

The effectiveness of combining weblog with project-based learning: a case study of the energy technology course at a junior high school

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ABSTRACT: The purpose of this study was to explore the effectiveness of combining Weblog with Project-based Learning (WPBL) in the Energy Technology course for freshman students at junior high school in Taiwan. This research was an eight-week quasi-experimental design. The research methods include quantitative and qualitative approaches. The research tools include the Learning Achievement Test (LAT) and Course Implementation Satisfaction Survey Questionnaire (CISSQ), along with responses from weblogs and learning. The findings of the study are: (1) WPBL can significantly enhance students' learning achievements; (2) students' learning satisfaction toward WPBL are high; and (3) the teaching model of WPBL developed by the researchers can be provided to teachers as a reference while teaching technology.

INTRODUCTION

With the advances in computer technology and convenience of Internet access, the traditional teacher-centred teaching mode is now outdated. Students can acquire knowledge through class lectures; nevertheless, by this method, students are incapable of utilising the skills they learned in solving problems in daily life [1]. Hsu pointed out that in the learning process of PBL, students' independent thinking and problem-solving skills should be cultivated [2]. According to Barak and Dori, it could be argued that PBL establishes a mechanism in terms of group working and problem solving [3]. However, teachers may have a difficult time in conducting PBL due to the lecture schedule, academic pressure and time limits of course arrangement. Furthermore, junior high school students are required to take the Basic Competence Test, with the interactions between teachers and students being insufficient due to the busy class schedule. Thus, PBL fails to be practised because teachers face great pressure from academics, the course schedule, and insufficient classroom and lecturing time. These reasons all hinder the conduction of PBL.

Weblog has become popular in recent years and it has been commonly used in that time. Elementary school teachers from Harvard University and the State of Maryland all incorporate weblogs in the courses as a tool for academic exchange and teaching. In Singapore, in order to accomplish the educational perspective goal *Thinking school, learning nation*, PBL combined with information technology was developed nationwide and great results were obtained [4].

Consequently, combining weblog with project-based learning (WPBL) is a potential teaching method that solves the problems of insufficient lecturing time. Plus, weblogs are equipped with the functions of reply, discussion and share, which increase interaction opportunities between teachers and students. This research article focuses on the effects of this WPBL teaching model on the energy technology course for junior high school students. This could be considered as a reference for teaching technology courses in the future.

PURPOSE OF STUDY

The purposes of this study are:

- To explore the effectiveness of WPBL in the energy technology course for junior high school freshmen;
- To analyse junior high school freshmen's learning satisfaction with WPBL;
- To develop the teaching mode of WPBL.

LITERATURE REVIEW

Compared with general Internet teaching methods, weblogs have advantages such as no time restriction, sparking learning interests, attracting more attention to concept learning and student-centred learning [5][6]. The utilisation of the weblog platform for teachers' supplementary tools will be a new trend and it has advantages [7]. Brownstein and Klein also suggested that establishing effective weblog rules include (1) ensuring the goals and specialties; (2) deciding who will be the main author; (3) creating the framework; (4) ensuring the teaching model; (5) deciding the content; (6) teaching students etiquette on the weblog; (7) modifying the weblog to meet the needs of the course [8]. Thus, teaching methods incorporated with a weblog include (1) the teachers' lecture Web site: teachers can post handouts or assignments on the weblog for students to do a preview, review and to hand in their work. Not only can the teacher's teaching history be recorded, students' learning spaces also could be expanded; (2) a platform for conversation: students are able to make enquiries without the limitation of space and time. Class discussion could be extended; the chances of discussion and negotiation are also increased; and (3) to display multifaceted evaluation: weblog is a place where students can hand in their assignments. Because students can upload words, pictures and multimedia files, their works can be shown in a more diversified way. Teachers can also carry out multifaceted assessments.

PBL consists of question discovery, data collection, discussion, answer verification and result sharing. As well, it is considered that PBL includes concept classification, information searching, enquiry, problem modification, planning and experimental design, experiment conduction, information analysis and result sharing [9][10]. In the PBL mode, a cooperative learning environment is offered, which leads to positive effects inclusive of developing knowledge sharing and independent learning skills, as well as cooperation and communication abilities [11][12]. However, when PBL is actually implemented in lecturing, disadvantages such as insufficient teaching equipment, time limits, the diminishing of regular class hours and a shortage of interactions are also discovered [13]. Consequently, it could be argued that if weblog can be applied to PBL and solve the problems resulting from PBL, the teaching result is expected to have tremendous potential and be worth researching.

RESEARCH DESIGN

Research Method and Subjects

The research was a one-group pre-test and post-test quasi-experimental design. The research subjects were 35 junior high school freshman students in Pingtung County, Taiwan, and were divided into 6 groups for conducting a three-hour experimental teaching session of *Understanding Energy and its Application* for 8 weeks. Project-based learning was mainly used for solar trolley-making related energy technology, and it was incorporated with a weblog platform for group discussion and information-sharing. Before the experimental teaching, a pre-test on the learning achievement of *Understanding Energy and its Application* was employed and the post-test was conducted one week after the experimental teaching followed by the course satisfaction questionnaire survey, class observation, weblog observation, students' discussions and responses, learning logs and teacher's reflection. All data were collected and analysed by qualitative approach.

Research Tools

- Yam weblog (<http://blog.yam.com>). It was used by group members for uploading text, pictures, and recording students' data, sharing information, discussion and learning logs.
- The Energy Technology Achievement Test: It was developed through referring to junior high schools' textbooks. The content is about the knowledge and application of energy. In addition to conducting the content validity, a total of 68 students participated in the pilot study. The Cronbach α was 0.841, indicating that the test obtained good validity and reliability.
- Project-based Learning Assessment Sheet: The content of the project was the making of a solar trolley car. The content and construction, group interaction, and performance of the actual product were evaluated and scored.
- Course Implementation Satisfaction Survey Questionnaire: The questionnaire contains two parts; the first part is demographical information, and the second part is course satisfaction. The course satisfaction part contains PBL course design, weblog tools and personal feeling toward learning. These three domains also obtained good validity and reliability.

Design and Conduct of the Experiment

The process of the design and conduct of the experiment is shown in Figure 1.

RESULTS AND DISCUSSION

Achievement Analysis

The pre-test and post-test on students' completion of the energy technology achievement test showed that the result reached statistical significance, where $t=-2.072$, $p<.05$. This obviously represents the differences between the grades collected from post-test and pre-test, which are 70.57 and 66.14 respectively. The average score of the post-test is higher than that of the pre-test; therefore, students agree that WPBL can promote their achievement in learning.

Satisfaction Analysis

Table 1 shows that most of the students consider it positive to use a weblog as an aid on a project. It also shows that they like to make a solar trolley car and other things related to the project. The qualitative data also show that a blog used as a platform for students to discuss and share their thoughts benefits them in raising their interests in learning and achieving.

Table 1: Statistics from questionnaire on weblog project-based learning.

Statement of Question	Mean	SD
<i>Phase I: PBL Course Design</i>		
I like the way of learning in this project course on <i>Energy Technology</i> .	3.94	0.684
The course design increases my interest in learning.	3.89	0.867
I can have further understanding of the research topic and other related knowledge through this project.	3.89	0.867
I think that the teacher explained clearly on how this course would go on.	3.86	0.879
I like the way of learning in this project of the solar trolley car.	3.94	0.998
I think this project is difficult.	3.23	1.031
<i>Phase II: Weblog Tools</i>		
I think weblog provides sufficient function.	3.46	1.010
I think the weblog we use this time is user-friendly.	3.74	0.950
I always spend lots of time inquiring how to use the features of the weblog.	3.40	0.946
To express my thoughts more clearly, I would make use of the feature of uploading photos or clips.	3.03	0.822
To exchange what I had learnt, I would use the feature of <i>Reply</i> to share with my classmates on the weblog.	3.89	0.867
Compared with class discussion, I think I am more willing to discuss on weblog.	3.97	1.014
I would have more feedback from my classmates on the weblog.	3.46	0.886
To inspect and learn from other blogs of other groups makes me learn even actively.	3.80	0.833
I like to discuss and communicate with teachers through the weblog.	3.57	1.145
<i>Phase III: Personal Feelings on Learning</i>		
I can have some chances to know other classmates through the group learning.	3.74	1.010
I feel pressure in the collaboration with other classmates.	3.01	0.867
I like to carry out project learning with classmates.	3.89	0.867
I can learn more through searching for information I want than listening to a lecture in class.	3.51	0.818
During these weeks when the project was ongoing, my learning attitude was more serious than it had been.	3.46	0.919

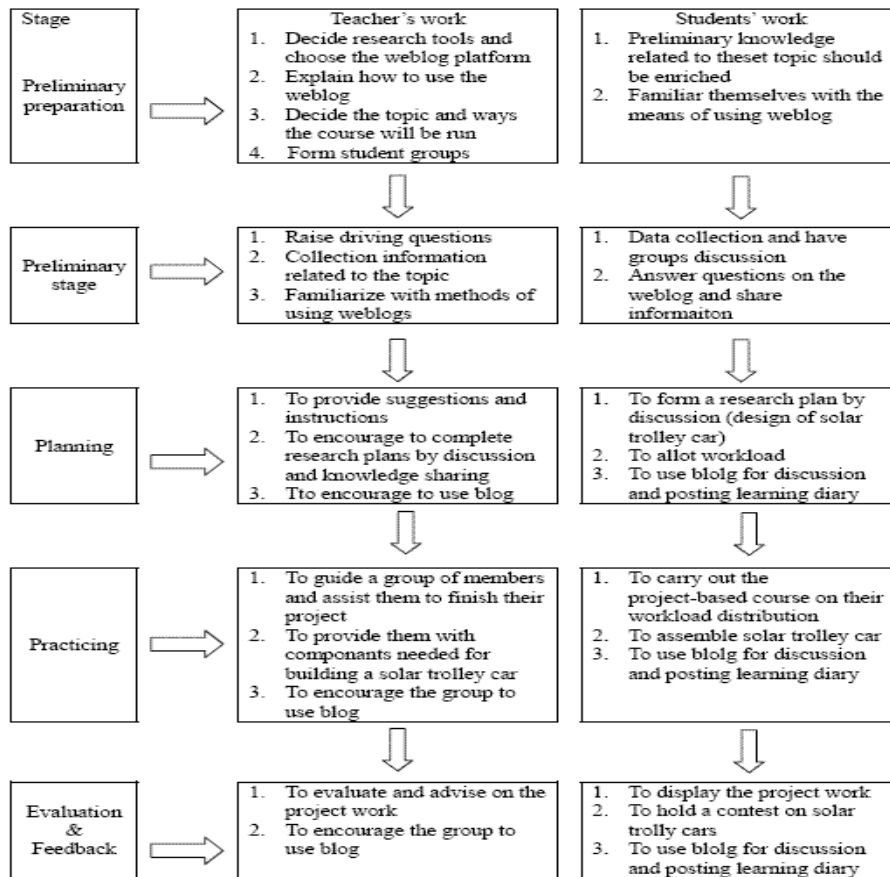


Figure 1: Experimental teaching flow.

Analysis of the Learning Process

In this study, the data collected from the class observation and on the weblog, discussions and reply posts and the learning diary of students, as well as the teacher's reflections on the project, are analysed with the qualitative method. The results are presented in Figure 2. The results reveal the greatest difficulties that the students encountered in the project; the obstacles students had during the making of a solar trolley car; the methods of collecting primary information; and the most gains earned from this project. All the findings can be used as references for technology teaching.

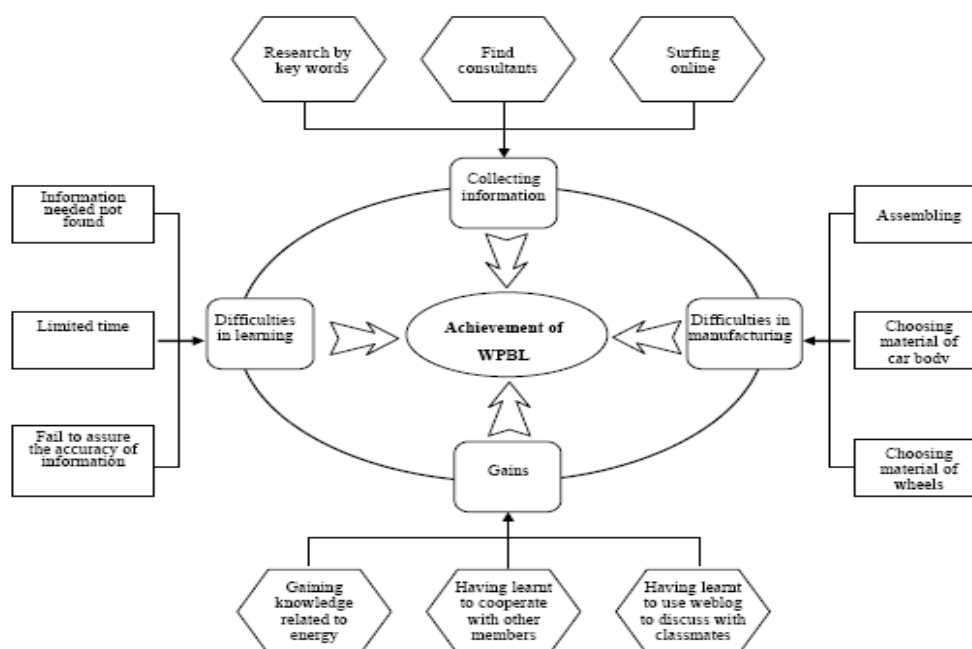


Figure 2: Learning process and gains.

Development of the Teaching Model

After the experimental teaching, a WPBL teaching model was constructed in accordance with the results of the experiment and with feedback from the teachers and students (as shown in Figure 3). The teaching model will be provided to teachers who like to use PBL with blog activities in technology education.

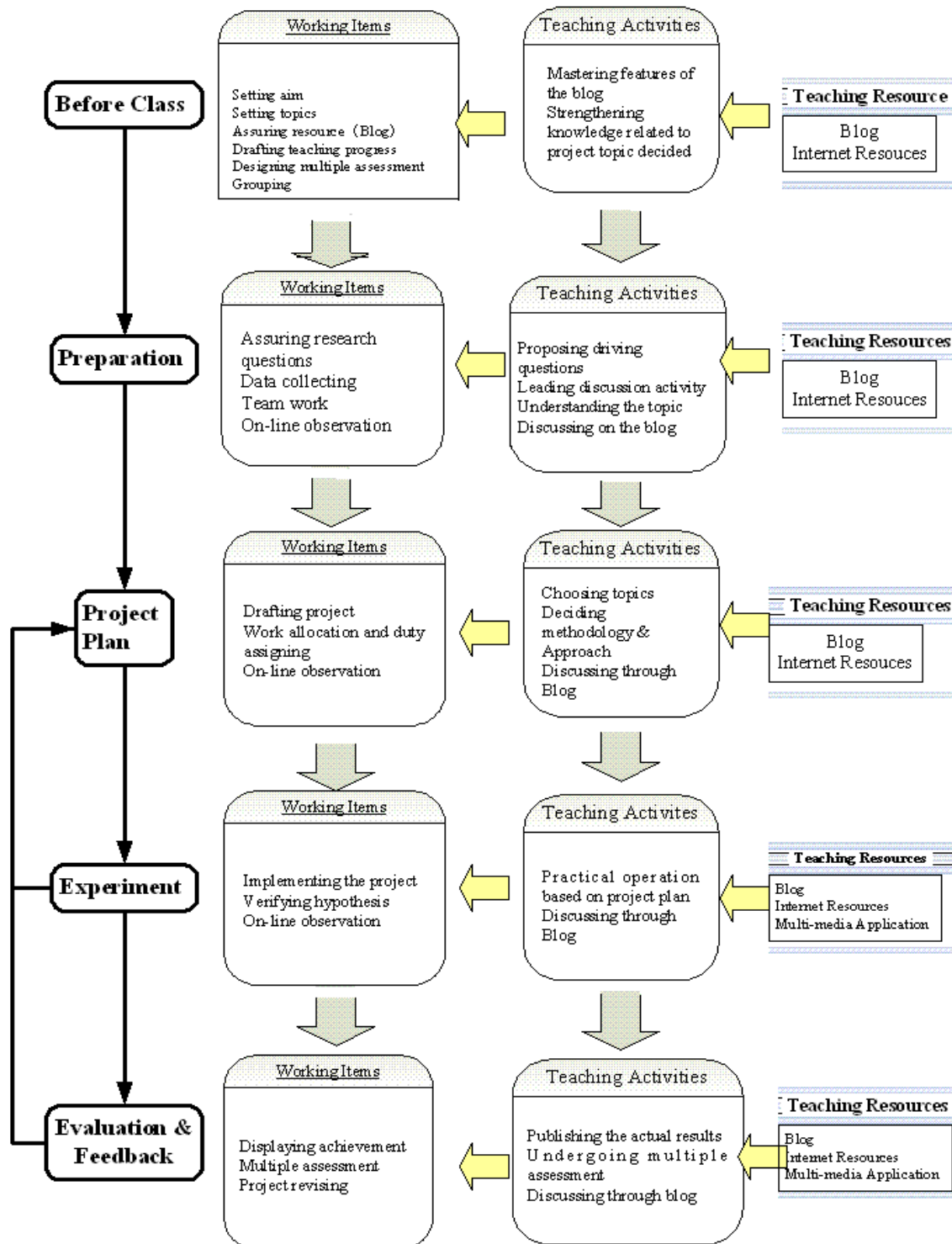


Figure 3: The WPBL teaching model.

CONCLUSIONS

Weblog with project-based learning (WPBL) can have a significantly positive impact on students' learning achievement of the Energy Technology course. Students' learning satisfaction of WPBL is high, reaching a significant level, with curriculum design of PBL, weblog features, and individual learning satisfaction. The teaching model of WPBL developed by the researchers can be provided to teachers as a reference on technology education.

SUGGESTIONS

- Teachers from junior high schools can apply WPBL to conduct technology-related teaching activities;
- The WPBL topics at junior high schools can involve such technology issues as green energy or energy saving, in accordance with current important ecological and environmental issues;
- Junior high schools should promote WPBL activities to make good use of Internet information resources, as well as to implement more learning activities for in-service teachers;
- In order to improve students' ability of using weblog, it first can be used as a platform to announce class affairs, discussions or homework submitted to let students get used to sharing comments and to provide suggestions on the weblog. Thus, it will be useful for enhancing the promotion and effects of weblog.

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