Development and Application of the Learning System of Basic Subjects of Information Technology Implementing the Scaffolding Teaching Strategy

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Abstract: This study aims to improve academic achievement and learning satisfaction by applying the learning system that employs the scaffolding teaching strategy in the courses for 'basic of information technology' of the technical high school students. To this end, first a web-based scaffolding teaching-learning model was designed, and a teaching-learning lesson plan was devised to form a basis to develop a learning system. This learning system was applied technical high school freshman students. As a result, the experimental group taught by the scaffolding teaching strategy had more positive changes in academic achievement and learning satisfaction than the control group. In addition, a high correlation between academic achievement and learning satisfaction was observed; and therefore, it was concluded that the group with higher academic achievement is more satisfied with what they have learned.

Keywords: Scaffolding teaching strategy, web-courseware, academic achievement, learning satisfaction

Introduction

These days, development of computer and information communication has changed all areas of society, the computer is not a machine that simply performs operation. It's the most important tool that manage audio, data, video multimedia data to sustain data society and make new creations possible. Hence, in 21st century information society, information education using computer is an inevitable problem. The technical high school adopted 'Basic of Information Technology' to make students understand and use the computer and information communication, which can make progressive outstanding individual [1].

So in these circumstances, systematic learning system to make technical high school students is desperate. we are trying to adopt Scaffolding teaching strategy in teaching-learning process to make students to discover their inner potential and use it. Based on this, the purpose of this study is to implement the system that can educate 'Principle of computer' chapter in 'Basic of Information technology' system using the web that maximize teacher-learner and student-student's active interaction, increase academic achievement by increasing individual's problem solving ability and improve the learning satisfaction by increasing academic achievement.

1. Background

1.1 Web-based instruction and scaffolding

Web based instruction can be used by diverse learners with various learning objectives, learning backgrounds, knowledge levels and learning abilities. Unlike original class lesson that was done with learning group at particular level, web based instruction environment should be supported so individuals can perform effective learning activities. Also, web based instruction is operated under the circumstances where it is hard to get help from teachers or peers at the right time and so, it has to be developed so one can learn oneself [2]. By providing scaffolding that reflects content knowledge and project's characteristic in web based instruction, it is able to support learner's individual learning. Scaffolding is teaching strategy that is essentially individualized and engineering approach where scaffolding is adopted in computer learning environment where individualized learning is possible is being tried [6][7][8][10].

Based on the Gagne's 9 events and the scaffolding developed by You Jin JANG(2004), teaching strategy is developed for this study as shown in the <Table 1>[4][5].
Learning system using scaffolding teaching strategy is developed based on the <Table 1>

<Table 1> The development of teaching strategy based on the web using scaffolding

Scaffolding (You Jin JANG, 2004)	Web-Based Instruction (Gagne's 9 events)	Student	Teacher
Activation of background	Gain attention / Inform learners of objectives	Gain attention	Motivation / confirm of learning objectives
	Stimulate recall of prior learning		
	Present the content / Provide learning guidance	Understanding learning content for model lesson	Model lesson
Activities for problem-solving	Elicit performance (practice)	Find a problem-solving method/ Problem-solving for scaffolding	Monitoring / Verbal coaching
	Provide feedback / Assess performance		
Application and wrap up	Enhance retention and transfer to the job	Wrap up for problem solving/ self-assurance	Provide feedback / wrap up

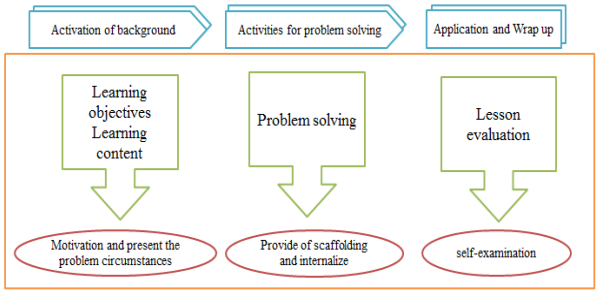
2. System Design and Implement

2.1 Analysis of the learning content

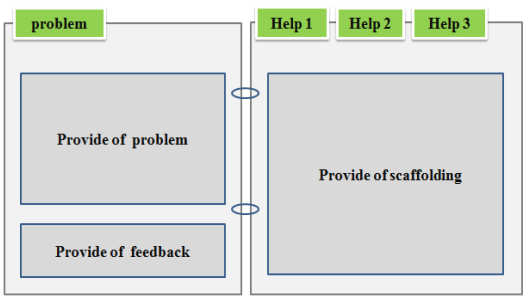
This study surveyed the most difficult subject among 'Basic Subjects of Information technology' for 100 students in the S technology high school students of Suwon city, South Korea. According to the results, they regard 'Principle of the computer' as the most difficult one. Therefore, the learning system of the scaffolding teaching strategy for 'Principle of the computer' has been developed.

2.2 Teaching- learning model and form design based on scaffolding

In this study, learning objectives, learning contents, problem-solving and lesson evaluation are designed based on the scaffolding teaching strategy as shown in the <figure 1>. Form design based on scaffolding provided on problem solving step is shown in the <figure 2>.



<Figure 1> Teaching-Learning Model

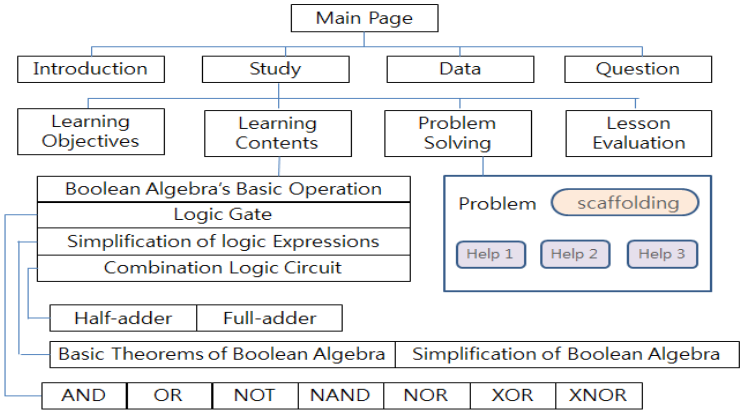


<Figure 2> Page Format

2.3 System overview

2.3.1 Overall system architecture

Main Page is composed of [Introduction], [Study], [Data], [Question] and Quick Menu is composed of [e-mail to master], [Chatting], [Q/A].



<Figure 3> Overall system architecture

2.3.2 Problem -solving page

In problem solving page, questions and help with 3 steps are provided the left frame and right frame respectively. Help providing method is a kind of software based scaffolding types. Help 1 and help 2 provided properly according to each question.
Help 3 is restructured according to this study using chatting source. Also, it is made into screen that can provide scaffolding that can give custom help for individuals during solving problems.

3. Method

3.1 Subject

The subjects of this study were 74 students who were in their first year in S technology high school located in Suwon City, South Korea. Experimental group and the control group were composed of 37 students, respectively.

3.2 Hypothesis

The following hypotheses were formulated:
(1) In 'basic of information technology' subject's principle of computer chapter class, there would be difference in academic achievements and learning satisfaction between classes that adopted scaffolding teaching strategy and classes that didn't.
(2) There will be correlation between academic achievement and learning satisfaction

3.3 Research design and process

The research design of the study are as follows:

Experimental group	O_1 (pretest)	X_1	O_2 (posttest)
Control group	O_3 (pretest)	X_2	O_4 (posttest)

Groups were divided into the experimental group and the control group, both were proved to be the same by pretest. Experimental group was provided with class model that applied scaffolding teaching strategy and control group was provided with class model that did not applied scaffolding teaching strategy. To minimize of the impediment factors that can affect research's validity and reliability, the conditions such as both groups' rate of progress, problem solving, learning contents, teacher's verbal instructions, etc, were same.

4. Research Result and Analysis

4.1 Pretest

Result of pretest of academic achievement (Independent sample t-test):

	Person	Collective averages	Standard deviation	t	p
experimental group	37	56.75	19.44	.058	.954
control group	37	56.48	20.57		

The pretest results of experimental group and control group showed significant level of 0.954 which means there is no significant differences between both groups (p>.05). So, experimental group and control group can be considered as same group.

4.2 Posttest

4.2.1 Academic achievement

Result of posttest of academic achievement (Independent sample t-test):

	Person	Collective averages	Standard deviation	t	p
experimental group	37	71.05	17.65	2.950	.004
control group	37	57.78	20.90		

The posttest results of academic achievement were 71.05 for experimental group and were 57.78 for control group. Experimental group had 13.27 higher academic achievement and significant level was .004 which meant there is statistical significant difference (p<.05).

4.2.2 Learning satisfaction

Result of test of learning satisfaction (Independent sample t-test):

	Person	Collective averages	Standard deviation	t	p

experimental group	37	21.62	4.63	3.498	.001
control group	37	16.70	7.19		

Average of learning satisfaction for the experimental group was 21.62 which was 4.92 higher than that of control group. Significance level was .001 which meant that there is statistically significant difference ($p<.05$).

4.2.3 The correlation between academic achievement and learning satisfaction

Using simple correlation analysis statistical method, the correlation between academic achievement and learning satisfaction is observed. Using the most general Pearson correlation coefficient, we obtained that correlation coefficient between academic achievement and learning satisfaction's is +0.780, which is high. The results explain that high academic achievement means high learning satisfaction.

5. Conclusion

This study tried to apply scaffolding teaching strategy into web based instruction that made individual learning possible and to increase academic achievement and learning satisfaction in technical high school's 'basic of information technology' subject.

For this purpose, simple survey was conducted by S technical high school in Suwon city. Teaching-learning model was development based on the survey results.

As a result, the experimental group taught by the scaffolding teaching strategy showed more positive changes than the control group in academic achievement and learning satisfaction. In addition, a high correlation between academic achievements and learning satisfaction was observed; and therefore, it was concluded that the group with higher academic achievement is more satisfied with what they have learned.

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