

# The Evaluation And Using Intention For Digital Teaching Materials Of Penghu Basalt

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## ABSTRACT

*The Bureau of Culture of Penghu County produced the Penghu Basalt Digital Teaching Materials, which are supplementary teaching materials for local curriculums in elementary and middle schools in Penghu County. But just what are the teachers' and students' opinions of the said teaching materials? Are they willing to use them? Are they suitable? These questions are, indeed, worth further research. The questionnaire survey was conducted to gather the opinions of 142 teachers and 151 students of elementary and middle schools in Penghu County. In addition, using the quasi-experimental and experimental teaching methods, after comparing the pre-test and post-test results to the control group, the learning effectiveness was determined. The results indicate that teachers and students have the highest evaluation for the interface design aspect of this teaching material. The teachers' evaluation for the teaching materials is significantly higher than the students'. Furthermore, the teaching materials are evaluated highly in terms of attracting attention, generating interest and willingness to use, indicating that the digital teaching materials have potential for promotion in Penghu. After the experimental teaching, only the vocational high school students' scores before and after the experiment showed significantly improvement, while the scores of the students in the other levels of schools did not.*

**Keywords:** Penghu Basalt, Digital Teaching Materials, Local Teaching Materials, Elementary and Middle Schools

## INTRODUCTION

The Penghu archipelago is situated in the Taiwan Strait and runs through the Tropic of Cancer. The archipelago is mostly made up of basalt lava flows and sedimentary rocks or clay layers. After extended weathering and erosion, the topography is often seen as square-shaped mountains, while the coast has columnar jointed basalt walls and cliffs, forming a special geographical and topographical landscape. In 2002, Taiwan's Council for Cultural Affairs selected the Penghu archipelago, with "*The Penghu Basalt Nature Reserve*" as one of the potential "*world heritage sites*" (The Council for Agriculture, 2004).

If we can include the magnificent wonders of Penghu basalt in the common heritage of the country, we can make them assets of all humankind. But what are the Penghu basalt geology, topography and development of the time and space structures? What value do the geology, topography, and landscape behold? How can we shape them into more valuable resources with local characteristics? These ideas should be established early in life. Modern information technology incorporated into teaching has become a useful tool for new teaching media, particularly computer network multimedia, in motivating student learning; it also allows students to engage in more active, individualized and diversified learning. Therefore, C-H. Lin and W-C. Lin, two teachers, were requested to write a script and the Dian Fan Digital Technology Company developed "*The World Wonders - Penghu Basalt digital Teaching Materials*," which are supplementary teaching materials for the local curriculums allotted in elementary and middle schools in Penghu County. The content is designed for elementary and middle school students. The physical environment of Penghu, as well as the definition, features, formation and appearance of the basalt, are introduced. In addition, the cultural relations between the basalt and public life are explained. Then, assessments and puzzle games are included to deepen understanding and their effectiveness of learning. The contents include:

introduction of Penghu; introduction of basalt; basalt and culture; basalt and life; the play stone creative area; the learning stations (The Bureau of Culture of Penghu County, 2005). The materials will train young children in Penghu to love their land, environment, culture and humanity and foster the right attitudes, thereby protecting the unique tourism resources in Taiwan. However, the teaching materials are solely based on the perspectives of the developers. How do the elementary and middle school teachers and students see them? Are the teachers and students of elementary and middle schools teachers interested, or are they willing to use them? What is the effectiveness of these materials? All of the above-mentioned are the motives for this study.

In fact, the purpose of this study is to explore the elementary and middle school teachers' and students' evaluations, desire to use, as well as the learning effectiveness of the "*Penghu Basalt digital Teaching Materials*."

## **LITERATURE REVIEW**

In traditional teaching, teachers are the main transmitters of knowledge, while students are passive receivers; but with the increasingly sophisticated network information, the role of teachers has gradually changed. The teacher has become the students' guide instead of being only the knowledge provider (Ariga & Watanabe, 2008). In this sense, the Internet may provide some assistance and it may generate new learning models. In addition, the digital learning environment focuses more on the "learning" rather than the "teaching" activities in teaching (Lee, 2000). Khan (1997) pointed out that the most important characteristics of web-based instruction are that it is interactive; it also features multimedia presentations of teaching materials, open systems, online searches, platforms that transcend time and space, global sharing, and learner control. In this environment, teachers may put up pre-designed teaching materials on the web through multiple methods. The learners can then, at their own pace, browse the teaching materials at any time and place. The teachers and students may also, through the video conference mechanism, communicate and clarify problems face-to-face. With the far-reaching network characteristics, learners from different places can participate in learning activities via the Internet. The learning environment has, therefore, extended from physical to virtual, and the teachers' teaching modes and the students' learning methods are broadened. Through multimedia technology presented in forms of text, images, graphics and voice, the students' curiosity is expected to be elicited, and they will be able to engage in more active, individualized and diverse learning. Furthermore, Yang, Lai & Chen (1997) believe that a good digital learning environment must be able to satisfy the needs of both teachers and students. At the same time, it has to have sound classroom and teaching material arrangements to enhance learning effectiveness. Liang (2002) pointed out that the curriculum design of web-based instruction should adopt the following teaching evaluation criteria: to meet the basic specifications of web-based instruction, including: to observe and record student learning behaviors and assess the students' performance (objective), to ensure that students find the online learning activities pleasant and gratifying (subjective), and to reduce cheating behaviors.

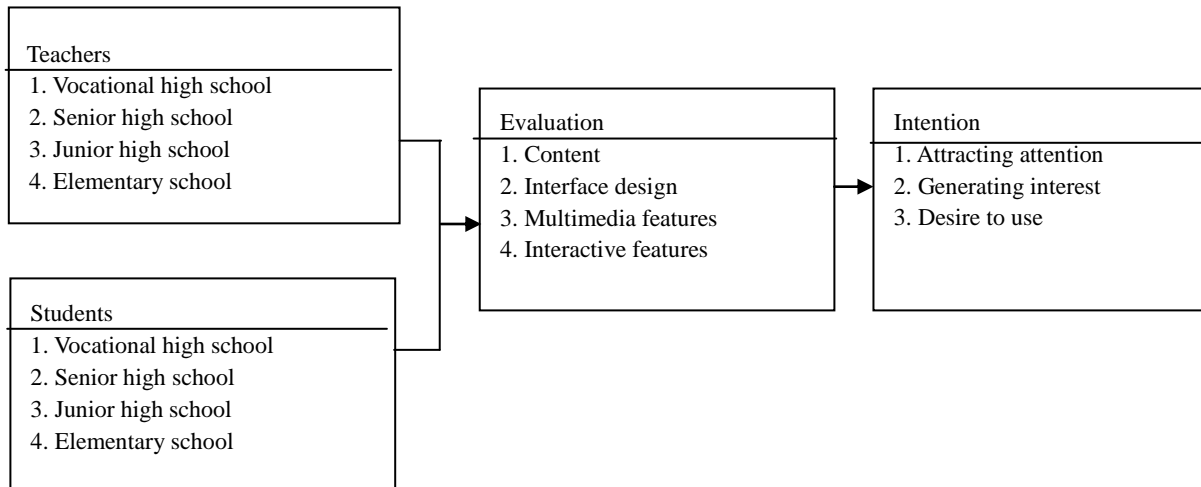
Digital teaching materials must meet the needs of the students, while the teachers must strengthen their information literacy (Cheng, 2001). The teachers must re-examine the contents of traditional teaching materials and add to and present them as digital teaching materials. Moreover, some websites provide curriculums or teaching materials that are more passive; the interactive strategy used is essential to generate "learning." Thus, the teachers' teaching strategy is also crucial (Huang, Yang, & Huang, 2001). Wu (2000) believes that digital learning can be divided into five aspects: 1) richness of the teaching material design, 2) interactive curriculums, 3) student management, 4) students' information literacy, and 5) system and web quality.

Based on the above-mentioned literature, the elementary and junior high school teachers' and students' evaluations of the "*Penghu Basalt Digital Teaching Materials*" will be discussed from four dimensions: 1) teaching material content, 2) interface design, 3) multimedia characteristics, and 4) interactive characteristics. In addition, the desire to use is discussed from the theory of consumer behaviors in the process of switching to a new product, which includes A (Attention), I (interest), and D (desire).

**RESEARCH METHOD**

**The Research Framework**

The research framework of this study is shown in Figure 1. Through the questionnaire survey, the evaluations of the teaching materials, in terms of content, interface design, multimedia features, and interactive features by the elementary and junior high school teachers and students of different grades, are found in order to determine whether or not these teachers and students are willing to adopt the teaching materials as supplementary teaching materials in the local teaching curriculums. In addition, a comparison was conducted to compare the differences in the teachers’ and students’ evaluations of the teaching materials and their desire to use them.



**Figure 1: Research Framework**

Then, through the quasi-experimental approach, the teaching experiment was conducted. The experiment design is shown in Table 1.

**Table 1: Experiment Design**

Group	Pre-test	Experimental Treatment	Post-test
Experimental Group	O1	X	O2
Control Group	O3		O4

**Questionnaire Development and Design**

Based on the related literature reviews, the researchers conducted discussions of the draft of the “elementary and middle school teachers and students’ evaluations of the digital teaching materials and their desire to use them” questionnaire. The questionnaire was completed after passing review by senior researchers. The questionnaire has content validity.

The questionnaire content includes four aspects: 1) the teaching material content, 2) the interface design, 3) the multimedia features, and 4) the interactive features. There are six questions for each aspect and three questions for the desire to use. The 5-point Likert scales are adopted for measuring the questions. The teachers and students rated the questions from “highly satisfied”, which is represented by a score of 5, to “highly dissatisfied”, which is represented by a score of 1. A higher score means a higher degree of satisfaction for a particular assessment item on the part of the teachers and students. The Cronbach’s  $\alpha$  coefficient is used to measure reliability. Regardless

of the teaching material content, interface design, multimedia features, interactive features, or desire to use them, the  $\alpha$  values are all higher than 0.8. In addition, a copy of the worksheet was designed for the experimental group and control group to complete in order to find out whether there are differences in learning effectiveness between the used digital teaching materials and unused ones.

**The Implementation Process**

In terms of questionnaires for the teachers, the questionnaires were distributed to 32 schools by mail or delivery by the researchers. Five teachers for the relevant courses were randomly selected from each elementary and junior high school, and seven teachers were selected from each senior high school and vocational high school. A total of 174 questionnaire copies were distributed and 165 copies were return. After eliminating the invalid copies, a total of 142 valid questionnaires were collected, making the effective return rate 81.61%.

In terms of the questionnaire for the students, the senior high school and vocational high school students are all first-year, the junior high school students are second-year, and the elementary school students are fifth graders. Two classes were randomly selected from both the experimental and control groups. In terms of the number of people, for the vocational high schools, 35 are from the control group and 33 are from the experimental group; for the senior high schools, 31 are from the control group and 28 are from the experimental group; for the junior high schools, 42 are from the control group and 50 are from the experimental group; for the elementary schools, 39 people are from the control group and 40 are from the experimental group.

Before the experimental teaching, a pre-test was first conducted for the students to complete the examine-sheet, which contains questions from the worksheet in the original teaching material design in order to confirm whether or not the experimental and control groups have the same understanding and confirm whether or not the initial point of the experimental and control groups is equivalent before conducting experimental teaching. The experimental group underwent a post-test after the researcher explained the said teaching materials, and the students were asked to fill out the questionnaire and examine-sheet.

Only the students that have used the “*Penghu Basalt Digital Teaching Materials*” (the students in the experimental group) were asked to immediately fill out the evaluation and survey on desire to use the materials. A total of 151 students filled out the questionnaire. The 147 students in the control group only filled out the worksheet and took the pre-test and post-test.

**RESULTS**

In this study, the four aspects (teaching material content, interface design, multimedia features, and interactive features) were used to evaluate the *basalt digital teaching materials*. Table 2 shows that of the four, teachers and students gave the interface design the highest evaluation rating. Other than the fact that the teachers’ evaluation rating for the multimedia aspect was higher than the students’, the rest of the aspects have reached significant differences. In general, the teachers’ mean evaluation is 3.85 while the students’ is 3.65, which are both higher than 3.5. It indicates that the teachers and students of elementary and middle schools in Penghu County have quite positive evaluations for the teaching materials. Based on the t-value, the teachers’ evaluation of the teaching materials is significantly higher than the students’.

**Table 2: t-test of Evaluation by Teachers & Students**

Evaluation	Teachers		Students		t-Value
	M	SD	M	SD	
Content	3.85	0.46	3.59	0.93	2.96**
Interface Design	3.95	0.45	3.69	1.00	2.28**
Multimedia Features	3.80	0.48	3.65	0.97	1.71
Interactive Features	3.80	0.48	3.61	0.98	2.02*
Overall	3.85	0.40	3.65	0.89	2.44**

\*p<0.05 \*\*p<0.001

Furthermore, the mean values of “attracting attention,” “generating interest” and “desire to use” are all higher than 4.68. Teaching materials have the potential for development. The t-test results have shown that the teachers’ rankings are significantly higher than the students’.

Based on a comparison of the experimental group and control group for all school grades in the pre-test, none of them have reached significant difference at 0.05. Therefore, they are all regarded as the same and an experiment may be carried out. After experimental teaching, only the post-test score of the vocational high school group is 38.33, which is significantly higher than the 34.7 before the experiment. The teaching materials can enhance the learning effectiveness of the vocational high school students. The other school grades have not reached 0.05 significant difference.

## **CONCLUSION AND RECOMMENDATIONS**

There are several conclusions in this study. First, the teachers and students in Penghu County have the highest rating for the interface design aspect, while the teachers and students of elementary schools and middle schools in Penghu County have rated the teaching materials highly. Secondly, the mean values of the teaching materials in attracting attention, generating interest and desire to use are quite high, indicating the teaching materials have great potential for promotion. The teachers have obtained significantly higher mean values than the students, indicating they are all willing to introduce the digital teaching materials to enhance the effectiveness of local teaching. Next is the vocational high school students who achieved a remarkable improvement in the scores before and after the experiment.

Due to the conclusions, recommendations are provided. First, the teachers have generally accepted the digital teaching materials, but since the elementary and middle schools are under the jurisdiction of the Bureau of Education of Penghu County, it is suggested that the Bureau of Culture of Penghu County and the Bureau of Education of Penghu County be linked to actively integrate the teaching materials into the local teaching. Secondly, the study results have shown that the teachers and students in elementary and middle schools in Penghu County have positive evaluations of the teaching materials. It is proposed that the development units regularly maintain the website content and update it with the latest information. Thirdly, the study has found that the students’ favorite part of the teaching material content is the interactive game, so more interactive games can be added in future preparations of teaching materials. For example, the games played in the “Million Dollar Quiz” allow the students to learn without feeling bored. The students can also access textbook knowledge through games; they will enjoy learning and find pleasure in learning. Next, the experimental teaching results have shown that only the vocational high school students have achieved an improvement, the students of the other levels have not. It may be because a single set of teaching materials cannot satisfy the needs of all the students, or it may be due to the experimental manipulations. The underlying reasons are pending follow-up discussion and analysis by researchers. Finally, in this article, only the evaluation survey was conducted. Whether or not the teaching materials enhance student learning and the effectiveness of learning still requires follow-up teaching experiments and research by researchers in order to determine the learning effectiveness of students at all levels. Updates to the textbooks to make the teaching materials more practical and usable may be required.

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