Effects of Children Activity Centered Learning Module on Science Related Attitudes and Conceptual Achievement of Eelmentary School Students

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We have used the developed modular teaching-learning materials and evaluated their effects on science related attitudes and conceptual achievement of elementary school students. In order to analyze the effects, we have made two groups of the text material: one that followed the 6th elementary science curriculum and the other modular material, that adopted the open education system with the children activity centered learning modules.

We have found the children to develop their attitudes about science when their scientific activities are more open and have various explorations. When they have undergone their change of attitude, their behavior becomes affirmative and their affirmative and positive attitudes to the science will be accumulated in obtaining the science concepts.

KEY WORDS: science-related attitude, conceptual achievement, modular teaching-learning

I. Introduction

A. Open Strategy in Science Education

At present most teachers argue that they are aiding students in "understanding" science by reviewing the information found in standard textbooks. Generally the real problems in school science can be summarized with the following statements: The science textbook is the source of nearly all information successful students need to learn. Teachers restrict student interest and attention to a rigid course outline. It is rare to depend on resources of any kind beyond the textbook, the teacher, or the science room(Yager, 1995). In Korean elementary science education, the resources are confined by the

standardized textbook.

But, children usually develop their ideas through a variety of experiences: they have creative explorations through the methods of open thinking and material. In providing experiences for students, teachers need to consider how relevant the experiences are to the children's lives. Above all, it is important that students can learn and enjoy the teachers' experiences for aesthetic reason. If students appreciate both the relevant and aesthetic minds, they will rise in interest and arouse motivation and take part in learning positively. Positive acts and active experiences construct science concepts; that is, learning will be more effective if it is enjoyable and adopted by child centered approaches (Johnston, 1996).

The modules teachers should develop and offer need to provide both relevant and aesthetic experiences for learners to help to develop the students full potential. Teachers need to review more indirect teaching approaches. The teacher should be a facilitator of learning rather than an impartor of knowledge. Their roles are motivator, diagnostician, guide, innovator, interactor, evaluator, instructor, experimenter and researcher (Johnston, 1996).

Furthermore teachers need to plan carefully to provide effective teaching and learning through open inquiry processes. If their research and plan to effective teaching and learning is supplied with modular learning program, the materials will be abundant to other teachers.

Up to now, most elementary teachers have taught with only textbook published by the ministry of education. The teaching materials are not given and never used in teaching. All Korean children have been given the same kinds of experiences with the same textbooks. They have scarcely experienced any creative activities and thinking.

In order to overcome the problems of the science education in Korea as mentioned above, we need more endeavors to study the effective teaching methods and develop the good quality module programs.

B. Science Related Attitude Development

Many problems exist in science instructional goals. Scientific attitudes are equally important to concepts, knowledges and

skills. Without positive attitudes, conceptual and skill developments will be impaired (Johnston, 1996). There is considerable consensus of opinion that the promotion of favorable attitudes to science is an important aim of science education. But there is confusion about what meaning should be placed on the attitudes to science (Fraser, 1978). The attitudes fall into two categories: attitudes to science and attitudes about science (Gardner, 1975). Attitudes to science involve distinctions between attitudes to science and scientists, enjoyment of science learning experiences, interest in science apart from learning experiences, and interest in a career in science. Attitudes in science can be further divided into attitudes involved with motivation, investigation, attitude to inquiry, adoption of scientific attitudes like curiosity, group participation, reflection, open-mindedness, objectivity, etc(Johnston, 1996). We should encourage to cultivating the positive attitude about science in learning and teaching science.

II. Methods

A. Subject

We have selected samples of 137 students who are in 5 grade. Two groups were designed with a statistical control as an experimental one (Table 1). One group has learned the elementary science textbook; and the other one, the module materials that we have already developed in order to study their effects on the attitude and the conceptual achievement in science.

B. Measurements

The TOSRA has been used in evaluating the science related

Table 1. Sample Size of each group

group \ sex	boy	girl	total
Textbook group	35	34	69
Module group	35	33	68
total	70	67	137

attitudes. The Social Implications of Science scale in TOSRA measures one aspect of manifestation of favorable attitudes towards science. The Attitude to Scientific Inquiry scale in TOSRA measures attitudes to scientific experimentation and inquiry as a way of obtaining information about the natural world. Adoption of Scientific Attitudes in TOSRA is a measuring scale of the specific attitudes: open-mindness, willingness to revise opinions, etc (test of science-Related Attitudes, Fraser, 1981). The internal consistency reliability of each scale in pilot testing the translated TOSRA given in this work is estimated using the Cronbach α-coefficient (Table 2)

We have developed the conceptual achievement evaluation instrument which consists of 9 objective problems and 2

Table 2. Name of each scale in TOSRA

scale name	N of item	a coefficient
Social Implications of Science	10	0.80
Attitude to Scientific Inquiry	10	0.84
Adoption of Scientific Attitudes	10	0.73
Leisure Interest in Science	10	0.82
total	40	

Table 3. Analysis flame of concept items

pattern	number	a. object of consist solar system	b. relative size of planet	c. revolution of planet	d. distance from the sun	e. the sun	f. method to observe the sun
objective	1		○				
	2					○	
	3				○		
	4	○					
	5	○					
	6	○					
	7		○				
	8						○
	9				○		
subjective	1	○	○	○	○		
	2	○					
total	N of item	5	3	1	3	1	1

subjective ones (Table 3).

C. Process

We have examined the science attitude and concept questionaries as the pre-tests which are same as the post-tests. One week later, we offered the different lessons between the module and text groups. The module group usually did quiz games, art-integrated experiences, conner-learnings by themselves. The text one was given more explanations by teacher. But students have the same experience of the visual materials. Then, we have compared with the post-test results for the two groups.

III. Results

A. Science-related attitudes

The Variation value of the science related attitudes between the two groups is equal and its pre-test score of each group is not statistically different (Figure 1).

After Correlations (Table 4) among each scale in TOSRA are high enough to use the MANCOVA

We figured out the results after treating the MANCOVA (Table 5 & 6).

There is a statistically significant difference between the textbook group and module one (Table 5). Specially, the Attitude to Scientific Inquiry scale shows statistically significant

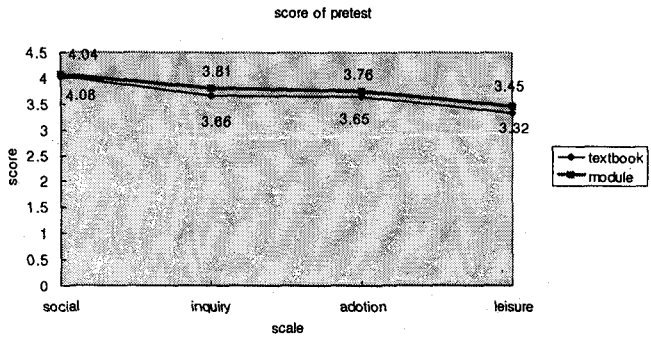

Figure 1. Pre-test scores

difference between two groups (Table 6).

The children-activity centered learning module we developed was shown to affect the science-related attitudes in the elementary school students. Therefore the module materials are very effective in cultivating the students' attitude to scientific inquiry (Figure 2).

We carried out the second-analysis of science-related attitude item by item. We have treated one item as one dependent variable. Multi-variative analysis of variance (MANCOVA) has been used to analyze the 10 items of each scale in TOSRA. The results of items in each scale are given in Table 7. In each scale, the items that cause an exhibited differences between the two

Table 4. Correlations among the scales

attitude scale	social	inquiry	adoption	leasure
social	1.00			
inquiry	.43**	1.00		
adoption	.55**	.58**	1.00	
leisure	.42**	.50**	.52**	1.00

** P < .01

Table 5. *Two-way Mancova*(S = 1, M = 1 , N = 61 1/2)

	Value	Exact F	Hypoth. DF	Error DF	Sig. of F
Material group	.08431	2.87713	4.00	125.00	.026*
Sex group	.03241	1.04680	4.00	125.00	.386
Material-Sex	.01739	.55293	4.00	125.00	.697

** P < .01 * P <.05

Table 6

Variable	Hypoth.	SS Error	SS Hypoth. MS	Error MS	F	Sig. of F
Social	49.29312	3478.31798	49.29312	27.17436	1.81396	.180
Inquiry	126.85876	4004.20196	126.85876	31.28283	4.05522	.046*
Adotion	58.57626	2698.39976	58.57626	21.08125	2.77860	.098
Leisure	6.42704	4900.19901	6.42704	38.28280	.16788	.683

** P < .01 * P <.05

groups is presented in Table 8.

The Social Implications of Science & the Attitude to Scientific Inquiry scales have statistically shown the distinct differences of each item between the two groups.

The students in the module group have recognized, of course, the negative influence of science after learning the developed modules. They have also showed the positive attitudes to do experiment and activity by themselves. Therefore the module education is very effective in guiding the children toward science inquiry and even in communicating to each other, and in opening their minds.

B. Concept achievement

As the pre-test score of the module group in the concept achievement is higher than that of the textbook group, we have used two-way ANCOVA with the material and sex groups. The results of pre-concept and post-test for concept achievement is in Figure 3.

There is statistically significant difference between textbook group and module one (Table 9). There is no sex difference. After

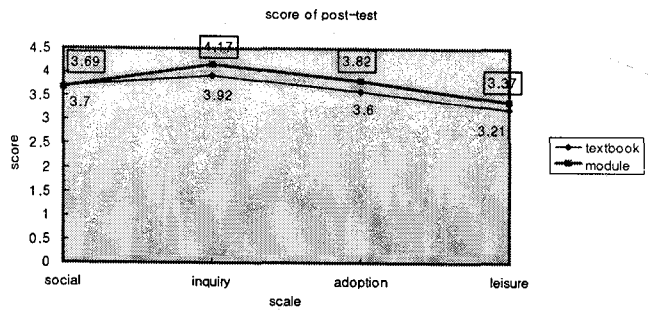

Figure 2. Post-test scores

Table 7. Effect of material group

scale	Test	Value	Exact F	Hypoth. DF	Error DF	Sig. of F
Social Implications of Science	Pillais	.16500	2.17360	10.00	110.00	.025*
Attitude to Scientific Inquiry	Pillais	.14727	1.95150	10.00	113.00	.045*
Adoption of Scientific Attitudes	Pillais	.12553	1.57908	10.00	110.00	.122
Leisure Interest in Science	Pillais	.05246	.60901	10.00	110.00	.803

Table 8. The items presenting group differences.

scale	item	score of module group
Social	(5)Science is man's worst enemy	low
	(13)Scientific discoveries are doing more harm than good	low
Inquiry	(6)Doing experiments is not as good as finding out information from teachers.	high
	(10)I would prefer to do experiments than to read about them	high
	(26)I would rather solve a problem by doing an experiment than be told the answer.	high
	(30)I would prefer to do my own experiments than to find out information from a teacher.	high
Adoption	(19)I like to listen to people whose opinions aredifferent from mine.	high

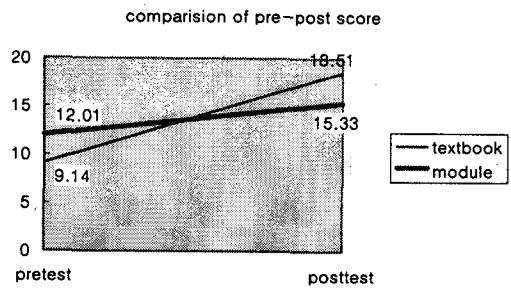

Figure 3. Concept scores

treating each group, the concept achievement score of the textbook group is even higher than that of the module group (Figure 3).

The children-activity centered learning module has been shown to have no effects on achieving the science concepts in the elementary school students in the present work. However, the module group got the higher score in the post-test of the attitude in science compared to the pre-test. One of the goals in

Table 9. Analysis of variance

Source of Variation	Sum of Squares	DF	Mean Square	F	Sig of F
Covariates	3220.487	1	3220.487	63.826	.000*
Pretest	3220.487	1	3220.487	63.826	.000*
Main effect	877.105	2	438.552	8.692	.000*
material	805.967	1	805.967	15.973	.000*
sex	86.896	1	86.896	1.722	.192
interaction effect	9.537	1	9.537	.189	.664
material-sex	9.537	1	9.537	.189	.664
Explained	3467.531	4	866.883	17.181	.000
Residual	6660.367	132	50.457		
Total	10127.898	136	74.470		

* $p < 0.01$

studying science is to bring up the science attitude, which affirmatively affects obtaining science concepts in the long run.

IV. Conclusion.

The science attitude is statistically significant difference between the textbook group and module group. Specially, the Attitude to Scientific Inquiry scale shows statistically significant difference between the two groups. The children-activity centered learning modules have been shown to affective by improving positive attitudes about science inquiry after evaluating the results of the items analysis. Each item has scored over 3.5 on average. The module group's students have also shown the attitude to recognize the negative sides of science. Of course, students have shown the positive attitudes to do experiments and activities by themselves. Students also have demonstrated attitudes to enjoy the activity and experience in science and to communicate that enjoyment each other.

The concept achievement is statistically significant difference between the textbook group and module group. But the concept achievement score of the textbook group is even higher than that of the module group. In the class of the textbook group, we used the visual materials such as the planets' photograph and the space probing photo on the internet like the module group, but

the teacher explanation was in detail, not like the module one which emphasized the student centered activities. We think that detailed teacher explanation has so much effect on the concept achievement in the textbook group compared to the module one. The teacher-children interaction should be emphasized in the student centered modules; likewise, the children-children interaction, too. The interactions may reduce the student's concept achievement in class.

However, the children-activity centered learning modules are proved to be very significant materials for the students to enjoy learning science and keeping their minds on investigating nature by themselves. Even the children-activity centered learning modules have been shown to have no effects on achieving the science concepts with the elementary school students in the present work. However, one of the goals in studying science is to bring up the science attitude, which affects obtaining science concepts affirmatively in the long run.

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