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Design and development of Webquest for Physics Module by employing Isman Instructional Design Model

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Abstract

The study was aimed at designing and developing a web-based teaching courseware, Webquest, for secondary school Physics module by employing the Isman Instructional Design Model and to test the effectiveness of the module. The paper draws attention to the design principles of the Isman Instructional Design Model. The prototype module was tested among a teacher and 4 students. The findings from interviews with the teacher and students show a positive response in attracting the students’ interests toward the topic. The module was then implemented with 30 participants. In the evaluation phase, students’ achievement score instrument was used to collect data for this study. The pre-posttest design conducted suggested that the module is effective. The findings from this study suggest that the Isman Instructional Design Model which pays attention to instruction from the learner’s perspective than from content perspective is suitable in designing and developing Webquest for Physics module in the secondary educational setting in Malaysia. The findings of this study are expected to provide insights into promoting teaching and learning of Physics based on Webquest.

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Keywords: Isman Instructional Design Model; Webquest

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Introduction

Technology is used in education for two main reasons: as a tool for increasing the effectiveness of instruction and to integrate technology into the curriculum (Gülbahar, Madran, & Kalelioglu, 2010). A webquest is a research activity that requires the learner “to collect information about a subject using the web” (Sharma & Barrett, 2007, p. 24). Webquests are a very common way of using Web resources to research a variety of topics, and if appropriately used can trigger the situations necessary to develop both written and oral communication (Laborda, 2009). Recent studies have indicated that Webquest has a very high potential as a tool in teaching and learning (Alshumaimeri & Almasri, 2012; Laborda, 2009; Segers & Verhoeven, 2009), enhancing students’ potential (Allan & Street, 2007; Zacharia, Xenofontos, & Manoli) and creating a positive learning environment (Allan & Street, 2007; Chang, Chen, & Hsu, 2011; Kleemans, Segers, Droop, & Wentink, 2011).

Webquest is a relatively new tool for teaching and learning. The model of Webquest was first developed by Dodge (1997) which consists of six components: introduction, task, information, process, evaluation and conclusion. WebQuest, which makes students access the web to complete a task or solve a problem, elicits higher-order thinking rather than simple information searching and recall (Gülbahar et al., 2010). Research done by Allan and Street (2007) on the impact of a knowledge by pooling WebQuest in primary initial teacher training, shows that WebQuest has the potential to promote high order learning within different disciplines in higher education. It also creates a new environment in learning. Most of studies on Webquest used quasi-experiment as the research design (Alshumaimeri & Almasri, 2012; Chang et al., 2011; Halat, 2011; Segers & Verhoeven, 2009; Hsiao, Tsai, Lin & Lin, 2012), while only a few on design and developmental research (Gülbahar et al., 2010; Norazah Nordin & Ngau Chai Hong, 2009).

Gülbahar et al., 2010 developed a web-based interactive system, Web Macerasi, for teaching-learning and evaluation purposes, and to find out the possible effects of the system. The study has two stages. In the first stage, a WebQuest site was designed as an interactive system in which various Internet and web technologies were used for infusing technology into the teaching and learning process. The Web Macerasi site was used for project work by 92 prospective students who attended different courses in different years. For collecting the students’ perceptions about the implementations of the system, a questionnaire of WebQuest effectiveness and a focus group interview guide were developed. Next, the first phase of the study was concluded, and the WebQuest system was updated based on the data gathered from students. In the second phase, 27 students from a different course used the system, and their perceptions were collected through the questionnaire and analyzed. It was found that the students favored the technology-supported media, were more willing to collaborate, found the feedback very useful, and agreed on the positive contribution of planned works. Consequently, the WebMacerasi site was found to be successful and to have been used effectively in terms of its aims.

The same scenario operates in Malaysia as only a few studies have focused on the design and development of Webquest. Norazah Nordin and Ngau Chai Hong (2009) developed a WebQuest for ICT secondary school subject. The main objective of the study was to develop teaching aids based on webquest and to evaluate students’ perception towards it. Questionnaires were used to evaluate between face aspect and teaching and learning content structure of the WebQuest developed. The results of the study shows that the overall presentation of the WebQuest entitled Computer System is suitable and interesting for teaching and learning of the subject. It can be implied that Webquest has potential as a tool in teaching and learning. However, not much literature on Webquest has explored its potential in the design and development of Webquest for Physics module. Hence, this study was aimed at designing and developing a Webquest for Physics module in secondary educational setting by using Isman Instructional Model and to test the effectiveness of the WebQuest module.

2. The Aim of Research

The aim of this research is to design and develop a WebQuest Physics module according to the Isman Instructional Design Model in the secondary educational setting and to test the effectiveness of the module. In order to achieve this aim, we set two research objectives. The first objective is to describe the
design and development of a Webquest module by employing the Isman Instructional Design Model. The second objective is to test the module effectiveness by pre/posttest design and interviewing 4 students.

This study seeks to answer the following research question:

• Is a WebQuest Physics module developed by employing the Isman model effective?

3. 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 WebQuest module in the secondary educational setting in Malaysia.

4. Scope and Limitations

In this study, a sample size of 30 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.

5. Instruments

The 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.

6. Theoretical Framework

6.1 Employing Isman Instructional Design Model in Developing of a Physics Module Based on Learning Style and Appropriate Technology

The major goal of the Isman Instructional design Model is to show how to plan, develop, implement, evaluate and organize full learning activities effectively to ensure competent performance by students (Isman, 2011). The theoretical foundation of the new model comes from behaviorism, cognitivism and constructivism views. Firstly, Isman (2011) used relationship 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 information into long term memory, hence instructional activities are designed in this model. The 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. Norlidah Alias and Saedah Siraj (2012) employed the Isman model effectively in the design and development of Physics module based on learning style and appropriate technology in the Malaysian secondary educational setting. Hence, the researchers aim to employ Isman model in the design and development of WebQuest Physics module 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)
6.2 Steps in the Isman Instructional Design Model

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 WebQuest module based on six components of the WebQuest: introduction, task, information, process, evaluation and conclusion.

The expert panel consisted of five individuals, two Physics master teachers, one ICT master teacher, a Professor in Physics Education and a head of department of curriculum and ICT in a local university. The experts review suggested that a WebQuest Physics module be developed on two topics on gas laws such as “Charles’s Law” and “Boyle’s Law”.

An example of WebQuest Physics module is as shown in Figure 2 and Figure 3.

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 Webquest Physics module produced.

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**Figure 2**: Main Page of Online Module of Webquest 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 a teacher and 4 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 WebQuest Physics module is documented in work logs as illustrated in Table 1:

Table 1: Use of Isman model to design and develop a Physics pedagogical module

<table>
<thead>
<tr>
<th>Steps</th>
<th>Work log</th>
<th>Descriptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1</td>
<td>Identify needs</td>
<td>Designing Physics module based on WebQuest</td>
</tr>
<tr>
<td>Input</td>
<td>Identify contents</td>
<td>Designing the webpage</td>
</tr>
<tr>
<td></td>
<td>Identify goals-objectives</td>
<td>Designing six components of the WebQuest: introduction, task, information,</td>
</tr>
<tr>
<td></td>
<td>Identify teaching methods</td>
<td>proses, evaluation and conclusion were designed.</td>
</tr>
<tr>
<td></td>
<td>Identify evaluation materials</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Identify instructional media</td>
<td></td>
</tr>
<tr>
<td>Stage 2</td>
<td>Testing prototypes</td>
<td>Using expert panel to redesign the WebQuest website produced.</td>
</tr>
<tr>
<td>Process</td>
<td>Redesigning of Instruction</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Teaching activities</td>
<td></td>
</tr>
<tr>
<td>Stage 3</td>
<td>Testing</td>
<td>Implementing the WebQuest module with a teacher and 4 students.</td>
</tr>
<tr>
<td>Output</td>
<td>Analyze Results</td>
<td></td>
</tr>
</tbody>
</table>
Stage 4
Feedback
Revise Instruction
Revise the comments given by students and teachers.

Stage 5
Learning
Pre/posttest was conducted to test the effectiveness of the WebQuest module.

7. Results

The effectiveness of the WebQuestPhysics module by employing the Isman model was analyzed. Findings from the module evaluation conducted among 30 participants suggested that the module is effective. A t-test was performed to determine if there were significant differences in achievement scores between the groups. Table 2 shows the results of t-test comparison of pre/posttest achievement for the WebQuestPhysics module.

The effectiveness of WebQuest module developed using Isman model

Findings from module evaluation conducted among 30 participants suggested that the module is effective.

Table 2: t-Test comparison of pre/posttest achievement towards WebQuestPhysics module

<table>
<thead>
<tr>
<th></th>
<th>Pretest (n = 30)</th>
<th>Posttest (n = 30)</th>
<th>t-value</th>
<th>p</th>
<th>Effect size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>52.07</td>
<td>55.03</td>
<td>5.55</td>
<td>&lt; .05</td>
<td>0.69</td>
</tr>
<tr>
<td>SD</td>
<td>18.18</td>
<td>16.58</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 2 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 toward the WebQuest Physics module than pretest.

8. Implication and Conclusions

This paper has described an effort to design and developed a WebQuest Physics module in the 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 learners. It indicates that the Isman instructional model was implemented successfully in the design and development of the WebQuest Physics module in the Malaysian secondary educational setting. The outcome of this study will hopefully enhance the process of teaching and learning Physics in secondary educational setting by utilizing WebQuest.

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References


