The Effect of Problem-Solving Instruction on Children's Creativity and Self-efficacy in the Teaching of the Practical Arts Subject

Namyong Chung and Gyoung-sug Ro

Theoretical Framework

Practical arts is a subject that not only promotes learners' better understanding of work in their daily lives, but also enables them to find ways to solve work-related problems by fostering basic skills and attitudes necessary for performing the work (Ministry of Education, 1993). That is why the Ministry of Education in Korea (1993) identified the practical arts subject as a "practical living" subject, a "creative problem-solving subject," and an "integrated knowledge subject." Moreover, practical arts education in the aspect of its educational goal helps develop students' problem-solving and creative-thinking skills. In the methodological aspect, it also develops students' self-efficacy by helping them acquire daily living skills as well as the joy of work experience and a sense of accomplishment through experiential learning based on the work experience (Ministry of Education, 1993). That's why the Ministry of Education made the practical arts subject a required course for the elementary education system in Korea.

The teaching of practical arts as a subject should be focused on developing creativity and self-efficacy by the active employment of scientific thinking through the activity-centered decision-making process. Plus, the teaching of the practical arts subject must be conducted according to the problem-solving model (Kwak, 1988; Seoul-Inchon Area Research Association of the Practical Arts Education, 1995; Research Association of the Practical Arts Education for All Korea National Universities of Education, 1997). However, most elementary school teachers in Korea have used the typical instruction method (lecture) to teach students the practical arts subject.

Choi (1997) suggested that practical arts education should be performed based on work experience activities by using problem-solving methods since the assumption of a model for the problem-solving method lies in the reflective thinking process; learners by themselves try to study creatively or reach conclusions comprehensively. And Kwak (1988) emphasized that the topics of practical arts education need to be taught by the problem-solving method while considering the necessity of problem-solving ability and creative thinking.

Na (1997) insisted that practical arts instruction should signify learner-centered instruction (i.e., learning by doing, using the various methods such as investigation, discussion, experiment, and work experience). While considering what students learned in previous instruction, then practical arts teachers could

Table 1. The Sexual Distribution of Subjects in the Study

Type	Male	Female	Total
Experimental	17	16	33
Control	16	17	33
Total	33	33	66

R_1 (Problem-Solving Instruction Group)	O_1	X_1	O_2
R_2 (Problem-Solving Instruction Group)	O_3	X_2	O_4

R1 : experimental group	X_1 : problem-solving instruction	O_1, O_3 : pre-test
R2 : comparative group	X_2 : typical instruction	O_2, O_4 : post-test

Figure 1. Quasi-experiment design.

Table 2. Creativity Measurement Factors and the Test Content

Factors	Time	Test Content
Fluency	3 min	As many imaginary words as possible to a given word should be written down within the time limit.
Flexibility	3 min	Many things which can be expressed in number in everyday life should be written down in number within the time limit.
Originality	4 min	By using the given vertical line, a student is required to draw a certain shape, and put down its name below it. The score is given only when the shape is unique. The drawing is graded according to the content of the shape.

Table 3. Comparison Between Problem-Solving Instruction and Typical Instruction

Problem-Solving Instruction		Typical Instruction	
Step1	Motivation	Introduction	Recalling the previous learning
Step2	Group objectives		
Step3	Confirmation of problems to solve	Development	Teacher-centered development of the current lesson
Step4	Problem-solving		
Step5	Test of solutions through application	Consolidation	Consolidating the current lesson
Step6	Evaluation of the solutions		

apply the content of the subject in the real situation by giving a sense of accomplishment as well as self-efficacy. Na added that in particular there should be priority in the student-centered problem-solving instruction so that creativity and self-efficacy could be developed.

But there exists a remarkable difference between the reality in educational fields and the researchers' insistence based on the result of the studies on problem-solving ability, creative thinking, and self-efficacy as shown in the above studies. In other words, creativity education as specified in the characteristics and goals of practical arts education has not been conducted properly, not to mention the lack of the establishment of a theoretical foundation for creativity education in the practical arts. However, Chung (1997) provided the theoretical foundation of creativity education in practical arts by analyzing the factors of creativity and their relation to the content of the practical arts subject and presenting the factors of the representative learning content for practical arts in each grade.

Hence, this study has two significant points: one is the examination of the effects on children's creativity and self-efficacy by applying problem-solving instruction in practical arts education, and the other is the implementation of the first study in Korea on problem-solving, creativity, and self-efficacy with the potential for further research.

The purpose of this study was to examine the effects on children's creativity and self-efficacy by applying problem-solving instruction in practical arts education and to show how this is reflected in the literature of problem-solving learning. The following delineations are the specific objectives used to achieve this purpose:

1. Identify the effects of problem-solving instruction on the development of children's creativity.
2. Identify the effects of problem-solving instruction on the children's self-efficacy.

Subjects for Study

For the subjects of this study, two out of seventhird grade classes at H Elementary School in the city of Pohang, Kyungsanpook-do, Korea, studying practical arts as required in all Korean elementary schools were chosen as the experimental and comparative classes. The experimental group received problem-solving instruction for two hours a week, and the con-

Table 4. A Form for Problem-Solving Instruction

I. Unit and Theme
II. Analysis of the Actual State
III. Instructional Objectives
IV. Procedure of Teaching
1. Motivation
2. Expected Objectives of the Student Group
3. Expected Problems
4. Plan for Solving Each Problem
Problem 1: ¨ method ≠ data Æ summary
Problem 2, 3, 4, ... problem N
V. Application of Learning
VI. Reference and Teaching Aids
VII. Procedure of Assessment

Table 5. The Results of the Creativity Pre-Tests

Subarea	Class	*n*	*M*	*SD*	*df*	*t* value
Frequency	Control Experimental	33 33	5.15 5.97	2.15 3.37	64	1.18
Flexibility	Control Experimental	33 33	3.64 3.52	3.51 2.24	64	- 0.18
Originality	Control Experimental	33 33	10.36 11.70	5.28 6.94	64	0.88
Total (Creativity)	Control Experimental	33 33	19.75 21.18	8.03 9.38	64	0.92

trol group received typical instruction without emphasis on problem solving with all other factors being constant. The duration of the study was five weeks from May to June of 1999. The demographic information on the participating students is presented in Table 1.

Research Design

This study shows the progress of creativity and self-efficacy in the experimental and control groups after the experimental group received problem-solving instruction and the control group received typical instruction (i.e., without the problem-solving emphasis). Thus, the independent variables in this study were, as instructional methods, problem-solving instruction (for the experimental class) and typical instruction with no problem-solving component (for the control class). The dependent variables were the post-test scores of the creativity and self-efficacy tests. Figure 1, a diagram of the experimental design, examines the assumptions of the study.

Instrumentation

The existing creativity test instruments were not fit for the subjects and purpose of this study since the instrument was made primarily for the target of upper grade students. Recently, for the third grade students, the Korea Creativity Research Institute (1998) developed the Creativity and Thinking Test with subareas for fluency, flexibility, and originality. The reliability of the creativity test was 0.93. The measurement factors and the test content are shown in Table 2.

The Self-Efficacy Test instrument was employed to measure the general level of self-efficacy on learning. In this study, the revised self-efficacy test from Sherer and Adams' (1983) questionnaire and Chung's (1987) questionnaire were employed (Cronbach alpha = 0.824).

Procedure

Homogeneity Test

In order to show the homogeneity between the experimental class and the control class, a pre-test was given to 246 students from seven third grade classes on Monday, April 26, 1999 (i.e., two weeks before the experiment). After the pre-test, two classes were chosen that showed little difference in the test, meaning

Table 6. The Results of the Self-Efficacy Pre-Tests

Type	*n*	*M*	*SD*	*df*	*t* value
Control Experimental	33 33	80.52 85.52	17.61 14.13	64	1.27

Table 7. Comparison of the Pre-Test and Post-Test Results in the Creativity of the Control Class

Subarea	Test	*n*	*M*	*SD*	*df*	*t* value
Frequency	Pre-test Post-test	33 33	5.15 8.76	2.15 3.36	32	6.84**
Flexibility	Pre-test Post-test	33 33	3.64 4.85	3.51 2.17	32	2.49*
Originality	Pre-test Post-test	33 33	10.36 10.36	5.28 5.28	32	-
Total (Creativity)	Pre-test Post-test	33 33	19.75 23.97	8.03 6.69	32	6.94**

*p < .05. **p < .01.

Table 8. Comparison of the Pre-Test and Post-Test Results for Self-Efficacy in the Control Class

Type	*n*	*M*	*SD*	*df*	*t* value
Pre-test Post-test	33 33	85.52 80.52	14.13 11.92	32	- 2.44*

*p < .05.

those two classes were not different in the aspect of students' creativity and self-efficacy. For the necessary time of the test, 30 minutes was allotted to the pre-test in considering the degree of students' attention and the range of the questionnaire. The post-test was administered in three weeks on July 5, 1999, after the experimental treatment (five weeks in total from May 10 to June 12, 1999). The test methodology and the time allotted for the post-test was equal to those of the pre-test.

Experiment Treatment

For the experimental treatment, the practical arts subject teaching plans with the problem-solving instruction component and the typical instruction method without such a component were approved by a preliminary examination of leading educators and elementary school teachers with expertise in the area. These two types of teaching plans are presented in Table 3.

Procedure of the Experiment

The teacher of the control class, who had almost equal educational experience in comparison with the teacher of the experimental class (researcher), clearly perceived the difference between problem-solving instruction and typical instruction. The control class teacher was asked to conduct the instruction to the complete fulfillment of the constituent principle of each aspect of instruction.

The following control conditions were enforced to ensure the effects of this experiment:

1. Qualitative control: the instruction of the experimental class was implemented by the researcher
2. Quantitative control: two classes were equally conditioned in the progression of the instructional period and learning
3. Methodological control: the problem-solving instruction was implemented in the experimental class while the typical instruction was implemented in the control class
4. Content control: although the instructional style for the class was different, the content-instruction was equal.

Analysis of Data

This study aimed to investigate whether or not there was a meaningful difference in the degree of students' creativity and self-efficacy between an experimental group with problem-solving instruction and a comparative group

Table 9. Comparison of the Pre-Test and Post-Test Results in Creativity of the Experimental Class

Subarea	Test	*n*	*M*	*SD*	*df*	*t* value
Frequency	Pre-test Post-test	33 33	5.97 9.21	2.15 3.36	32	6.08**
Flexibility	Pre-test Post-test	33 33	3.64 4.85	3.52 5.70	32	5.03*
Originality	Pre-test Post-test	33 33	10.36 10.36	11.70 21.76	32	7.84**
Total (Creativity)	Pre-test Post-test	33 33	19.75 23.97	21.18 36.67	32	9.778**

*p < .05. **p < .01.

Table 10. Comparison of the Pre-Test and Post-Test Results in the Self-Efficacy of the Experimental Class

Type	*n*	*M*	*SD*	*df*	*t* value
Pre-test Post-test	33 33	80.52 83.79	17.61 17.25	32	1.67

with traditional instruction. The collected data were analyzed by SPSS WIN, 7.5 version. Frequency, percentage, average, and standard deviation were employed, and the t test was also used to make a comparative analysis between the results from the experimental class and the control class.

Results

Homogeneity Between the Experimental Class and the Control Class

With the purpose of estimating the homogeneity between the experimental class and the control class, pre-tests of creativity and self-efficacy were conducted. The results of the pre-test presented in Table 5 showed no meaningful statistical difference between the two classes, and likewise in creativity subareas including fluency, flexibility, and originality. So, in the aspect of creativity, the experimental class and the control class should be regarded as identical.

The pre-test results for students' self-efficacy in the experimental and the control class indicated, as in Table 6, no meaningful difference. Thus, the two classes were equal in the aspect of self-efficacy.

Comparison of the Pre-Test and the Post-Test of the Control Group

The pre-test and post-test comparison results of students' creativity in the control class are shown in Table 7. There was a significant difference between the pre-test result and the post-test result in creativity, and likewise in the tests of creativity subareas including fluency and flexibility. However, the pre-test and the post-test in originality as a subarea of creativity showed no significant statistical difference.

The pre-test and post-test for self-efficacy in the control group showed a statistically significant difference as shown in Table 8, but the score for the control class was found to be lower than before the experiment.

Comparison of the Pre-Test and Post-Test in the Experimental Group

The pre-test and post-test results in students' creativity indicated that there was a statistically significant difference between the pre-test and the post-test results since the creativity test score was increased in accordance with the experimental treatment with problem-solving instruction as indicated in Table 9. Moreover, there were significant differences in the creativity subareas, which included fluency, flexibility, and originality. This confirmed that the problem-solving instruction could enhance the subareas of creativity.

The pre-test and post-test results for self-efficacy showed no statistically significant difference as shown in Table 10, but there was a minor increase in the average of the test scores.

Table 11. Comparison of the Post-Test Results in Creativity in the Control Class and the Experimental Class

Subarea	Test	*n*	*M*	*SD*	*df*	*t* value
Frequency	Pre-test Post-test	33 33	8.76 9.21	3.36 4.62	64	0.46
Flexibility	Pre-test Post-test	33 33	4.85 5.70	2.17 3.18	64	1.27
Originality	Pre-test Post-test	33 33	10.36 21.76	5.28 8.92	64	6.31**
Total (Creativity)	Pre-test Post-test	33 33	23.97 36.67	6.69 12.83	64	5.04**

**p < .01.

Table 12. Comparison of the Post-Test Results for Students' Self-Efficacy in the Control Class and the Experimental Class

Type	*n*	*M*	*SD*	*df*	*t* value
Pre-test Post-test	33 33	80.06 83.79	11.92 17.25	64	1.02

Comparison Between the Post-Test Results in the Control Class and the Experimental Class

The result of the post-test for students' creativity showed that there was a statistically significant difference between the control class and the experimental class as indicated in Table 11. In the creativity subareas, the aspects of fluency and flexibility showed no statistical significant difference between the two classes, but in the aspect of originality, a significant difference between the two groups was demonstrated. For this reason, the problem-solving instruction could be said to have more impact on the advancement of creativity than in the case of traditional instruction.

Although the post-tests for self-efficacy in the control group and the experimental group showed no statistically significant difference as shown in Table 12, the comparison of average scores on the post-tests for students' self-efficacy indicated higher scores in the experimental class than in the control class.

Conclusions and Discussion

The findings reflect several significant differences between the typical instruction group and the group with the problem-solving component. From the findings, the following conclusions can be drawn:

1. The problem-solving instruction showed a marked effect on originality, whereas the other creativity subareas, including fluency and flexibility, showed just a slightly higher average not large enough to be statistically significant. The reason for not showing a statistically significant difference in fluency and flexibility might be the short period of the experiment's duration. Therefore, using problem-solving instruction in the long term can also have an effect on other subareas of creativity.
2. The problem-solving instruction within the context of practical arts class showed no statistically significant difference in students' self-efficacy, but the experimental class got a higher average score on the post-test. This might also be caused by the short period of the experiment's duration.
3. In the traditional instruction without the problem-solving component, students' self-efficacy was significantly lowered after the instruction period. This result could have been caused by (a) the short-term experiment or (b) the control group teacher who used a bad teaching skill. However, this result still indicates that typical instruction can be an obstacle in the development of children's self-efficacy.

All the details above indicate that the problem-solving instruction for elementary school children is related to the teaching-learning process in promoting children's creativity.

However, previous research on the effect of problem-solving instruction has suggested that it is difficult to draw a general conclusion that one process of instruction is always more effective than others. This is why one kind of teaching-learning process does not necessarily or consistently work better than others. Moreover, change in self-efficacy during the short term is hard to assess. Thus, only after the steady use of problem-solving instruction can a positive change in children's self-efficacy likely be noted.

Recommendations

The following recommendations are based on the findings and conclusions of this study:

1. Research on various methods to develop creativity and the development of an instructional model and learning materials are needed.
2. The positive effect of problem-solving instruction can be expected in subjects other than practical arts if problem-solving instruction is employed. Therefore, the experimental study of problem-solving instruction compared with traditional non-problem-solving instruction is suggested.
3. Long-term study of the promotion of creativity and development of curricula connecting elementary and secondary education is recommended.
4. This study has significance in the point that there was an attempt to promote creativity by using problem-solving instruction in the teaching of practical arts and that this study can be utilized in other subjects as well.

The theories and research with positive results for children are not supposed to be directly used without any pre-examination or regard of the students (subjects). Instead, there should be an understanding of children's abilities and verification of the effects of theories and methods suitable for children by carefully examining them prior to implementation.

Dr. Namyong Chung is an assistant professor in the Department of Practical Arts Education at the Daegu National University of Education, South Korea. He is member-at-large of Epsilon Pi Tau.

Gyoung-sug Ro is a teacher at Pohang Honghae Elementary School, South Korea.

References

Choi, Y. H. (1997). *Inquiry of practical arts education.* Seoul, Korea: Hyungseol.

Chung, M. K. (1997). Practical arts subject teaching plans for the development of elementary school students' creativity. *Bulletin of Practical Arts Education Society of Korea, 10*(2), 1-12.

Chung, T. H. (1987). *Study of motivational factors of learning hour input in instruction and subject analysis.* Unpublished doctoral dissertation, Graduate School of Korea University.

Korea Creativity Research Institute. (1998). *Creativity and thinking faculty test.* Seoul, Korea: Lee, Gi-Woo

Kwak, S. M. (1988). *Practical arts education*. Seoul, Korea: Kabeul.

Ministry of Education. (1993). *Curriculum explanation III.* Seoul, Korea: Daehan Textbook.

Na, S. I. (1997). Application methods of the problem-solving method on the practical arts subject for elementary school education. *Proceedings for the Seminar for '97 Elementary Practical Arts Education.*

Research Association of the Practical Arts Education for All Korea National Universities of Education. (1997). *Practical arts education.* Seoul, Korea: Educational Science Publisher.

Seoul-Inchon Area Research Association of the Practical Arts Education. (1995). *Practical arts education.* Seoul, Korea: Educational Science Publisher.

Sherer, M., & Adams, C. (1982). The self-efficacy scale: A construct validity study. Paper presented at the annual meeting of the Southeastern Psychological Association, Atlanta, GA.