners

	Pretest (n = 30)	Posttest (n = 30)	*t*-value	*p*	Effect size
Mean	51.80	54.17	3.39	< .05	0.45
SD	15.18	12.63			

Table 9 shows that there is a significant difference between pretest (mean = 51.80, SD = 15.18) and posttest (mean = 54.17, SD = 12.63) marks, t (29) = 3.39, p < .05. The mean scores indicate posttest have significant higher achievement towards Physics module for Reflective Learner than pretest.

Effectiveness of modules based on learning style and appropriate technology developed using Isman model according to gender

The researchers also compared the effectiveness of the module according to gender. The module was effective for visual and active learners both male and female students. However, the verbal and reflective modules were effective for female learners and not for male learners.

Table 10: *t*-Test comparison of pre/posttest achievement towards Physics module for Visual learners by gender

	Mean	SD	t-value	*p*	Effect size
Pair 1 Male Pretest-posttet (n = 15)	1.20	1.96	2.36	<.05	0.12
Pair 2 Female Pretest-posttest (n = 15)	1.97	4.53	8.96	<.05	0.85

Table 10 shows that there is a significant difference between male (mean = 1.20, SD = 1.96) and female (mean = 1.97, SD = 4.53) marks, male t(14) = 2.36, p < .05 and female t(14) = 8.96, p < .05. The mean scores indicate female have significant higher achievement towards Physics module for Visual Learner than male. In addition, the module is significant for both male and female.

Table 11: *t*-Test comparison of pre/posttest achievement towards Physics module for Verbal learners by gender

	Mean	SD	t-value	*p*	Effect size
Pair 1 Male Pretest-posttest (n=15)	1.33	4.68	1.10	>.05	0.08
Pair 2 Female Pretest-posttest (n=15)	3.00	3.85	3.01	<.05	0.39

Table 11.0 shows that there is a significant difference between male (mean = 1.33, SD = 4.68) and female (mean = 3.00, SD = 3.85) marks, male t(14) = 1.10, p > .05 and female t(14) = 3.01, p < .05. The mean scores indicate female have significant higher achievement towards Physics module for Verbal Learner than male. In addition, the module is significant for both female and not significant for male.

Table 12: *t*-Test comparison of pre/posttest achievement towards Physics module for Active learners by gender

	Mean	SD	t-value	*p*	Effect size
Pair 1 Male Pretest-posttest (n = 15)	1.47	1.36	4.19	<.05	0.56
Pair 2 Female Pretest-posttest (n = 15)	4.46	3.34	5.19	<.05	0.66

Table 12 shows that there is a significant difference between male (mean = 1.47, SD = 1.36) and female (mean = 4.46, SD = 3.34) marks, male t(14) = 4.19, $p < .05$ and female t(14) = 5.19, $p < .05$. The mean scores indicate female have significant higher achievement towards Physics module for Active Learner than male. In addition, the module is significant for both male and female.

Table 13: t-Test comparison of pre/posttest achievement towards Physics module for Reflective learners by gender

	Mean	SD	*t*-value	*p*	Effect size
Pair 1 Male Pretest-posttest (n = 15)	0.33	3.51	0.37	>.05	0.01
Pair 2 Female Pretest-posttest (n = 15)	4.40	2.99	5.69	<.05	0.70

Table 13.0 shows that there is a significant difference between male (mean = 0.33, SD = 3.52) and female (mean = 4.40, SD = 2.99) marks, male $t(14) = 0.37$, $p > .05$ and female t(14) = 5.69, $p < .05$. The mean scores indicate female have significant higher achievement towards Physics module for Reflective Learner than male. In addition, the module is significant for female and not significant for male.

IMPLICATION AND CONCLUSIONS

This paper has described an effort to design and developed a Physics module based on learning style and appropriate technology in Malaysian secondary educational setting by employing the Isman model. In addition, the effectiveness of the modules was tested and it was found that the module was effective for visual learners, active learners and reflective learners. However module was less effective for verbal learners. It indicates that Isman instructional model was implemented successfully in the design and development of the Physics module in the Malaysian secondary educational setting. The modules are now published in

freewebs.com
http://modulpedagogifizik.webs.com,
http://pedagogifizikactive.webs.com,
http://pedagogifizikreflective.webs.com,
htttp://pedagogifizikvisual.webs.com,
http://pedagogifizikverbal.webs.com)

and will be implemented in one Science Learning Centre in FELDA secondary school and Teachers Training College for two years. The outcome of this project will hopefully enhance the process of teaching and learning Physics in secondary educational setting by giving emphasis on learning style and appropriate technology.

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REFERENCES

Abdullah Nor. (1998). *Kajian mengenai beberapa faktor yang mempengaruhi kecenderungan terhadap Fizik bagi pelajar-pelajar tingkatan empat.* Latihan Ilmiah. Universiti Kebangsaan Malaysia.

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.

de-Marcos, L., Hilera, J. R., Barchino, R., Jimenez, L., Martinez, J. V., Gutierrez, J. A., & Oton, S. (2010). An experiment for improving students' performance in secondary and tertiary education by means of m-learning auto-assessment. *Computers & Education, 55*(3), 1069-1079.

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.

Dunn, R., Della Valle, J., Dunn, K., Geisert, G., Sinatra, R., & Zenhausern, R. (1986). The effects of matching and mismatching students' mobility preferences on recognition and memory tasks. *Journal of Educational Research*, *79(*5), 267-272.

Felder, R. M., & Silverman, L. K. (1988). Learning style and teaching styles in Engineering Education. *Engineering Education*, *78*(7), 674-681.

Felder, R. M., & Soloman, B. A. (1988). *Index of Learning Styles.* Retrieved from http://www.ncsu.edu/felder-public/ILSpage.html

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.

Heck, A., & Ellermeije, T. (2010). Mathematics assistants: Meeting the needs of secondary school physics education. *Acta Didactica Napocensi, 3*(2).

Hein, T. L. (1997). *Digital video, learning styles and students understanding of kinematics graph*. Doctoral thesis, Kansas State University.

Isman, A. (2005, October). The implementation results of New Instructional Design Model: Isman Model. *The Turkish Online Journal of Education Technology, 4*, Article 7.

Isman, A. (2011, January). Instructional Design in Education: New Model. *TOJET: The Turkish Online Journal of Educational Technology, 10*(1).

Isman, A., Yaratan, H., & Caner, H. (2007, July). How Technology Is Integrated Into Science Education In A Developing Country : North Cyprus Case. *The Turkish Online Journal of Education Technology, 6*(3), Article 5.

Kamisah Othman, Lilia Halim, & Subahan Mohd Meerah. (2006). What Malaysian Science teachers need to improve their science instruction: A comparison across gender, school location and area of specialization. *Eurasia Journal of Mathematics, Science and Technology (Edn.),* 2(2). Retrieved from http://www.ejmste.com/022006/d4.pdf

Keefe, J. (1987). Overview of theories and findings on Learning Styles. *Oregon School Council Study Bulletin, 30*(9).

Kinshuk, & Lin, T. (2004). Cognitive profiling towards formal adaptive technologies in Web-Based learning communities. *Int.J.WWW-Based Communities, 1*(1), 103-108.

Kolb, D. A. (1984). *Experiental learning : Experience as the source of learning and developent*. Englewood Cliffs, NJ: Prentice Hall.

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.

Malaysia Ministry of Education. (2007). Kementerian Pendidikan Malaysia, Kupasan mutu jawapan SPM: Fizik kertas 2 (Commentary on quality of answer SPM: Physics paper 2). Kuala Lumpur: Lembaga Peperiksaan Malaysia.

Mun, W. K., Hew, K. F., & Cheung, W. S. (2009). The impact of the use of response pad system on the learning of secondary school physics concepts: A Singapore quasi-experiment study. *British Journal of Educational Technology, 40*, 848-860.

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).

Ng Sook Chin. (2005). *Relationship between learning styles and understanding of selected chemical concepts among pre-university science students.* Unpublished masters dissertation, University of Malaya.

Norizan Ahmad. (2005). *Pengintegrasian teknologi dalam pengajaran dan pembelajaran Sains di sekolah Malaysia.* [Integration of technology in teaching and learning of Science in Malaysian schools] Unpublished doctoral thesis, University of Malaya.

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

Sabariah Othman, Rosseni Din, & Aidah Abdul Karim. (2000). Pembinaan modul integrasi komputer untuk pembelajaran kimia menggunakan MS Powerpoint 2000. Dlm. *Prosiding Konvensyen Teknologi Pendidikan ke 19* (hh. 244-251).

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.

Shahanom Nordin. (1994). *Penghasilan dan penilaian keberkesanan Modul Pengajaran Kendiri Fizik di kalangan pelajar berbeza kebolehan dan jantina pada peringkat Tingkatan 4.* [Production and evaluation of Self-teaching Physics module among students of different aptitude and gender at Form Four level]

Doctoral thesis, Universiti Teknologi Malaysia.
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.
Yilmaz-Soylu, M., & Akkoyunlu, B. (2002). The effect of learning styles on achievement in different learning environments. *The Turkish Online Journal of Educational Technology*, *8*(4), Article 4.
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.
Wong, M. L. (2005). *Design and development of Bio-Webclean for Form Four students of different learning styles.* Unpublished masters dissertation. University of Malaya, Kuala Lumpur.