An Analysis of the Jeju Beach Science Camp Program Based on the HASA Curriculum and a Survey of Preference

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Abstract: The purpose of this study was to analyze the Jeju beach science camp program and to survey the participating students' preference levels for the activities included therein. The camp programs were analyzed on the basis of the standards set for the HASA curriculum. The program's "manipulatory skill" area included many manipulatory and creative activities while the "inquiry area" included many basic and integrated inquiry activities. It was also indicated that the "knowledge area" included many activities appropriate for understanding concepts and principles while the "attitude area" included many activities appropriate for stimulating curiosity and enjoyment. Thus, it could be seen that the areas stipulated for the HASA curriculum were considerably consistent with the purpose of the science camp. The participating students showed preference for manipulatory and creative activities included in the program. They also preferred basic, inquiry level activities included under the area of "inquiry skills." It was identified that the students most preferred the conceptual stage included under the area of "knowledge" where they were required to grasp the common characteristics of events, things, and phenomena, as also the enjoyment stage included under the "attitude" area, where they were required to participate in pleasant science activities. These findings indicate that science camp programs should be composed of manipulatory and creative activities as well as activities that aim at basic research and the understanding of concepts.

Key words: science camp program, manipulating skill, inquiry, knowledge, attitude

Ⅰ. Introduction

The scientific achievements of Korean students notched up relatively high rankings in a comparative study of international curricula however, their interest in science was rated very low. In the results of the Third International Mathematics and Science Study-Repeat(TIMSS-R) carried out by the International Association for Educational Achievement, our students' scientific content achievement was ranked fifth among all the studied countries while their interest in science was ranked only 22nd (Lee & Jung, 2004). In modern-day society, where science and technology are perceived as important subjects, this low level of interest in science exhibited by Korean students can be perceived as a very serious problem. In particular, when seen from the viewpoint of the cultivation of scientific knowledge which is an important objective of science education, interest in science can be considered a very important factor. Factors that must be given priority as means to cultivate scientific knowledge are interest in science and the provision of information that can stimulate curiosity in the learner. Interest in and curiosity about science will foster interest in issues related to scientific technology and this interest, in turn, will lead to participation in the decision making process on related issues, ultimately resulting in rational decisions (Kang, 2010). Therefore, efforts have been made to enhance students' understanding of science through eliciting their first-hand research into natural phenomena and by modifying the school curriculum with the objective of increasing the association between science and real life. For example, the 7th educational course emphasizes the importance of experiencing first-hand the phenomena that are described in textbooks. When seen from this context, it is clear that the focus isnow on out-

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of-school science education.

As indicated by the results of a study, out-of-school science activities can help raise the interest in science of students having low preference for the subject by providing a new dimension to their science studies as well as stimulating their scientific curiosity during their school days in fact, throughout their lives. Such students will go on to essay the important role of promoting the popularization of science in future society (Kim & Lee, 1996). Science activities outside school can thus become an important channel to raise interest in science. Therefore, providing diverse scientific experiences using not only regular school lessons but also materials from real life can be said to play quite a significant part in raising students' interest in science.

Of science activities outside school, science camps are characterized by the fact that unlike school science or laboratory lessons, they are held in natural surroundings that are not limited by either space or time. Science camps generally comprise activities that involve living in close cooperation with peers in natural surroundings with the objective of establishing friendly human relations and truly getting to know each others' personality while accumulating knowledge of nature and undergoing physical training through outdoor activities. With regard to studies done outdoors, Sharp (1957) emphasized that in order for effective learning to occur, any subject should be learned through first-hand experience garnered by living in natural environments. The function of outdoor education is also regarded as an extension of the school curriculum as it provides the students with first-hand experience of the concerned subject in outdoor environments (Smith *et al.*, 1970). In particular, since science camp activities offer students an escape from the monotony of their daily lives to enjoy a sense of freedom and undergo living experiences that will help them form desirable human relations, such activities indirectly assist in fostering democratic citizens equipped with scientific experience and possessing extensive scientific knowledge (Kim, 2005). Of course, in reality, the time that students actually get to freely interact with each other is limited due to issues such as entering a school of higher grade and thus, it is very difficult for them to actively participate in science-related outdoor activities such as science camps. It is encouraging that nonetheless, science-related events are on the increase, mainly at the elementary school and lower-middle-school levels, and that parental interest in such events is also on the rise. However, as pointed out by Orion and Hofstein (1997), the fact that the main objective of general science camps is holding recreational and adventure activities can be pointed out as a problem.

Since science camps can be operated in any place other than classrooms, the activities they include can also be very widely diversified. These activities can be largely divided into two activity areas: science-related activities and outdoor education-related activities. The science-related area includes outdoor study activities such as observing, collecting, sampling, and classifying activities scientific experiments, scientific research, and arts-and-crafts-related activities activities related to increasing problem-solving power through conversations or discussions and scientific quizzes, science plays, scientific picture drawing, constellation observation, and field trip activities. Outdoor education related activities include physical training, boot camp training, and recreation (Seoul Metropolitan Board of Education, 1987a).

In Korea, the initial-stage science camps which were held in the 1980s were activated after the publication of data pointing toward their usefulness by the Seoul Metropolitan Board of Education (1987b), the Korean Association for Science Education (1988), and the Information Center for Elementary Science (1990). However, science camp activities received a setback at the beginning of the 1990s due to problems such as high operating expenses, difficulties in the

preparation process, cost of teacher education, lack of good programs, low levels of participation, and study oriented educational reality (Kim, 2005). These phenomena can be considered to have acted as factors limiting science camps and related studies.

The out-of-school science education programs that are currently implemented in our country can be divided into field experience studies, science playgrounds, science classes, and science camps on the basis of content or form (Choi & Woo, 2003). These science camps are mostly operated by government educational institutions such as the Ministry of Education, Science and Technology; offices of education general government institutions and other youth organizations. Although some studies have been conducted in relation to science camps (Kim & Lee, 1996; Park *et al*, 1999; Park, 2002; Choi, 2005), most of them are limited to the analysis of the actual state and development of camp models. Not many studies include a concrete analysis of the contents of the camps or the suitability of these contents. This study is an attempt to resolve the above situation, and was initiated with the intention of analyzing the diverse program activities included in the Jeju beach science camp on the basis of an analytic framework and to gauge students' interest level in the activities included therein through a survey. This study aims to provide concrete data on the common characteristics of the activities that attract students' interest and to provide guidelines for the future development of science camp programs.

The HASA (Hands-Head-Heart-at Science Activity) initially had 3 "H" at its core. In other words, the activities the project included aimed to induce a balanced growth of the ability to conduct scientific experiments, to foster growth in scientific knowledge, and to inspire confidence in science. However, the project was reestablished with human oriented alternative science activities at its base (Hearts-on Alternative Science Activities) (Science Education Research Center, Hanyang University, 2009). In other words, the project now works as an educational course aimed at enhancing inquiry (Hands), knowledge (Head), and attitude (Heart), and so it is sometimes specified as a standard for the HASA (Hands-Head-Heart-at Science Activity) curriculum (Hong *et al.*, 2006). Besides, Song *et al.* (2004) point out that as changes in science teaching methods are to be made in accordance with changes in science education paradigms irrespective of educational size or level or whether the education is imparted in or outside school, the adoption of a practical approach to science through the inculcation of methods similar to those used by actual scientists would prove highly valuable. The objectives of the HASA that place emphasis on manipulating scientific skills are shown in 〈table 1〉.

The proclaimed goals of the Jeju beach science camp were "to foster continued interest through manipulation in science through activities that deal with scientific phenomena, raise students' problem-solving ability that can be applied to real life, and enable them to scientifically explain natural phenomena" (Jeju Youth Science Club, 2007). These goals can be interpreted as being similar to those outlined by the HASA curriculum standards. Therefore, in this study, theJeju beach science camp program was

Table 1

The puprose of HASA (Hanyang University Research Center for Science Education , 2009)

	(handicraft skill) hands operated skill		(inquiry) hands	(knowledge) head	(attitude) heart
Ⅰ	doing	→	foundation	fact	curiosity
Ⅱ	making	→	compound	concept	enjoyment
Ⅱ	applying		creativity	principle and law	passion

analyzed on the basis of the proclaimed standardsfor the HASA curriculum.

The analysis of the science camp program and the survey of the participating students' preference for various activities in the program that were undertaken in this study can be considered to have served the functions of assessing the organization and operation of the camp as well as preparing the basic data for the future development of science camp programs.

The research questions were as follows. First, what activities did the Jeju beach science camp program comprise? Second, what kind of activities did the participating students prefer?

Ⅱ. Methods and Procedure

1. Participants

In this study, the 360 students (ranging from 5th grade 8th grade) who had participated in the 2009 Jeju beach science camp hosted by the Jeju Special Self-Governing Provincial Office of Education and superintended by the Jeju Youth Science Research Study Group were surveyed with the objective of assessing their level of preference for the activities included in the science camp. The details of the study subjects are presented in 〈Table 2〉.

Table 2
Subjects

grade	participants	respondents
5	120	116
6	93	87
7	82	70
8	65	58
total	360	331

2. Analyzing method

The activities included in the 2009 Jeju beach science camp program were analyzed on the basis of the HASA curriculum. The program was analyzed by ten elementary/middle school teachers in the Jeju Youth Science Club. The results that coincided with the results of the individually performed analysis were extracted. In the cases where the result of an identical activity was dissimilar, it was adjusted after a discussion. In the course of the camp activities, all the students participating in the camp were surveyed for their level of preference for the 19 activities included under the seven areas of the science camp program. The responses were analyzed by area and the frequencies of the programs that were the most preferred by the students were examined using a Likert five-point scale. The preference was calculated by adding up the ratios (%) of the responses "very satisfied" and "satisfied." The results of the survey were analyzed using the SPSS 12.0.

Since this research was restricted to the 2009 Jeju beach science camp, the results cannot be described as applicable to all science camps. Moreover, the research did not comprise a factor analysis of the preferences. It is thus necessary to carry out asubsequent study that will address the above shortcomings.

Ⅲ. Results and Discussion

1. Analysis of the Jeju beach science camp program

The Jeju beach science camp program is composed of science hiking, a scientific visit, a science olympic, astronomical observations, creativity programs and marine activities and each of the areas is again composed of sub programs in sub areas. The details of the program composition are presented in 〈table 3〉.

The sub programs were analyzed based on the areas of manipulating skills, knowledge, research and attitudes. The results of the analysis are as shown in 〈table 4〉.

1) Results of the analysis of manipulating skills

Based on the results of the analysis of the

Table 3

Composition of the camp program

Course	Area		Mark	Content
1	Science hiking	* course 1 the mystery of nature	A	◦ observation of plants in surroundings and sample making
			B	◦ human body puzzles
			C	◦ observation of insects in surroundings and making insect models
		*course 2 living science research	D	◦ making rubber balloon rockets
			E	◦ making infinite mirrors
			F	◦ attaching wings to eggs
		*course 3 finding principle	G	◦ amazing freezing experiment using liquid nitrogen
			H	◦ solar heat cooker using the reflection of light
			I	◦ finding science principles in foods
2	Scientific visit	visit to Gotzawal (3 teams)	J	◦ What is Gotzawal?
				◦ process of the formation of Gotzawal and the geological features of Gotzawal
				◦ plants and animals in Gotzawal
3	Science olympic	science olympic(Ⅰ)	K	◦ building the Tower of Babel using paper cups
			L	◦ getting flying disks pass through a target
			M	◦ Pass through laser beams
		science olympic(Ⅱ)	N	◦ air basketball(experiencing Bernoulli's principle)
			O	◦ mission impossible (experiencing electric circuits)
			P	◦ target hitting using the elasticity of rubber bands
4	Creative Goldberg device		Q	◦ team activities for teamwork and togetherness
				◦ discussing activities through setting creative subjects
				◦ activities to experience the importance of group activities
5	Scientific images and science lecture		R	◦ space images
				◦ science lecture(subject : the birth and death of stars)
6	Astronomical observation		S	◦ how to use astronomical telescopes
				◦ finding planets
				◦ story of constellations and observation of constellations
7	Marine activities	The sea is my friend	T	◦ rafting : to cultivate the power of unity and the ability to respond to nature
				◦ banana boat : to experience scientific phenomena by plays
				◦ yacht : to experience scientific phenomena by plays
				◦ skin : exploration of underwater marine ecosystems
8	Programs when it rains		U	◦ scientific making activities– constellation plate making, model aircraft making
				◦ space science movie play

program, among the manipulating activities of simple assembling or operating completed products, seven were shown to be very appropriate and seven were shown to be appropriate. Of the making activities that are activities to implement experimental processes

Table 4

The result of program analysis

content	action	handicraft skill			inquiry			knowledge			attitude		
		doing	making	applying	foundation	compound	creativity	fact	concept	principle and law	curiosity	enjoyment	passion
science hiking	A	○	⦿	△	⦿	○	△	⦿	○	△	○	⦿	△
	B	○	⦿	△	○	⦿	△	⦿	○	△	⦿	○	△
	C	△	⦿	○	⦿	○	△	△	⦿	○	○	⦿	△
	D	△	⦿	○	○	⦿	△	△	○	⦿	⦿	○	△
	E	○	⦿	△	○	⦿	△	△	○	⦿	○	⦿	△
	F	○	△	⦿	○	○	⦿	△	○	⦿	○	⦿	△
	G	⦿	○	△	⦿	○	△	△	⦿	○	⦿	○	△
	H	○	⦿	△	○	⦿	△	△	○	⦿	○	⦿	△
	I	○	⦿	△	○	⦿	△	△	○	⦿	○	⦿	△
scientific visit	J				○	⦿	△	△	⦿	○	⦿	○	△
science olympic	K	○	△	⦿	△	⦿	○	△	⦿	○	○	⦿	△
	L	⦿	○	△	⦿	○	△	△	⦿	○	○	⦿	△
	M	⦿	○	△	○	⦿	△	△	○	⦿	○	⦿	△
	N	⦿	○	△	⦿	⦿	△	△	⦿	○	○	⦿	△
	O	⦿	○	△	○	⦿	△	△	⦿	○	⦿	○	△
	P	⦿	○	△	⦿	○	△	△	⦿	○	⦿	○	△
astronomical observation	S				⦿	○	△	△	⦿	○	○	⦿	△
					⦿	○	△	△	⦿	○	⦿	△	○
					⦿	○	△	△	⦿	○	⦿	○	△
science lecture	R				△	⦿	○	△	⦿	○	⦿	○	△
creative program	Q	△	○	⦿	△	○	⦿	△	⦿	○	△	○	⦿
marine activities	T	⦿	○	△	⦿	○	△	△	⦿	○	○	⦿	△

※ appropriacy to purpose (⦿ very appropriate, ○ appropriate, △ insufficient)

with teachers' help or alone, seven activities were analyzed to be very appropriate and eight were indicated to be appropriate. Of the applications that mean activities to develop existing activities to make new finished products by oneself or to apply leaned manipulating skills to real life related problems, three activities were analyzed to be very appropriate. That is, in the composition of the program, it was shown that the ratio of manipulating activities that are relatively lower level activities was high and the ratio of applications that are higher level activities was low.

2) Results of the analysis of the area of inquiry

Activities that were judged to be appropriate in cultivating skills for basic inquiry processes such as observation, classification, measurement, inference and prediction were shown to be 19 in total including ten that were considered to be very appropriate. In addition, activities that were very appropriate and appropriate for integrated

inquiry process skills such as problem perception, establishment of hypothesis, variable control and data conversion were shown to be 11 and 11 respectively and thus it can be assumed that the Jeju beach science camp program is effective in raising the process skills. On the other hand, programs that were very appropriate and appropriate for creativity that indicates study activities requiring divergent thinking and figurative thinking were shown to be two and two respectively and thus it could been seen that creativity related activities were relatively insufficient.

3) Results of the area of knowledge

With regard to the area of concepts among the components of scientific knowledge, all the activities were shown to be very appropriate. However, activities that were very appropriate in relation to facts were only two and thus it could be seen that the basic part of the program should be revised and supplemented in that scientific facts form the basis of scientific knowledge. In the case of principles and laws, all the activities except for two were shown to be appropriate.

4) Results of the analysis of the area of attitudes

With regard to curiosity, nine activities were shown to be very appropriate and 12 activities were shown to be appropriate. Twelve and nine activities were identified to be very appropriate and appropriate for showing enjoying that indicates pleasantly participating in science activities respectively. In relation to the passion that means enjoying science as well as developing into the stage of studying science, only two activities were shown to be very appropriate and appropriate and thus it could be seen that the activities of this camp were not sufficient to have participating students experience passion for science.

2. Survey of preference for the science camp program

The course 1, 'the mystery of nature' was composed of 'observation of plants in surroundings and sample making', 'observation of insects in surroundings and making insect models' and 'human body puzzles'. Based on the results of the preference survey, the insect model making activity was shown to be the most highly preferred. The preference for each activity is presented in figure 1.

The course 2, 'living science research' included activities including 'making rubber balloon rockets', 'making infinite mirrors' and 'attaching wings to eggs' and based on the results of the preference survey, 'making infinite mirrors' showed the highest preference at 79%. The preference for each activity is presented in figure 2.

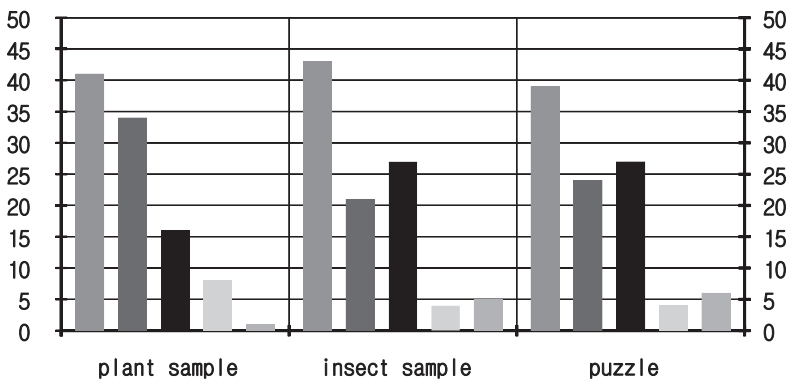

Fig. 1 *Preference for 'the mystery of nature'*

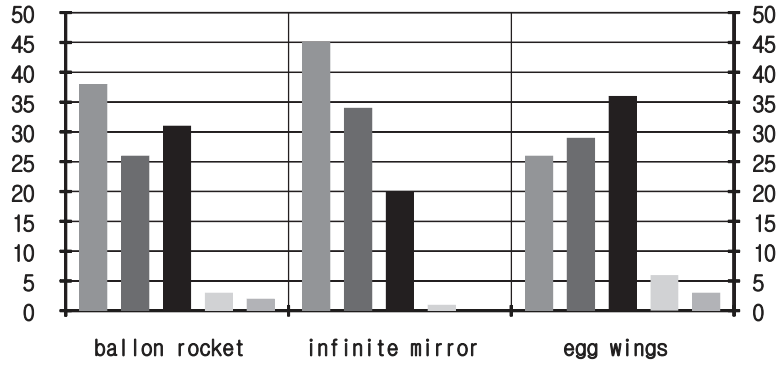

Fig. 2 *Preference for 'living science research'*

The course 3, 'finding principles' was composed of 'amazing freezing experiment using liquid nitrogen', 'solar heat cooker' and 'finding science principles in foods' and based on the results of the preference survey, the showed preference ratios of 83%, 45% and 66% respectively and thus the 'amazing freezing experiment' that cannot be experienced in the field of school showed the highest preference. This can be considered to be consistent with the result of a study by Hong *et al.* (2006) indicating that when lessons were given centering on activities for students to firsthand manipulate or make things, students' interest was induced.

In the scientific visit and creativity program, a visit to Gotzawal, astronomical observation and creative domino building activities were done. For these activities, the participating students showed relatively low preference. In particular, it was indicated that only 30% of the students were satisfied with the visit to Gotzawal and this is considered to be because the difficulties experienced on the day of the visit due to the rainy weather were reflected. This result is consistent with the results of a study by Choi (2005) and it can be seen that the bad weather and difficulties in the implementing process adversely affected the preference. However, since Gotzawal is ecological topography that has an important meaning in the environment of Jeju region, it is considered that the activity should be continued through revisions and supplementations of the content and method of the activity. As pointed out by Choi *et al.*(2008), given that region based experience education contributes to the enhancement of participants' environment consciousness and understanding of the region, it is considered that visits to the

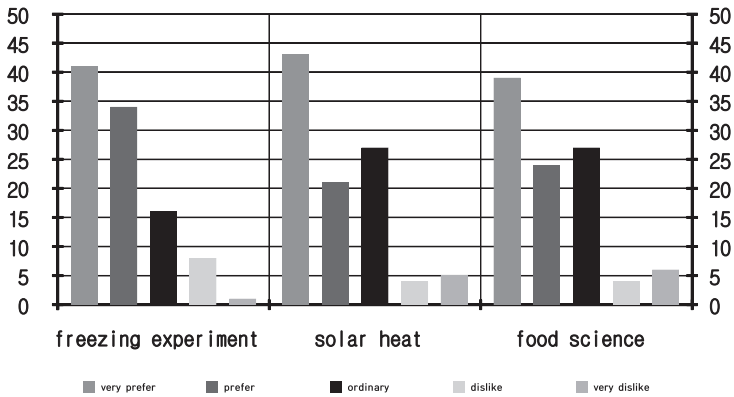

Fig. 3 *Preference for 'finding principles'*

unique topography of the region should be continued.

The program 'science olympic' was composed of six sub programs including 'building the Tower of Babel using paper cups', 'getting flying disks pass through a target', ' wireless limbo using laser beams', air basketball using Bernoulli's principle, 'mission impossible using electric circuit tests, 'target hitting using the elasticity of rubber bands and target hitting using the principle of magnets and the preference for 'building the Tower of Babel using paper cups' showed the highest preference at 74%.〈figure 5〉

The science image program was composed of space images and a lecture on the life of stars and the students' preference for this program was shown to be 68%.

Based on the results of the survey of the students, activities that showed high preference were mostly doing or making firsthand related activities. In the case of the area of research, it was identified that the students preferred basic research to integrated research or creative research. In the case of the area of knowledge, it was identified that the students the most highly preferred the stage of concepts to grasp common characteristics of events, things and phenomena and in the case of the area of attitudes, the students the most highly preferred the stage of enjoying where they would pleasantly participate in science activities. This was consistent with the results of a study by Yeon(2003) indicating that students feel interest in activities stimulating their intellectual curiosity in which they can participate firsthand and that they prefer programs that contain many play factors. In particular, as shown in the previous study(Choi,

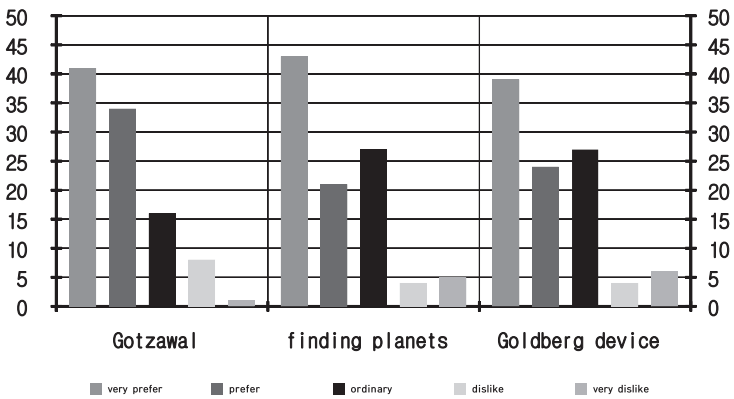

Fig. 4 *Preference for 'the scientific visit and creativity program'*

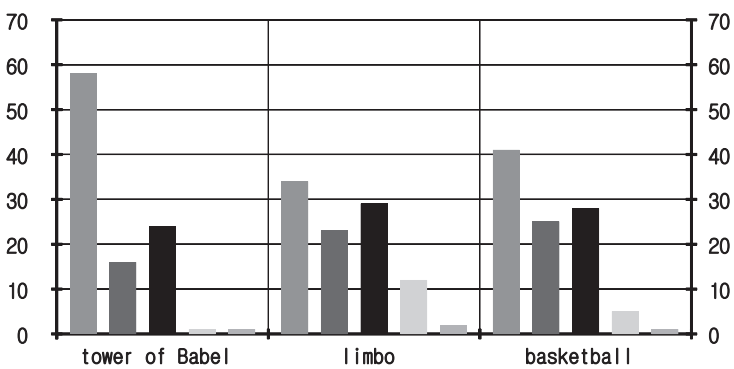

Fig. 5 *Preference for 'science olympic(I)'*

2005), it was indicated that the students participating in the camp highly preferred activities that stimulated curiosity including dramatic effects or new experience.

Ⅳ. Conclusion and Suggestion

In this study, programs in the 2009 Jeju beach science camp superintended by the Jeju Youth Science Club were analyzed and the preference of the students participating in the camp for the program activities was surveyed. In this science camp, 20 programs were developed and applied in 8 areas.

The camp programs were analyzed based on the standard for the HASA curriculum and based on the results, the manipulating skill area included many manipulating and making activities and the inquiry area included many basic and integrated inquiry activities. It was also indicated that the knowledge area included many activities appropriate for concepts and principles and the attitude area included many activities appropriate for curiosity and enjoying and thus it could be seen that the areas were considerably consistent with the purpose of the science camp.

The participating students' preference for the programs was analyzed and based on the results, the students preferred manipulating and making in the area of manipulating skills and basic research in the area of inquiry skills. It was identified that the students the most highly preferred the stage of concepts where they were to grasp common characteristics of events, things and phenomena in the area of knowledge and the stage of enjoying where they were to pleasantly participate in science activities in the area of attitudes.

Therefore, it can be seen that the trend shown in the analysis of the program and the students' preference were similar to each other to some extent. This indicates that science camp programs should be composed of manipulating and making oriented activities and activities that pursue basic research and the understanding of concepts. Besides, this result can be considered as proving that for students to perform higher level research such as integrated and creative research, it is necessary to develop activities that can enhance students' preference rather than simple manipulating oriented activities.

In particular, it is considered that, for science camps to serve important roles as science education activities outside school, more specialized programs in relation to school grades and genders should be developed and operated. To this end, data on students' preference should be secured first and then, based on the data, further segmented activities and programs should be developed. In relation to the specialization of programs, methods to select students participating in the camps should also be considered. With regard to methods to select students participating in the camps, it is considered that the current random selection through applications through Internet and camps for students recommended by science rooms or schools should be utilized dualistically.

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