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Persatuan Pendidikan Sains dan Matematik Johor (PPSMJ)

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Foreword Pro-Chancellor UTM

Assalamualaikum w.b.t and Salam Sejahtera

It is with great pleasure that I wlcome all participants to International Conference on Education and Higher Order Thinking Skills 2016 in conjunction with the 2nd International Seminar of Science and Mathematics Education. I would like to congratulate Faculty of Education, Universiti Teknologi Malaysia and Persatuan Pendidikan Sains dan Matematik Johor (PPSMJ) for their success in organising this conference. Education in the 21st century aims at preparing future generations who are capable of solving complex and challenging issues. Thus, Malaysian system of education through its National Education Blueprint has forwarded the idea in inculcating higher order thinking skills (HOTS) in the process of teaching and learning at all levels of education. Hence, the success of this mission depends on the support from all stakeholders such as educators, parents and society.

Therfore, this conference is an opportunity of lectures of both local and international institutes of higher education. School teachers in Malaysia, undergraduate and postgraduate students, and academician from various disciplines in education to present, share, exchange opinions and discuss research and execution of HOTS. Being the university which aims at producing the best human capital in Malaysia, I am glad that Faculty of Education has taken the initiative to organise this conference. This conference will mark the involvement and significant contribution of Universiti Teknologi Malaysia in ensuring the national agenda of inculcating HOTS in our education system is a success.

I hope this conference will be able to achieve its objective and may the outcome of the conference be also applied in promoting academic discourse in the issue of HOTS.

Lastly, I wish all the best to all the conference participants and may your time in the conference will be beneficial to your personal and academic growth and also to the betterment of the society.

Thank you

Y. Bhg. Tan Sri Dr. Salleh bin Haji Mohd Nor
Pro Chancellor
Universiti Teknologi Malaysia

Foreword by Dean of Faculty of Education UTM

Assalamualaikum w.b.t and Salam Sejahtera

Continuous teaching and learning improvement has always been our upmost priority at the Faculty of Education, University Teknologi Malaysia. With increasing concern over higher order thinking skills (HOTS) among all students in Malaysia. Faculty Education made an initiative to welcome all researchers from over the world to share their thoughts and research finding on ways to improve HOTS. In collaboration with Persatuan Pendidikan Sains dan Matematik Johor (PPSMJ), it is with great pleasure to welcome all participants to International Conference on Education and Higher Order Thinking Skills 2016 in conjunction with the 2nd International Seminar of Science and Mathematics Education. Higher Order Thinking Skills (HOTS) has been included as one of the important components of the Educational Development Blueprint Malaysia (PPPM 2013-2025). The Ministry of Education (MOE) states that the three main elements that need to be emphasized when executing HOTS include curriculum, pedagogy and assessment. In teaching Science and Mathematics, the role of HOTS is crucial towards improvng students' understanding about the fundamental concepts of Science and Mathematics. Higher order thinking skills plays the role of encouraging students to apply knowledge of Science and Mathematics in the real worl. Rote memorization and teacher-centered learning can no longer fit into the picture because it widens the gap between HOTS and Science and Mathematics teaching.

Although many conferences were held discussing on the best ways to improve teaching and learning, we believe it is equally important to specifically discuss on methods to improve HOTS for Science and Mathematics learning by transforming ideas and innovating current practices. Hence, this conference provides a platform for teachers, academicians, researchers and educational psychologists to present their innovative ideas, research finding, current development in national educational system, curriculum development, creative and innovative teaching practices and pedagogical assessments related to HOTS.

In line with our clients' charter which is always ready to find and disseminate knowledge creatively through friendly, efficient and ethical services for the prosperity of the people, it is with high hope that this conference will be able to achieve our initial objectibe of 'Transforming Minds, Generating Innovation' in Science and Mathematics learning through HOTS. For making this conference a great success, I would like to take this opportunity to congratulate the organizing committee for their hard work. I also look forward to having fruitful discusstion with fellow participants. On behalf of Faculty of Education, I wish that this conference will be a beneficial one, particularly to improve teaching and learning for Science and Mathematics through HOTS.

Thank you,

Baha

Prof. Dr. Baharuddin Aris
Dean
Faculty of Education Universiti Teknologi Malaysia

Foreword by Chair of Persatuan Pendidikan Sains dan Matematik Johor (PPSMJ)

Assalamualaikum w.b.t and Salam Sejahtera

It gives me great pleasure and honor for me to address you in conjunction with the ICE-HOTS conference in this year. I would like to say that PPSMJ is very pleased to be associated with this significant and timely International Seminar of Science and Mathematics Education 2016 (ISSME). It would like to extend my warmest to welcome all participants to this international conference. The main objective of this conference is to provide a plateform for both local and international academicians to share their research regarding Higher Order Thinking Skills (HOTS). This conference will help to disseminate current development about HOTS in the national educaiton system. In additon, this conference could serve a platform for teachers to share their implementation of HOTS through pedagogical assesments and other aspects at the school level. As science and technological changes shape the intellectual the future outlook of today's students, schools and colleges have begun to realize the need to instill higher order thinking skills (HOTS) among their students.

As we find ourselves in the middle of a science and technological transition, it is no longer enough fir students both at the school and university lebels simply to know basic facts and skills. To be successful in the entire teaching and learning, students must master HOTS such as decision making, prioritizing, strategizing and collaborative problem solving. It may be said that there is no one right way to teach or assess higher order thinking skills, but the literature suggests that the effective teaching approaches require active students' involving instead of didactic teaching practices to promote and facilitate higher order thinking skills. Teaching approaches that focus on content rather than the process do not facilitate higher order thinking skills. Teaching strategies such as project oriented, problem-based learning, cooperative learning, concept-mapping, and debates have been reported to help because these strategies help engage students in their learning processes and can foster their higher order thinking skill dispositions. Therefore, higher order thingking skill is a must have skilss for analyze complex data, evaluate situations and actions, and implement the most appropriate actions to make decision.

I hope this conference provides unique opportunities for lecturers of both local and international institutes of higher education, schools teachers, undergraduate and postgraduate students from various disciplines in education, policy makers and academicians to improve your understanding of higher order thinking skills. Further this understanding will be used as guidelines in preparing students to be successful learners and contributors in 21st Century.

I sincerely hope this cinference will achieve its objectives and that you will find this conference will a fruitfull one. Most of all I hope you will enjoy this conference as much, if not more, as we enjoyed in orginasing it.

Have a good conference.

Thank you

Prof. Dr. Noor Azlan Ahmad Zanzali
Chair
Persatuan Pendidikan Sains dan Matematik Johor (PPSMJ)

Foreword by Director of ICE-HOTS In Conjunction With 2nd ISSME 2016

Assalamualaikum w.b.t and Salam Sejahtera,

On behalf of the Organizing Committee, we would like to welcome all presenters and participants to the International Conference on Education and Higher Order Thinking Skills 2016 in conjunction with the 2nd International Seminar of Science and Mathematics Education 2016 (ICE-HOTS In Conjunction With 2nd ISSME 2016).

This conference is jointly organized by Faculty of Education, Universiti Teknologi Malaysia (UTM) and Persatuan Pendidikan Sains dan Matematik Johor (PPSMJ). ICE-HOTS 2016 in conjunction with 2nd ISSME 2016 is very special because it is the first conference in Malaysia which gives opportunities to academicians and researchers to share their knowledge, experience and research findings about Higher Order Thinking Skills (HOTS) and other issues on education. As we know, HOTS has been introduced in Malaysia Educational Development Blueprint (PPPM 2013-2025) in order to equip students with attributes which can make them to be globally competitive. Therefire, this intellectual discourse will generate and disseminate views about our progress so far in the implementation of HOTS in the educational system.

We would like to thank our distinguishe keynote speaker, reviewers, presenters and all participiats for their contributions in making this cconference a success. Lastly, we would like to express our gratitude to the dedicated organizing commeittee, members of Faculty of Education UTM and those who have directly snd indirectly given their support in making this conference a realiy.

Thank you

Dr. Abdul Halim Abdullah
Director
(ICE-HOTS in Conjunction With 2nd ISSME 2016)

Development of Interactive Multimedia on General Physics I for Physics Prospective Teachers

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Abstract

The purpose of this research was to develop interactive multimedia based visual learning style on General Physics I course. The characteristics of interactive multimedia consists of presentation, text, video, simulation, animation by adapting the visual learning style of students..This research used research development model 3-D, namely, Define, Design, and Develop. The details of the stages were: (1) the literature review and need assessment, (2) formulation of competences indicators, (3) formulation of learning model, (4) formulation of the IM design, (4) the development of story boards, (5)obtaining relevant files, video, graphics/animation, and audio production, (6) authoring and debugging, (7) validating by 3 experts and giving questionnaire to student. Preliminary study results indicated that learning process in general physics I course tend to emphasize mastery of physics concepts mathematically and do not adapt student learning style difference. Validation results revealed that the developed interactive multimedia design was valid and results of student questionnaire showed a good responses. It should be concluded that the interactive multimedia was feasible and suitable to be implemented in General Physics I course.

Keywords: Interactive multimedia, visual learning style, general physics I, prospective teacher.

Introduction

Physics is one part that can not be separated from science and also contribute to the development of technology. Results of preliminary research, shows that the fact of physics is still unpopular even considered difficult and tiresome. There are several reasons students have difficulties in understanding and studying the physics of them, concepts that are abstract and difficult to observe commonly found in teaching physics, example, the cargo molecules move in tubes containing gas (gas Kinetic Theory concept). Basically, children learn through concrete things. To understand an abstract concept that children require concrete objects (real) as an intermediary, or visualizations. Also preliminary study results indicate that in the study of General Physics I, students have difficulties in understanding the concepts that are abstract and microscopic because unavailability of adequate media to visualize these concepts. Available media only in the form of a power point text and images that not adapting student learning style differences. In order to make concepts of General Physics I easily to understand by students its necessary to innovate in advanced physics course. One of this innovation in the lecture that integrate information and communication technology in the interactive multimedia, according to: (a) Interactive multimedia could increase the based physics concept understanding; (b) Increase the understanding concept of prospective physic's teacher, solve the student's based physics misconception; (c) Increase the critical thinking skills and generic science skills; (d) Succes of interactive multimedia in based physics lectures because of students be more active and autonomous. A lecture needs to realize that the communication process does not always run smoothly, even the communication process can

lead to confusion, misunderstanding and even lead to wrong concepts. To overcome these difficulties, the need for learning media as a form of simplification or modeling of abstract concepts, so that the concepts presented more real and can be observed. Computer media is a medium that can be used to evaluate the material or abstract concepts. Using multimedia (audio-visual) can display not only the graphics, but also display images, sound animations, video and text of the subject matter, which can represent abstract physics problems. Use of Multimedia computers can stimulate student interest in a subject matter, but it is the nature of interaction allows students play an active role. Multimedia is a term frequently heard and discussed among educational technologists today. Unless clearly defined, the term can alternately mean "a judicious mix of multimedia such as print, audio and video" or it may mean the development of computer-based hardware and software packages produced on a mass scale and yet allow individualized use and learning. In essence, multimedia merges multiple levels of learning into an educational tool that allows for diversity in curricula presentation. Every display on the program, there are a combination of several components. The components can be text, image (image), tables, graphs, animations, or sounds. (a) The text is the basis of word processing and multimedia-based information; (b) Image, is used to make the information more attractive, helping recall information learned, help understanding of matter and as visualization; (c) Animation / Video, are used in this program, made using Macromedia Flash, so the smaller size of the animation, because the picture is vector image format. In this program, the animation is a visualization of the events described in the material (textual). There are two kinds of animation is used, ie linear animation running (e.g flight animation landing), which run without any user input and run repeatedly. The second animation is animation that requires input users, the animation speed and average speed. Animation in this program is useful for visualizing events rarely encountered in daily life and events that difficult illustrated by the simulation in the laboratory; (d) Voice, which aims to increase understanding of the concept, but it sounds should be regulated (turned on or off), and sound to be heard clearly and effectively used; (e) Menu button and icon. In this program Many diagnostic program is available in a wide selection and menu button icons, navigation buttons (such as the back button, go, get out and others). The function buttons for navigation, to move from one display to other display; (f) Interface Design of interface design is based on flow charts that have been planned, it can be argued that, for transitions between screens will makes switching among screens become more attractive. It can be seen on the main menu and appetizer.

Methodology

The research utilized the three stages of 3-D model according to Thiagarajan et al which consists of; define, design, and develop. The stages were detailed in accordance to the development of multimedia projects by Ivers and Baron shown in Figure 1.

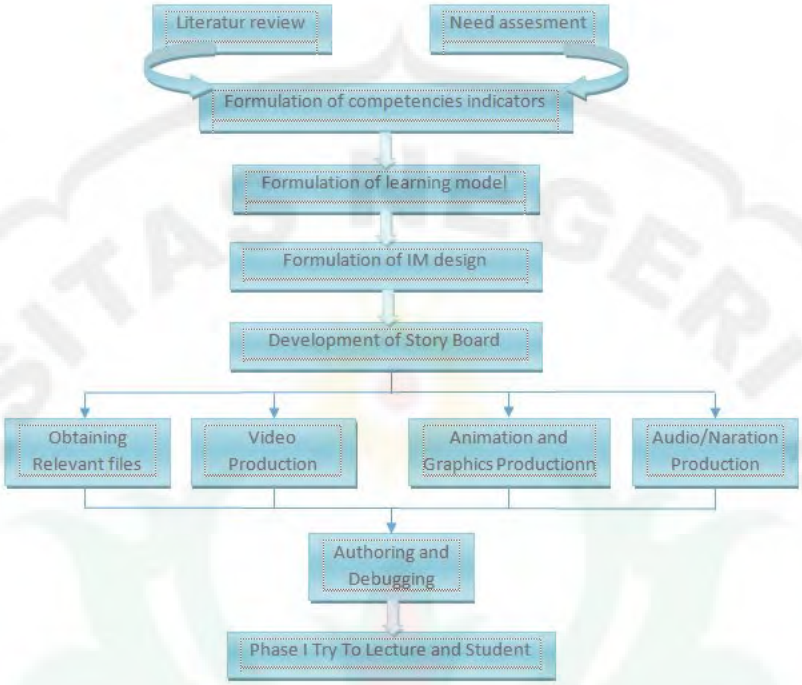

Figure 1 Research steps

At stage of the needs analysis to be carried out searches of information related to the condition of students, faculty and university will be a sample. In order to obtain such information will be performed observations and interviews. Which is desirable in needs assessment needs analysis is the need to program interactive multimedia in CAI form. Multimedia is a combination of text, photo, graphic art, sound, animation, and video elements are digitally manipulated. The needs of students of the program developed, learning environment, obstacles courses, general and specific objectives, assessment items. They will also be carried out analysis of learning materials subject in General Physics I to be presented via a web-based electronic module, a literature review conducted for the temporary introduction of the product to be developed. The study of literature on this research with theoretical studies that examine relevant theories so that it can be used as the basis for development. The study of literature is also necessary to know the measures most appropriate in the development of a product. An educational products possibility is not entirely new. Similar products or similar products have been developed by other developers in other places. Those things are studied through the study of literature in the form of documents of physics learning research results or results-based interactive multimedia. At the planning stage, by planning some aspects of learning. Ranging from determining the competency standards, basic competence, compiling indicators and learning objectives, learning rearrange according to the media that will development, prepare a storyboard to compose web-based electronic module. Next will be validated by experts and expert media material in a single instrument, and validated by the students of a number of 40 people.

Result and Discussion

After the designing of the IM display, the IM scenario in the form of story boards was created. The creating of the IM's story board considered constructivist learning. In general, the story board is designed to follow: introduction of the concept, quantitative or qualitative activities by user to discover the attributes of concept, mathematical formulation of the concept, examples of solving problems involving the concept, and problem-solving exercises.

Based on the scenarios, the development phase conducted which includes searching and selection IM files and java applets that have developed other researcher, video production, graphics production and animation, and audio production. After that, files, text, video, animation, graphics, and audio were integrated into IM, by means of an authoring program and ensure IM produced was running well. Macromedia Director MX 2004 program was used to authoring the IM, with the consideration of the program can display extension-JAR files, as well as has flexibility like Macromedia Flash MX 2004.

Validation of Program

Description of learning, story board and theoretical design of e-learning consulted with experts (judges) to be validated. Results of the validation data analysis expert summarized in Table 1, and interactive multimedia display quality and completeness of its features include both categories. The assessment of interactive multimedia program is valid and feasible to use in research.

Table 1 Results of Validation of Interactive Multimedia Program

No	Aspect	Validator			% of ideal	Value r-pearson	Conclusion
		V1	V2	V3			
1.	Subject matter in Interactive Multimedia						
	1. The rate of material conformity with the syllabus	4	3	4	91,67	0,98	Valid
	2. The scope and depth of the material in interactive multimedia program	3	3	4	83,33	0,64	Valid
	3. The order and systematics material the theory kinetic of gases theory of gases	4	2	4	83,33	0,98	Valid
	4. Practising ways of solving the problem	3	3	4	83,33	0,64	Valid
	5. The material is easy to understand	3	3	4	83,33	0,64	Valid
	6. Linguistic posts	4	2	3	75	0,76	Valid
2.	Technique						
	1. Ease of navigation links	4	2	3	75	0,76	Valid
	2. Regularity of the relationship between the nodes (nodes) with a link (link)	4	2	3	75	0,76	Valid
	3. Readability of text	3	3	4	83,33	0,64	Valid
	4. The quality of the image display	4	3	4	91, 67	0,98	Valid
	5. Animations displayed can be accessible	4	3	4	91,67	0,98	Valid
	6. Accessible simulation	3	3	4	83,33	0,64	Valid
3.	Presentation						
	1. Ease of students accessing tasks and solve problems	4	2	3	75	0.76	Valid
	2. Attractiveness of the program based on the display image and corresponding color	3	3	4	83,3	0.64	Valid
	3. Satisfaction students enjoy the interactive multimedia program	3	3	4	83,3	0.64	Valid

Based on the results of expert validation for interactive multimedia display quality and completeness of its features include of categories. The validity assessment of interactive multimedia program is valid and feasible to use in research. Scores tabulation of the matter, technique, and presentation of interactive multimedia program is shown in Table 2. And anova test results for validity result is shown in Table 3.

Table 2 Scores Tabulation of Interactive Multimedia Program

Element	Score			
	1	2	3	4
	0	1	9	8
Technique	0	2	9	7
Presentation	0	1	5	3

Table 3 Anova Test Result for Validty Result

	Number of square	Matter	Average of square	F	Sig.
Inter group	13.500	2	6.750	.520	.611
in Group	116.750	9	12.972		
Total	130.250	11			

From the above table can be seen the value of comparisons between groups with variance in the groups (F) by 0:52. This value is then compared with the value of F table with 2 numerator and 9 denominator. Based on these it can be seen that the value of F table for α = 5% was 4.26. Since F count is smaller than the value of F table, so hypothesis H_0 should be received. Thus, there is no difference between the average material, technical and presentation of the interactive multimedia program. Finkelstein *et al* identified interactive multimedia simulation characteristics that supports the learning of physics students; (1) an engaging and interactive approach; (2) dynamic feedback; (3) a constructivist approach; (4) a workspace for play and tinkering; (5) visual models / access to conceptual physical models; and (6) productive constraints for students. Based on utilization of IM researches, it can be identified that IM in General Physics courses could improve the understanding of basic physics concepts, increase the mastery of concepts of physics teacher candidates. tackle basic physics student's misconceptions, improve critical thinking skills of prospective teachers of physics and physics teacher, as well as generic skills in science teaching physics. IM worked in Introductory Physics courses because students are more active and independent, the IM computer animation can visualize abstract processes that are impossible to see or imagine, capable to repeat serving required information, given students the freedom to choose and track materials, and student was guided to learn, think, discover and construct knowledge independently through interactive questions presented by the rapid response. Based on the above descriptions, the research focused to know how the development of IM on General Physics I course for prospective VHS teachers, how feasibility of the IM developed, and how student responses to the IM developed. After the designing of the IM display, the IM scenario in the form of story boards was created. The creating of the IM's story board considered constructivist learning. In general, the story board is designed to follow: introduction of the concept, quantitative or qualitative activities by user to discover the attributes of concept, mathematical formulation of the concept, examples of solving problems involving the concept, and problem-solving exercises. Based on the scenarios, the development phase conducted which includes searching and selection IM files and java applets that have developed other researcher, video production, graphics production and animation, and audio production. After that, files, text, video, animation, graphics, and audio were integrated into IM, by means of an authoring program and ensure IM produced was running well. Macromedia Director MX 2004 program was used to authoring the IM, with the consideration of the program can display extension-JAR files, as well as has flexibility like Macromedia

Flash MX 2004 has. For the IM testing purposes, the population was all prospective of VHS teachers in physics education, at a state university of Medan. The sample selected by cluster random sampling technique. The tryout is try out I was used to determine how students respond to the IM that have been produced and to determine the feasibility of the IM from the users (students), by means of questionnaire. Expert judgments carried out by physics education expert, IM expert, IM learning specialist, and learning technologist. Expert judgments conducted by rubrics that developed by adapting the multimedia project evaluation rubric by Ivers and Baron. To devices that have been developed, captured response experts, professors, and students, the results are as follows: (i) based on a questionnaire completed lecturer: learning device developed very helpful lecturers and provide convenience to the lecturers in creating interactive multimedia-based learning and student-centered ; (ii) obtained a response that the device developed meets the indicators of contextual learning. According to the assessors, the prominent characteristics of the devices that have been developed: emphasis on application to the real world, pay attention to the diversity of abilities and learning styles of students, develop high-level thinking, pay attention to students' prior knowledge, and support the realization of a democratic atmosphere and interactive learning; (iii) based on the questionnaire responses of students: learning to use a device that has been developed on average make 75% of students enjoy learning physics, 21% mediocre, and 4% (around 1-2 students) do not happy. Prominent reasons written by students who are happy studied physics: many visual lab, many get a chance discussions, opinions, and ask a friend or lecturer, increase knowledge, understanding linkages physics with everyday life, and many find things. The new who have never or rarely experienced. Furthermore multimedia can help learning. When students were taught through, both direct conventional method & interactive multimedia method than it was found that the acquired retention was better in case of interactive multimedia method. Using multimedia modules to better prepare students for introductory physics lecture. In addition, Yahya *et al* found that interactive multimedia based learning developed conceptual understanding, generic science skill, and critical thinking skill. The study result by Viajayani *et al* showed that using learning media macromedia flash pro 8 in physics learning about heat and temperature can increase the students' achievement. Hadi's study result showed that learning process using computer can increase student outcomes. Meanwhile Bennet & Brennan found that interactive multimedia shows a high degree of acceptability with our study group, any practical application must have a meaningful accessible component and be fully integrated into the lecture series, as opposed to being offered as a study resource alone. Study result by Dow Su & Chuan Yeh found that animation units were well-organized and helpful for most college students' effective physics learning. It would significantly make a positive contribution to students' physics learning attitudes.

Conclusion

The research utilized the three stages of 3-D model according to Thiagarajan *et al* namely, define, design, and develop. The stages were detailed in accordance to the development of multimedia projects by Ivers and Baron, namely: *1) Preliminary study, 2) Planning, 3) Develop preliminary form of product), 4) Preliminary field test*. In this study, carried out steps 1-4 because of the limited number of researchers. The assessment of interactive multimedia program is valid and feasible to use in research, based on assessment of expert that aspects of interactive multimedia programs are valid. Furtheremore there is no difference between aspects of interactive multimedia programs as though that the average material, technical and presentation of the interactive multimedia program is equal. The characteristic of learning model through interactive multimedia programs are designed for the

purpose of learning improve problem solving skills, logical thinking skills, and understanding of the concept.

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