Analysis of the effect of the top-down teaching method for training of developing contents based on smart media

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ABSTRACT

Recently, as smart devices are distributed more and more, the need for education of developing contents based on smart media increases. In order to develop contents based on smart media, it is necessary to learn new programming language as well as to understand the structure of platforms as device-manufacturers and communication companies have different platforms. Generally, the problem in education of programming is that it can provide learning to understand the language stage by stage, but it is difficult to suggest a clear result such as completion of learner's project from macroscopic and integrated approach. Especially, there is a difficult of learning several programming languages due to the characteristics of platforms in developing smart contents. Accordingly, in the education of programming for developing smart contents, it is not appropriate to use the traditional teaching method of programming which conducts projects from an integrated point of view after learning the grammatical elements of the language.

This paper aims to suggest the top-down teaching method as an effective teaching method for developing contents based on smart media, and to analyze the effect after developing and applying the suggested teaching model.

Keywords : Smart Contents, programming training, Top-Down Teaching Method

1. INTRODUCTION

Traditionally, programming training has been considered as the most important training sector as well as the most difficult sector in computer science and engineering fields.

Programming training can play a positive role in acquiring high-recognitive skills such as problem-solving skill, logical thinking and procedural problem-solving method by preparing the environment for planning given information in an exact and systematic way and for operating the information logically.

However, the most decisive problem in the programming teaching method is the fact that there are few cases where the final results utilizing the relevant programming language have been completed. Though learning to understand the relevant language can be well prepared by each stage and by each module, it lacks macroscopic and integrated approaches, so it is difficult to suggest a clear result about what the learner becomes to deal with after learning the relevant language[1].

This is because the traditional programming training focuses on delivering knowledge and has a feature that students accept the knowledge passively.

Currently, there are many studies about effective teaching methods for programming training. For example, teaching-learning method using problem-based learning based on constructivism and project-based learning can be known to have a positive effect on enhancing student's assessment and promoting problem-solving ability, and it is hard to expect the result of training without arousing interest and motivating.

Until now, most studies on teaching methods for programming training considered programming languages as a field of study which has a positive influence on improving creativity, problem-solving ability and logical thinking, and most studies have focused on the learning of C language.

On one, hand, from the programming point of view, paradigm has changed from the type of modularized programming to structural programming and then, to object-oriented programming. In the 90s, object-oriented languages became the most powerful tool used to develop various systems, and especially, smart contents platforms which are becoming the main issue currently also include many object-component groups for supporting programming, so it is very important to understand these and know how to use them in order to develop smart contents.

In addition, as smart contents programming generally includes visualization, sensors, multimedia and game factors, it is hard to obtain the desired results through the teaching methods of programming languages having existing algorithm-centered structural characteristics. As the need for programming training increases currently in order to develop smart contents in the field related to computers, it is time to prepare effective programming teaching method which can supplement the traditional programming teaching methods.

Therefore, this study considers the characteristics of

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programming teaching and what the effective programming teaching method is. Also, it suggests the top-down teaching method as an effective programming teaching method for developing contents based on smart media, and aims to analyze the effect after developing and applying the suggested teaching model.

2. RELATED WORK

2.1 Works on programming teaching

Most works on programming teaching until now can be divided into investigation on teaching methods, development of class models, development of programming teaching courses, development of higher thinking abilities (analytical skills, logical thinking, comprehensive thinking, creativity, problem-solving ability and etc.) and programming training for connecting to learning.

Kim MiRyang suggested project-based approach, problem-based/problem-solving learning, cooperative learning, peer tutoring, and case study as potentially more effective teaching methods on programming teaching. Especially, she emphasized that the project-based approach is one of teaching methods which should be applied most positively, and learners can attain satisfaction and sense of accomplishment that they've realized results completed with relevant languages in the process of developing one project[1].

There are many works relevant to project-based learning. Kim ByeongWook et al. confirmed that learning motivation could be differed according to the type of learning in PBL-based programming classes and that learning motivation was improved in general[2]. Bae HakJin et al, suggested scratch programming teaching-learning model based on PBL. This study designed a learning model including the stage of recognizing problems, preparing a plan for problem-solving, exploring, finding out solutions, and presentation and evaluation, applied the model to elementary school students, and confirmed that the model was effective to improving logical thinking skill and problem-solving ability[3].

Like this, several studies suggested the important of programming training and its effect in an aspect of developing higher thinking abilities, but there were few studies about teaching methods for effective programming teaching methods and improvement of project quality for students who majored in computer engineering and applied their programming knowledge in industrial areas after graduation.

This paper suggests a teaching method which enables learners to apply their knowledge in actual industrial areas with confidence by being equipped with comprehensive and macroscopic intelligence, not by just considering programming training as one major in the field of computer science.

2.2 Top-down teaching method for programming training

As more and more fields are using computers, demand for various software increases, and it becomes necessary to develop software systems systematically and efficiently. Then, concept of object-oriented appears.

Paradigm from programming point of view has changed from structural programming (top-down) to object-oriented

programming (incremental). To speak accurately, object-oriented way can be seen to add the concept of enhancing maintenance and reusability to top-down way.

Therefore, programming training based on smart device platforms should teach top-down type of programming techniques which consider the reusability of components as a basis, and treat each part as a black box, not dealing with individual grammar deeply in the stage of designing the overall system.

Top-down teaching method is a type of teaching method where students first understand the whole system and then, learn detailed components which compose the system.

The top-down approach suggests that it should provide students with planned experience where they can overview the learning contents as a whole and recognize the whole shape. In the field of cognitive psychology, there are suggestions which support the top-down approach where learners can figure out the comprehensive meanings without analyzing individual characteristics deeply[4][5].

In addition, the top-down approach is also used in countries where people use English as a native language to teach English or as a literature approach from the whole context to sentences, words and phonemes[6].

As reviewed above, this study defines the top-down method as a programming teaching method which enables students to imagine the result of their final project by providing learning experience where they can contact the whole contents in advance through the top-down approach, not existing bottom-up approach based on cognitive psychology.

3. DESIGN OF TOP-DOWN TEACHING FOR TRAINING OF DEVELOPING CONTENTS BASED ON SMART MEDIA

This study designed a programming class using top-down teaching method in the process of receiving programming training for the purpose of developing smart media-based contents.

The main idea of designing the class is to enable learners to complete their own project results by analyzing the system in the whole context, inducing creative contents development and repeatedly learning detailed grammar of programming language needed to their project based on several core cases of smart contents.

3.1 Teaching-learning contents

For the experiment of this paper, the class was prepared over 160 hours during 4 weeks, and learners learned core contents for developing contents based on Android platform.
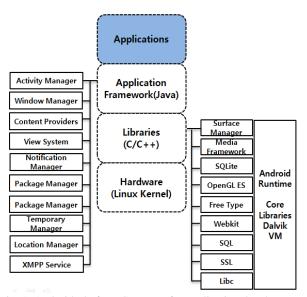
Fig. 1. Android Platform Structure for application development

Functions essential to develop contents were selected as a learning content based on Android platform structure as shown in above Fig. 1 The developer can develop Application Software using the application framework only by understanding the platform structure[7].

Following Table 1 suggests main learning contents.

Table 1. Main learning contents

Week	Learning contents
1st	-Project creation & Load the created project -Add button widget & Implement posting message -Multiple activity creation & Data transfer between activities -Data transfer between activities using static variables -Develop application for psychological tests -Debugging method
2nd	-Implement times using a handler -Splash screen effect using a timer -Deal with MediaPlayer class -Process ProgressBar -Implement MP3 player using MediaPlayer -Add user-defined class -Deal with ArrayList -Implement caption sync of MP3 player using MediaPlayer
3rd	-Activity Life Cycle -Link to external MAP program -Receive Google map API -Link to Google map -Link to GPS 기 -Lint to servers -Develop the project
4th	-Complete & introduce & publish the project

3.2 Teaching-learning strategy according to the framework of learning contents

As shown in Android platform structure, in order to develop application software, students should know how to use JAVA and XML, as well as utilize the framework. In existing programming classes, students generally develop integrated projects after learning the structure of language and grammar at first. But, in the ear of Windows environment and smart devices, it requires programming teaching methods through contents examples having more powerful visual impacts. Accordingly, the researcher conducted the study with the assumption that the top-down teaching method would be more effective considering the complexity and object-oriented feature of modern programming languages.

The test group of this study was to acquired higher skills relevant to Android as well as JAVA and XML naturally as they got interested in programming and analyzed it repeatedly through Android contents having interesting and core functions.

It is important to change the thought that only a professional developer can develop contents and to enable learners to get interest and confidence as they repeat the development and application for several times step by step from a small size of contents. Furthermore, it is more effective to make them focus on their own unique results.

Following Table 2 shows examples of contents used to progressive learning.

Table 2. Examples of contents used to progressive learning

Main screen and function help
Buttons outputting a simple beat sound are arranged, and it provides a function to store and play the beat patterns made by using such button sounds. It can play many stored beat patterns simultaneously. The basic algorithm to store and play beat patterns is the same as the synchronization algorithm of MP3 player.
It provides orally narrated children's stories and a quiz game connected to those stories for 5~7-year-old children. It is educational contents which help children recognize the right living habits through the quiz game. The stories are applied with data structure and algorithm which are the same as that of synchronizing music and caption in MP3 players and a time function using a handler.

3.3 Programming training process using the top-down teaching method

Programming training model utilizing the top-down teaching method suggested by this study aroused learners' interest in development and enabled them to perform creative and integrated design about contents which they ultimately wanted to develop in an initial stage of learning through completion of developing actual application which can be utilized actually based on learning contents of each week.

Fig. 2 shows the programming training model utilizing the top-down teaching method.
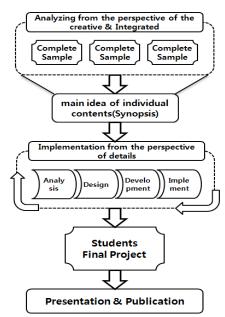
Fig. 2. Instruction Model for training of developing contents based on smart media

As shown in Fig. 2, the class first introduces the implementation of various visible effects in an initial stage of training, and then, learners are to learn detailed features of languages step by step. Though they are small-sized contents, students are to practice to apply contents by composing top-notch frameworks, learning about them repeatedly and transforming their favorite type.

They are to understand algorithm naturally by learning algorithm through various examples and by practicing various types of problems which can be solved through such algorithm. The real class dealt with several core concepts, not dealing with all general concepts of JAVA and Android, and focused on fostering learners' ability to use those concepts as they pleased.

4. RESEARCH METHODOLOGY

4.1 Study subject
This study designed the preliminary model based on literature studies, modified and supplemented this model through the professional's evaluation, and applied it to the test. The top-down teaching model for smart contents development training developed in this study was applied to 40 students which applied for the training course for developing smart contents in A university in Daejeon, and by dividing them into a test group and a controlled group, the model was applied through 160-hour classes for 4 weeks. from July, 2011 to August, 2011.

4.2 Study design
In order to figure out what influence the top-down teaching method for training of developing smart contents has on satisfaction of contents development training and to examine whether it is effective to the quality of developed contents, this study applied the pre- and post-test design to a controlled group.

The test group conducted the class in the top-down teaching method for smart contents development training, and the controlled group was applied with the traditional programming class which conduct individual programming learning. Detailed test design of this study is as follows.

Table 3. Study design

Test group	O1	X1	O3
Controlled group	O2	X2	O4

O1, O2 : Pre-test (knowledge, attitude toward programming)
X1 : Training of contents development in the top-down teaching method
X2 : Training of contents development in the traditional teaching method
O3, O4 : Post-test (satisfaction on training, evaluation of contents quality)

As for composition of learners in the two groups, it considered the level of pre-knowledge of the learner groups considering the efficiency of classes and objectivity of the test, and it evaluated the homogeneity through pre-survey developed by modifying and supplementing the questionnaire which examines the attitude and thought toward programming. But, the level of inner knowledge individual intelligence or problem-solving ability of each learner were not considered.

4.3 Test tool
For this study, the test tool developed by the researcher of this study was used as test items about the evaluation of the learner's interest in programming class, satisfaction on the class and the professional's evaluation on developed contents' quality.

Table 4. Satisfaction on the training of smart contents development

No	Item
1	Training of contents development is quite interesting experience.
2	I enjoy programming class and feel worth taking the class.
3	The class motivated me to develop contents that I aimed.
4	I can understand what I've learned and utilize it.
5	The class was well-related to contents development project.
6	I am satisfied with developed contents.
7	I think that developed contents have high quality.
8	I've improved the technical ability in programming.
9	I gained confidence in developing contents.
10	I want to take a course for professional developer.

Table 5. Evaluation areas by professionals on the training results

Evaluation area	Score
Creativity	20
Technique	20
Merchantable quality	20
Design	10

| Degree of completion | 20 |
| Presentation | 10 |

15 professionals including those in the field of computers and UI/UX professionals participated in the developed contents evaluation. Among them, the evaluation results from only 4 professionals were used to analysis.

5. RESULTS AND ANALYSIS

For statistical analysis of this study, SPSS 12.0 for windows was used, and as for detailed analyzing method, in order to figure out what influence the top-down teaching method has on smart contents development training, the study applied different teaching methods to the same two groups which passed pre-test, and conducted post-test. The pre-test was analyzed by conducting independent sample t-test in order to calculated average and standard deviation and to verify whether there was a statistically significant difference.

Homogeneity test was conducted to the two groups about learners' level of pre-knowledge and attitude toward programming.

For this study, when the study conducted a test targeting two groups which had different level of abilities from the first, it would have a significant influence on the study results. So, it is very important to conduct the homogeneity test between the two groups.

Each item of the pre-test was composed of questions about interest in programming, level of effort, learning attitude, recognized difficulty, performing ability, confidence and vision related to career.

Table 6. Pre-test on the level of pre-knowledge and attitude toward programming

Group	N	Mean	S.D.	p(sig.)	t	df
Test group	20	3.017	0.48273	0.548	-0.321	38
Controlled group	20	3.050	0.35077			

*P < .05

Levene's equal variance evaluation in the result of analysis in Table 6 is for evaluating whether the variance of the two group is the same as that of each other, and as P value is .548, higher than the significant level, .05, it can accept the assumption that the variance of the two groups is the same, and accordingly, it can be seen that there was no difference between the two groups.

5.1 Satisfaction evaluation about smart contents development training

In the Table 7, all scores of the test group were higher than that of the controlled group no. 3, no. 5, no. 7, no. 8, no. 9 items in the satisfaction evaluation about smart contents development training, and p-value was lower than .05, showing that there is a significant difference in the average between the test group and the controlled group. Especially, in no. 5

question asking the connectivity between the class and project process, there was relatively high level of difference in average between the test group and the controlled group. This shows that it was very difficult for learners in the controlled group who learned general contents of Java and then learned the developing process of Android to connect their grammatical knowledge of the language to the real project.

Table 7. Satisfaction evaluation about smart contents development training

No	Group	N	Mean	S.D.	p(sig.)	t	df
1	Test group	20	3.45	.605	.346	-1.177	38
	Controlled group	20	3.70	.733			
2	Test group	20	3.30	.571	.287	-2.196	38
	Controlled group	20	3.75	.716			
3	Test group	20	3.35	.671	.035	-1.800	38
	Controlled group	20	3.80	.894			
4	Test group	20	3.40	.681	.846	-1.418	38
	Controlled group	20	3.70	.657			
5	Test group	20	3.30	.470	.029	-2.476	38
	Controlled group	20	3.85	.875			
6	Test group	20	3.70	.801	.472	-1.189	38
	Controlled group	20	4.00	.795			
7	Test group	20	3.20	.616	.022	-2.717	38
	Controlled group	20	3.85	.875			
8	Test group	20	3.20	.636	.045	-2.207	38
	Controlled group	20	3.72	.844			
9	Test group	20	3.09	.487	.035	-4.070	38
	Controlled group	20	3.91	.769			
10	Test group	20	3.80	.696	.943	-.651	38
	Controlled group	20	3.95	.759			

*P < .05

However, as for no. 1, no. 2, no. 4, no. 6, no. 10, question, higher than .05, it shows that there is no difference in average between the test group and the controlled group. It is analyzed that such a result is because learners in both two groups already had experience in programming but they got interest in new types of programming, that is, smart contents development.

5.2 Professional's evaluation on the learning results.

Table 8. Professional's evaluation on the learning results

Group	N	Mean	S.D.	p(sig.)	t	df
Test group	8	79.425	6.4217	.025	-.548	14
Controlled group	8	75.113	7.0501			

*P < .05

Table 8 shows the result of evaluating the difference in average of evaluating scores by professionals on the learning results. Professionals selected 8 excellent students through the 1st evaluation by each group and then, conducted the 2nd evaluation. As P-value of the test groups is .025, lower than the significant level, .05, showing that the top-down teaching method in smart contents development training had a positive influence on the learning results. Such a results shows that as Android platform among all platforms for developing smart contents is based on Linux Kernel and C/C++ library, and is the upper level language for students to learn Android SDK, the study method should be different from that of other languages which programmers code all codes.

6. CONCLUSIONS

There are many studies about effective computer programming teaching-learning method until now. It can be said that it reflects the difficulty in programming training as well as its importance of programming language training in the field relevant to computers. For example, though it is not difficult to prepare learning where students understand relevant languages in each stage, it is difficult for learners to suggest a clear result even after learning relevant languages due to lack of macroscopic and comprehensive approaches toward the project.

Thus, this paper suggested the top-down teaching method as an effective programming teaching method for developing smart media-based contents, developed and applied the suggested teaching model and analyzed its effect.

As a result of the study, it was shown that general satisfaction on the class was high in the test group applied with the suggested teaching method. The reason is thought that learners have more interest and confidence, expect to achieve the goal more positively in the class focusing on the project than in the class focusing on delivering knowledge.

In addition, there was a significant difference in the professionals evaluation on learning results, and the average score was higher in the test group. This was analyzed that

learners in the test group could connect learning contents in each stage to the final project through the process of repeatedly analyzing and applying what they learned.

At last, there was a discussion on whether the top-down strategy would be important or the bottom-up strategy would be for programming teaching. However, for better programming, both strategies should be used to learners. But, teachers should carefully consider which part they apply such two strategy in general learning.

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