



Empathy as an Element of Promoting the Manifestation of Group Creativity and Survey on Empathic Ability of Korean Elementary School Students

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ABSTRACT

This research examined the importance of empathy, which was regarded as one of the elements that might assist in accelerating the manifestation of group creativity, and studied the actual state of empathic ability of Korean elementary school students. For such, a cognitive and affective empathic ability test was conducted over 228 students that were in their fifth and sixth grades of public elementary school in Korea, and this result was indirectly compared with preceding research results of the United States and the Netherlands, which had studied the empathic ability over students in a similar age range as the research subjects. As a result of the research, Korean elementary school students appeared to have higher cognitive empathic ability than affective empathic ability. In particular, the mean score of perspective taking of Korean elementary school students, in cognitive empathy, appeared to be relatively higher than the mean score of the elementary school students in the United States and the Netherlands. The mean score of fantasizing appeared to be lower than the mean score of perspective taking, while failing to reach the mean. Moreover, empathic concern of Korean elementary school students, in affective empathy, appeared to be relatively lower than the mean score of elementary school students of the United States and the Netherlands. Moreover, the mean score of empathic awakening appeared to be higher than the mean score of empathic concern, however, the mean score of empathic awakening appeared to have failed to reach the mean. The educational implications for such have been discussed.

Keywords: *group creativity, cognitive empathy, affective empathy, science education in Korean elementary school*

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State of the literature

- Balanced development between cognitive empathy and affective empathy must be premised to effectively realize the group creativity of elementary and middle school students.
- There is a need for research to be undertaken regarding empathic ability in order to effectively develop the group creativity of elementary and middle school students, however, research on the empathic ability of elementary and middle school students is almost non-existent or inadequate in the science education sector of Korea.
- This research examined the importance of empathy, and studied the actual state of empathic ability of Korean elementary school students.

Contribution of this paper to the literature

- We confirmed the actual state of cognitive and affective empathic ability of Korean elementary school students.
- We provided the importance of education on empathy within group creativity education to the elementary and secondary science sectors.
- The results of this research are beneficial for future studies of preparation of strategies and having an in-depth understanding on the cognitive and affective empathic ability of elementary school students.

INTRODUCTION

Group creativity is a process of developing and expressing ideas expected to be useful for achieving a common goal of a group sharing self-identity through the cooperative interaction (Nijstad & Paulus, 2003). Communication and cooperation between members of a group possessing individual characteristics may assist in obtaining diverse ideas in unexpected and new forms by doubling the creativity possessed by one individual (Ha et al., 2011). Thus, there is a possibility that the efficiency of ideas generated from cooperation within a group may be higher than the efficiency of ideas generated from one creative individual (Ha et al., 2011). In reality, along with the emergence of complex issues that are difficult to resolve only by efforts of one individual or one sector, in our society, instances of various people cooperating together and solving problems are appearing in many sectors. For example, 'NineSigma', which is a group creativity network of the high-tech industry businesspeople of P&G, and 'YourEncore', which is a community of retired scientists and engineers, are introduced as cases facilitating the pursuit of innovation through the process of group creativity internally and externally (Libert et al., 2007). The 'C. Elegans Project' (Brenner, 2009), which figured out the perfect genomic information of *Caenorhabditis elegans* in 33 years through cooperation and sharing of data possessed by each laboratory in the world, is one of the representative cases that showed the possibility and value of group creativity.

The reason such cases are being continuously reported is that the condensed thoughts and insights of a group may be elicited by the mutual exchange of the advantages between diverse people (Shalley et al., 2004), and this tendency is expected to be further accelerated in

future society where diverse forms of social interaction are available by the connection of all individuals based on enhanced information and communication infrastructure (Lee, 2012; Malone, 2008). Regarding such phenomenon, Choi (2011) said, regarding contemporary society, that the era of Homo symbiosus (a symbiotic being) or Homo reciprocus (an interdependent being), that indicates a mutually cooperating human being, which surpasses Homo Sapiens (a thinking being), is opening. Thus, although future society may require one great creative person, it more requires people with the capacity to generate creative ideas through cooperation. Consequently, the importance of group creativity is newly emerging of late (Shalley et al., 2004).

However, various sectors in Korea show a tendency of regarding creativity as an individual capacity, and the approach to creativity in the primary and secondary science education field mostly stays at an individual level (Jeong & Cho, 2012; Park & Kang, 2012). For example, improvement of the problem solving ability has been emphasized for developing students' creativity in Korea's science education (Kim et al., 2002), and researches relating to development of techniques to cultivate divergent thinking or convergent thinking of individual students in such problem solving process have been conducted (Hwang et al., 2004; Park & Kang, 2012; Seong, 2003). In addition, studies for the effectiveness on problem solving models in terms of the character, intelligence, cognitive style, and motivation of individuals for the improvement of students' creativity after revising and supplementing the problem solving models conforming to the contents of the science subject have been undertaken (Joo et al., 2011; Kim et al., 2002; Kim et al., 2008; Yoon & Woo, 2011). It is only in recently that the science education sector of Korea started to show interest in group creativity and started to undertake studies on the means or strategies to cultivate group creativity of elementary and middle school students. For example, there are studies such as the research on development of group-utilizing study model (Lee & Lee, 2009), the study on the development and application of discussion class utilizing café-type dialogue (Kim, 2013), and the research on development and application of class model on social and ethical issues relating to science based on group creativity strategy (Lee et al., 2014). In particular, Korea is recently focusing on seeking strategies utilizing design thinking that is reported as one of the innovative methods of assisting the manifestation of group creativity (Brown, 2008).

Design thinking is a problem solving process and thinking method that started at IDEO, which means the method of thinking and process for finding the best answer of a problem based on the cooperation and empathy by the formation of a group of diverse people (Martin, 2009). 'Design' in design thinking has the meaning of creatively resolving an issue through group introspection for a better result, beyond the nominal meaning of planning or decorating the exterior of a particular product or apparel (Martin, 2009). Developed countries, such as the United States, United Kingdom, Germany, or Japan, are already discovering the potential of group creativity by introducing and applying design thinking in various sectors, such as management, art, and architecture, and have already developed a process based on design thinking that may enhance the group creativity of students, applying such process in

the school field. For example, the d.school of Stanford University is operating an integrated collaborative education course centering on design thinking, and the Hasso Plattner Institute of University of Potsdam of Germany has developed and proposed a design thinking process conforming to the educational situation (Konno, 2015). Furthermore, there are reports on studies applying activities based on design thinking in the project courses taken by students (Carroll et al., 2010; Kwek, 2011).

Accordingly, the studies and the efforts to introduce design thinking in the science education sector have commenced as well in Korea. For example, a study extracting the core capacities of people that are proficient in design thinking and introducing design thinking in science education has been undertaken (Lee et al., 2014). In addition, a study examining the effect after developing design thinking process suitable to the science education conditions of Korea and applying such process in the secondary school science classes has been undertaken (Lee et al., 2015). The design thinking process here has been developed into five phases of 'understanding knowledge', 'empathy', 'sharing perspective', 'generating idea', and 'prototype' by considering the characteristics of students and the science education situations of Korea, and the developed process appeared to be helpful for secondary school students to experience the group creativity process and understand its value (Lee et al., 2015). This study also suggested that empathic ability of students was important for group creativity based on the design thinking process for more effective manifestation (Lee et al., 2014).

Empathy is a cognitive and affective response to the emotion and situation of others (Davis, 1980; Hoffman, 1984), which is the source of the manifestation of group creativity (Sawyer, 2007). In other words, group creativity means the result of dynamic cognitive and affective cooperation based on harmonious association, which is differentiated from the result of simple mechanical and group cooperation. Thus, for cooperative interaction to effectively occur, matters such as a shared goal between all members, understanding each other, and connection between members with different backgrounds or talents are required, and empathy is reported as one of the useful elements that may support and accelerate such factors (Martin, 2009).

Accordingly, empathy is emphasized in design thinking, and in the design thinking process proposed by IDEO (IDEO, 2011) and Hasso Plattner Institute (Konno, 2015), an observation phase, in which the activity of understanding and empathizing the demands of others is performed, is included. In the design thinking process developed by Korea's Lee et al. (2015), a phase which has the name of 'empathy' provides an opportunity to understand each other and form a positive relationship through affective communion between members of a group, in addition to understanding the demands of others, is included. As a result of applying the design thinking process of emphasizing the empathy phase to high school students of Korea, it appeared that the mutual understanding and trust formed between members at the empathy phase became a driving force for students to solve a problem to the end (Lee et al., 2015). Thus, students could adequately adjust the conflicts that appeared in the process of experiencing design thinking, and it was mentioned that the activities of listening

attentively to each other, accepting each other, and supporting each other, between members, were engaged in more easily (Lee et al., 2015). A study measuring the group creativity index undertaken by an MIT research team explained that empathic ability needed when speaking in even terms without one person dominating over the other was connected to the manifestation of group creativity (Jeon, 2013).

As a result, there is a need to discuss not only group creativity in science education, but empathy, to assist the meaningful manifestation of group creativity, along with the growth of individual students. This is because the ability to empathize can be developed through education (Gazda & Evans, 1990, Park, 2004, Rogers, 1975). Accordingly, efforts are being made to make connection between empathy and each school subject, as a part of the policy of the Ministry of Education in Korea, however, such efforts are inadequate at present. Thus, the empathy education that has been mostly formed in the Korean language or ethics subjects is being attempted in science education, however, there are no specific studies being undertaken in relation. Consequently, there is a need to first understand the actual status of the empathic ability of Korean students in order to effectively prepare a strategy for students' empathy education for the development of group creativity. Thus, this research seeks to study the actual status of empathic ability over students in their fifth and sixth grades in elementary school in Korea. This is because the upper grades of elementary school are a period when distinguishing diverse emotions and understanding other people's perspective through cognitive development become available (Davis, 2007; Hoffman, 1982, 2000), thus, that is the suitable period for educating empathy for the development of prosocial behavior (Findlay et al., 2006).

Therefore, this research investigated the actual status on the level of empathic ability of elementary school students in Korea and sought to derive the implications for empathy education within the science curriculum at elementary school.

THEORETICAL BACKGROUND

Group creativity can be seen as the ability of a community creating synergy through the cooperative interaction of many individuals. The fact that a synergetic effect exceeding the sum of the performance of individuals can be generated by active interaction between members of a group is becoming a factor that does not allow to overlook the value of group creativity. However, according to preceding studies on the effect of group task performance (Mesmer-Magnus & DeChurch, 2009; Stasser & Titus, 1985; van Ginkel & van Knippenberg, 2008), many groups are reported to be failing in actually realizing such group creativity effect. In other words, unlike general expectations, the effect of group task performance can never be regarded as more superior than individual performance, and rather, there have been many instances showing reverse effects as well. Such study results confirm the fact that a synergetic effect does not arise only because many people work together, and that satisfying particular conditions over several levels is necessary to have meaning surpassing that of individual performance. Thus, this research seeks to examine matters focusing on the importance of

empathy among the various conditions for individual creativity to sublimate into group creativity.

Definition of Empathy

Empathy means the ability to perceive and feel as another person by temporarily identifying oneself with what the other person feels and thinks (Mehrabian & Epstein, 1972). In the event that empathic ability is lacking, there may be difficulty in delivering one's own mind or thought to others, and at the same time, in understanding the thoughts and acts of others (Smith, 2006). Such empathy may be classified into cognitive empathy and affective empathy (Mehrabian & Epstein, 1972).

Cognitive empathy is the ability to understand and accept the thoughts or perspectives of others (Mehrabian & Epstein, 1972). In other words, cognitive empathy shows the cognitive condition of understanding the perspective or situation of others in a certain condition and understanding the reason that others think or feel in that way (Howe, 2012). Cognitive empathy can be classified into perspective taking and fantasizing (Davis, 1980), and perspective taking is to make voluntary efforts to understand others' thoughts in daily life, which is to integrate the empathic emotion generated in the process with one's own general knowledge (Davis, 1980, 2007). Fantasizing is to imagine one's own feeling within a situation after assuming a fictional situation. Thus, it means to become a character within an imaginary situation, such as in a movie, novel, or play (Davis, 1980, 2007). Affective empathy is the ability to feel as if vicariously experiencing the emotion or feeling of others (Mehrabian & Epstein, 1972). In other words, affective empathy is an emotional response conforming to the situation faced by others, rather than one's own situation (Hoffman, 1984), which can be classified into empathic concern and empathic awakening (Davis, 1980). Empathic concern means to have interest and feel compassion and sympathy towards others having a particular experience and empathic awakening means an emotional response of experiencing the same emotion as others. Namely, empathic awakening is a type of an emotional sharing process, of sharing another person's feeling, thus, means a state of emotional awakening triggered to a person empathizing due to a situation or condition faced by another person.

Thus, it can be known that empathy is not only a cognitive activity of taking one's own perspective based on understanding the behaviors of others, but an emotional response directly experiencing the emotional condition conforming to the situation of others.

Group Creativity and Empathy

The preconditions for the effective manifestation of group creativity are establishment of common goal, meaningful communication, and cooperation through a horizontal relationship (Sawyer, 2007), and empathy can be a factor of supporting and promoting such conditions (Lee et al., 2014; Sawyer, 2007). Accordingly, the detailed roles and meaning of empathy in group creativity are as follows.

First, it is important for members to find the problem or goal to jointly resolve for the manifestation of group creativity (Yang, 2011). However, empathy can apply as a factor deriving continuous interest and participation of members regarding a problem, along with sensitivity towards the problem, during this process. Thus, in order to solve a particular situation, examining the specific problem and revealing the cause must be preceded, and at this stage, sensitivity towards a problem is reported as to perform an important role (Sawyer, 2007). Sensitivity towards a problem means the ability of viewing a given phenomenon from a critical and diverse viewpoint, while maintaining a psychological doubt instead of simply accepting the phenomenon as seen. Sensitivity is related to cognitive empathy of recognizing and thinking from others' perspective, and is related to affective empathy as well in terms of finding a problem from consideration and interest towards others (Howe, 2012; Park, 2004). In particular, it is reported that empathy for others in the problem discovery process may assist in inducing the eagerness for positive and active participation of members while preventing the demotivation phenomenon pursuant to the lack of necessity of solving a problem, that is reported as one of the factors disturbing the manifestation of group creativity (Kerr & Bruun, 1983; Weber & Hertel, 2007). Thus, empathy not only can provide new and diverse viewpoints to members of a group in the process of discovering problems to solve, but can induce positive enthusiasm to participate, and in this aspect, the close relationship between group creativity and empathy can be considered.

Second, a meaningful communication must be engaged in between group members for effective manifestation of group creativity, and the role of empathy can be expected in this process. Communication that includes psychological and emotional parts starts from actively accepting the comprehension on the difference or dissimilarity between one and others (Egan, 1990). Thus, empathy can be regarded as the most essential and basic core element in communication (Eisenberg & Miller, 1987). Because empathy is an emotional response to the feeling of others while a cognitive behavior of accepting the perspective of others (Howe, 2012), communication based on empathy allows to positively perceive the emotion or cause of others while effectively expressing the broad understanding of such, both verbally and non-verbally (Hoffman, 2000). Thus, based on the fact that empathy may assist in accelerating quality communication, the close relationship between group creativity and empathy can be considered.

Third, there is a need for people having different backgrounds and talents to optimize the connection of ideas or talents they possess within the group for effective manifestation of group creativity, and for such, a horizontal group atmosphere must be formed first (Kwon & Jang, 2013). This is because it is difficult to arouse the curiosity of members, voluntary participation, and horizontal collaboration within a traditional and hierarchical atmosphere or relationship. Thus, the possibility that group members will actively engage in conversations with others increases when acknowledging that the group they are affiliated in supports their opinion and is a safe group that is not threatening, and this may lead to a positive result by doubling the performance within the group. The process of understanding and empathy

between group members may provide an opportunity to build trust and respect personalities and characteristics while reducing hostile judgments and prejudice towards others (Gazda & Evans, 1990), which can eventually assist in forming a positive atmosphere of the group (Park, 2004; Yang et al., 2009). Based on the fact that the experience of mutually receiving and providing empathy may naturally lead to a creative and harmonious atmosphere of the group, the close relationship between group creativity and empathy can be considered.

Since empathy may promote the group members' active communication, composition of common goal, and will to participate in problem-solving through formation of a positive group atmosphere based on trust and faith, the role of empathy can be expected as one element of assisting the manifestation of group creativity.

RESEARCH METHOD

Research Subjects and Procedure

This research was conducted over 122 fifth grade students (59 male students and 63 female students) and 106 sixth grade students (55 male students and 51 female students) currently enrolled in G and S elementary schools, respectively located in K city and S city, which were major cities in Gyeonggi-do, Korea (Table 1). The average age of the students was 11.82 (SD = 0.51). G and S elementary schools were general public elementary schools in Korea, and there were no research subjects that had received empathy education or participated in related activities. The researchers provided the prior guidance on the contents and implementation method of the survey to eight homeroom teachers of fifth and sixth graders of each elementary school, and the teachers conducted the survey. And then, the researchers collected all questionnaires after one week.

Table 1. Research subject

Classification	Fifth Grade		Sixth Grade		Total
	Male	Female	Male	Female	
G Elementary School	30	31	26	28	115
S Elementary School	29	32	29	23	113

Test Tool

In order to investigate the actual status of the empathic ability of Korean elementary school students, we used the empathic ability questionnaire of Park (1997) that was adapted from the test tool developed by Bryant (1982) and IRI (Interpersonal Reactivity Index) of Davis (1980) by considering the level of elementary school students and the educational situation in Korea. The verification of the empathic ability questionnaire of Park (1997) was completed for validity and reliability.

The empathic ability questionnaire was composed of two categories of cognitive empathy and affective empathy (Park, 1997), and here, cognitive empathy was composed of

two subcategories of perspective taking (5 questions) and fantasizing (5 questions), and affective empathy was composed of two subcategories of empathic concern (5 questions) and empathic awakening (15 questions). Perspective taking is an ability of comprehending the perspective or situation of others (Davis, 1980), which is composed of questions such as, 'I try to understand the other person's position at least for a moment when there is somebody making me angry' and 'I listen to the opinion of others having different viewpoints when making an important decision'. Fantasizing is for one to become a character within a hypothetical situation (Davis, 1980), which is composed of questions such as, 'I really feel like I am the character when reading stories' and 'I easily stand in the position of the character when watching a movie'. Empathic concern is an ability to take interest and feel compassion or sympathy for others having a particular experience (Davis, 1980), which is composed of questions such as, 'I often become sincerely concerned of person when seeing that person is more unfortunate than me' and 'There are instances when I do not feel much sympathy even when seeing someone suffering pain'. Empathic awakening is an emotional response experiencing the same emotion as others (Davis, 1980), which is composed of questions such as, 'I wish to laugh together when seeing someone else laugh' and 'I really feel heartbroken when seeing an injured child'. All questions in the questionnaire were in the 5-point Likert scales, and the internal consistency coefficient (Cronbach's α) of cognitive empathy and affective empathy in this research respectively appeared to be .78 and .76. In addition, the internal consistency coefficient (Cronbach's α) of perspective taking and fantasizing, which were the sub-factors of cognitive empathy, respectively appeared to be .81 and .77, and the internal consistency coefficient (Cronbach's α) of empathic concern and empathic awakening, the sub-factors of affective empathy, respectively appeared to be .80 and .74.

Data Analysis

Regarding the empathy test data, the mean score and standard deviation per sub-factor were calculated by using SPSS 21.0 for Windows. Afterwards, the research results of the United States (Batanova & Loukas, 2012) and the Netherlands (Hawk et al., 2013) that studied the empathic ability of students in a similar age range as the fifth and sixth graders of the elementary schools in Korea were examined to study the actual status of empathic ability of Korean elementary school students in more detail. Batanova and Loukas (2012) studied the empathic ability of students in the United States aged 10~13 by using the IRI of Davis(1980), and Hawk et al.(2013) studied the empathic ability of students of the Netherlands with an average age of 11.99, also by using the IRI of Davis(1980). Because there are no or inadequate preceding researches studying the empathic ability status over, not only elementary school students, but middle school students, at present in Korea, there was no choice but to compare the foreign students and Korean students to understand the empathic ability level of Korean elementary school students. Thus, it was determined that understanding the empathic ability level of Korean elementary school students would be meaningful even through indirect comparison, although direct comparison between this research and preceding researches of other countries would be difficult due to factors such as cultural differences, subtle differences

in language, and errors in translation that might occur in the process of adapting the foreign test tool, albeit using the same test tool. Moreover, only the scores of ‘perspective taking’, the sub-factor of cognitive empathy, and ‘empathic concern’, the sub-factor of affective empathy, were compared, and the reason for selecting these two sub-factors was that perspective taking, which was an ability of perceiving the conditions and feelings of others, was used as the representative factor of explaining cognitive empathy (Miklikowska et al., 2011). In similar fashion, empathic concern, which was the ability to take interest and feel compassion and sympathy towards others, was commonly used as the representative factor of explaining affective empathy (Valiente et al., 2004), thus, this research compared the mean value centering on perspective taking and empathic concern, and analyzed the causes.

RESULTS AND DISCUSSION

The mean and standard deviation of the cognitive and affective empathic factors of Korean elementary school students can be seen in **Table 2**. The mean score of cognitive empathy appeared to be 3.05(0.59) out of 5 and the mean score of affective empathy appeared to be 2.60(0.42) out of 5, thus, the mean score of cognitive empathy appeared to be higher than affective empathy.

Table 2. Mean score and standard deviation of the cognitive and affective empathy factors of Korean elementary school students

Factor(Total Score)	Mean	Standard Deviation
Cognitive Empathy(5)	3.05	0.59
Affective Empathy(5)	2.60	0.42

As such, a difference in cognitive empathic ability and affective empathic ability of Korean elementary school students appeared, and the results of examining in detail the contents per sub-factor composing of cognitive empathy and affective empathy to review the specific condition and cause of cognitive and affective empathic ability were as follows.

Cognitive Empathic Ability of Korean Elementary School Students

The mean score and standard deviation of Korean elementary school students regarding perspective taking and fantasizing, which are sub-factors of cognitive empathy, are as **Table 3**.

Table 3. Mean and standard deviation of the cognitive empathy factors of Korean elementary school students

Factor(Total Score)	Mean	Standard Deviation
Cognitive Empathy	Perspective Taking(5)	3.14
	Fantasizing(5)	2.95

For Korean elementary school students, the score of perspective taking appeared to be 3.14(0.62) out of 5. And the mean score of perspective taking of Korean elementary school students appeared to be higher than the mean score of elementary school students in the United States(score of 2.47(0.87)) (Batanova & Loukas, 2012) and the mean score of elementary school students of the Netherlands(score of 2.06(0.79)) (Hawk et al., 2013). Consequently, it could be known that the empathic ability of comprehending the perspective or situation of others by Korean elementary school students is relatively higher.

There are many limitations in clearly explaining and interpreting the cause by which the perspective taking score of Korean elementary school students appeared to be relatively higher than the elementary school students of the United States and the Netherlands. The reason is that empathy has complex and diverse propensities appearing differently depending on personal characteristics, nearby environment, and individual situations (Hoffman, 2000; Shin, 1994). However, when considering preceding research results showing that cognitive empathy has a meaningful positive relationship with study achievement (Austin et al., 2005; Park, 2004), and in particular, when considering the fact that perspective taking is related to cognitive function (Kim & Kim, 2009; Park, 2004), the high science achievement level of Korean elementary school students can be regarded as one of the reasons. Currently in Korea, elementary science education classes mostly emphasize acquisition of knowledge and thinking technique through scientific investigation, and such class methods and contents probably would have affected the high science study achievement level and the cognitive function development of elementary school students (Kim & Kim, 2013). Korean elementary school students have actually appeared to be in the highest rankings in terms of math and science achievement, several times in the TIMSS, which is an evaluation conducted once in four years by the International Association for the Evaluation of Educational Achievement(IEA) over the math and science achievement level of students around the world(Kim & Kim, 2013). Thus, this can be thought as the cause of the relatively high score in the perspective taking factor, which is highly related to cognitive function or study achievement.

The mean score of fantasizing, another sub-factor of cognitive empathy, appeared to be 2.95(0.70), which appeared to be lower than the mean score of perspective taking. Thus, it could be known that Korean elementary school students have a low ability of imaging other people's thoughts or feelings by putting themselves in the other people's position to understand them.

Fantasizing is a high-level cognitive activity process including the emotional analysis of others, along with understanding others in light of one's own experience or knowledge (Lee & Chin, 2014). Consequently, fantasizing develops from the process of forming a relationship with others premised on cognitive development (Lee & Chin, 2014). Accordingly, science education at Korean elementary schools at present emphasize training on empathy and mutual cooperation through collaborative learning in inquiry-based learning or a problem-solving process(MEST, 2011). This is because students may form relationships with others

through a mutual cooperation process and may learn the ability of understanding and imagining the emotion or feelings of others during this process. However, in reality, the actual activity process concentrates more on problem-solving and acquisition of scientific knowledge, rather than empathy or formation of relationship with others. The reason is that elementary school students of Korea receive education with the goal of entering an upper level school, from when they are in the higher grades of elementary school. Thus, there is a high possibility that elementary school students of Korea may lack experience with positive interaction in relationships with others(Shim & Kim, 2013; Yang et al., 2012), and the score for fantasizing probably appeared to be lower compared to perspective taking due to such cause. Preceding research results showing that the level of empathic ability, such as fantasizing, may be low even when the cognitive level is high (Lee & Chin, 2014) support this view as well.

Cognitive empathy becomes the basis of controlling emotions or impulses through understanding the differences or dissimilarities between oneself and others, which may support and accelerate meaningful communication, which is one of the premises for effective manifestation of group creativity. Communication, which includes psychological and emotional matters, starts from actively accepting the understanding regarding the differences or dissimilarities between oneself and others (Egan, 1990). However, it could be known that the cognitive empathic ability of Korean elementary school students at present is developing in an imbalanced way due to the problems of elementary science education in Korea. Thus, efforts may have to be made for the balanced development of the cognitive empathic ability of students, however, while education emphasizing cognitive aspects may have a positive effect on the development of empathic ability regarding perspective taking, which is to understand the perspective or situation of others, education based on the cognitive aspect may not be sufficient for the development of empathic ability regarding fantasizing, which is to understand and comprehend the emotional aspects of others. Thus, there is a need to prepare measures to develop cognitive empathic ability such as fantasizing within the process of teaching scientific knowledge in the elementary science education sector of Korea through various studies and discussions.

Affective Empathic Ability of Korean Elementary School Students

The mean score and standard deviation of Korean elementary school students regarding empathic concern and empathic awakening, which are sub-factors of affective empathy, are as **Table 4**.

Table 4. Mean and standard deviation of the affective empathy factors of Korean elementary school students

Factor(Total Score)		Mean	Standard Deviation
Affective Empathy	Empathic Concern(5)	2.50	0.39
	Empathic Awakening(5)	2.66	0.44

Korean elementary school students appeared to have a score of 2.50 (0.39) out of 5 for empathic concern. The mean score of empathic concern of Korean elementary school students appeared to be lower than the mean score of the elementary school students of the United States (score of 2.96 (0.86)) (Batanova & Loukas, 2012) and the elementary school students of the Netherlands (score of 2.75 (0.52)) (Hawk et al., 2013). Moreover, the mean score of empathic awakening, the other sub-factor of affective empathy, appeared to be 2.66 (0.44), which can be considered to be at a low level, as it appeared to be higher than the mean score of empathic concern, but failed to reach the mean. Thus, it could be derived that Korean elementary school students have a relatively low level regarding the ability to take interest and have compassion or sympathy towards people facing problems. Moreover, it could be derived that the emotional response level of experiencing the same emotion as others is low.

The affective empathy of students is formed through education based on a continuous and systematic approach (Park, 2004). Thus, the above result may mean that education or training on empathy relating to empathic concern and empathic awakening has not been adequately performed within the elementary education process. The Korean education world announced a medium-to-long term plan with the goal of cultivating the upright character of elementary and middle school students, and overall, revised the national curriculum in the direction of emphasizing practical personality education (MEST, 2011). Moreover, emphasis has been given to generally implement such education through both curriculum-based and non-curriculum-based education, in addition to implementing the personality education in some of the relevant subjects such as Korean language, ethics, and social studies. As such, elementary school education has the goal of teaching empathy towards others, cooperative attitude, and consideration, however, the reality is that a considerable number of Korean elementary school students are receiving education focusing on knowledge, as mentioned above. This view is supported by many preceding researches pointing out that elementary science education is still focusing on classes emphasizing scientific knowledge and concepts and that education on matters dealing with the affective sector of interacting and communicating with others, scientific quality education such as social responsibility of science, and value recognition regarding science is insufficient (Shim & Kim, 2013; Yang et al., 2012).

Affective empathy is the basis of the attitude of respecting others and sensitively responding to the demands and needs of others, by escaping a self-centered perspective, and may assist in supporting and accelerating a cooperative process through horizontal relationship or establishment of a common goal that are mentioned as premises for the effective manifestation of group creativity. This is because the passion for continuous participation of the members may be induced in the problem solving process, when a problem or goal to jointly solve through the interest and consideration towards others is established and a group atmosphere of trusting others through the process of understanding and empathy between group members is formed (Sawyer, 2007). However, this research showed that the affective empathic ability of Korean elementary school students was lower compared to the

cognitive empathic ability. Thus, when considering the fact that affective empathy may have a positive effect on the group creativity process, the need to urgently engage in discussions and studies to develop the affective empathic ability of Korean elementary schools in the elementary science education sector could be confirmed.

CONCLUSION AND PROPOSAL

Recently, diverse researches and considerations centering on design thinking are being undertaken for the development of the group creativity of elementary and middle school students in the science education sector of Korea. However, in order for the creativity of many individuals to sublimate into group creativity through cooperative interaction, the empathic ability of group members is reported to be important. Thus, there is a need for research to be undertaken regarding empathic ability in order to effectively develop the group creativity of elementary and middle school students, however, research on the empathic ability of elementary and middle school students is almost non-existent or inadequate in the science education sector of Korea. This research studied the actual state of empathic ability of Korean elementary school students first in order to deduct a positive result for design thinking that has been introduced in Korean science education as a strategy to realize the group creativity of elementary and middle school students. For such, a cognitive and affective empathic ability test was conducted over 228 students in their fifth and sixth grades in a public elementary school in Korea. Moreover, this research sought to understand the level of empathic ability of Korean elementary school students by examining the research results of the United States and the Netherlands, which studied empathic ability over students in a similar age range as the students subject to this research by centering on perspective taking, which was a sub-factor of cognitive empathy, and empathic concern, which was a sub-factor of affective empathy.

As a result of the research, Korean elementary school students appeared to have higher cognitive empathic ability than affective empathic ability. In particular, the mean score of perspective taking of Korean elementary school students in cognitive empathy appeared higher than the mean score of elementary school students in the United States and the Netherlands. The mean score of fantasizing appeared to be lower than the mean score of perspective taking, and that score did not reach the mean. Thus, it could be known that the empathic ability of Korea elementary school students of understanding the perspective or situation of others is high, but the empathic ability of understanding and feeling the emotional aspects of others through imagination is relatively low. The science education condition in Korea of setting importance on development of cognitive function and study achievement may be considered as one of the causes for such results. Perspective taking may be developed through the development of the cognitive aspect while fantasizing may be developed in the process of forming a positive relationship with others, including the development of the cognitive aspect, thus, it can be seen that the perspective taking ability of Korean elementary school students appeared to be higher than the fantasizing ability due to science education mostly emphasizing learning in the cognitive aspect, such as scientific knowledge acquisition or concept formation.

Moreover, the mean score of empathic concern of Korean elementary school students in affective empathy appeared to be relatively lower than the mean score of elementary school students in the United States and the Netherlands. Furthermore, the mean score of empathic awakening appeared to be higher than the mean score of empathic concern, which, however, failed to reach the mean. Thus, it could be known that Korean elementary school students have a relatively low level of behavioral will to directly help others and to experience the same emotion or feel sympathy by thinking of other people's problems or situations as their own business. Affective empathy may be developed through education or experience of empathic exchange through continuous interaction with others, along with development of a high cognitive level, just as fantasizing. However, due to the social atmosphere of emphasizing entry into upper level schools in Korea's elementary science education, education on the emotional aspect is extremely insufficient or inadequate compared to education on the cognitive aspect. This is probably why the affective empathic ability of Korean elementary school students appeared to be lower than cognitive empathic ability.

Balanced development between cognitive empathy and affective empathy must be premised to effectively realize the group creativity of elementary and middle school students. However, for Korean elementary school students, the affective empathic ability appeared to be lower than cognitive empathic ability, and the fantasizing ability appeared to be lower than perspective taking ability within cognitive empathic ability. Thus, there is a need to prepare a measure to evenly develop both cognitive and affective empathy, and in particular, in order for design thinking to more effectively function to cultivate group creativity in a situation where affective empathic ability is lower than cognitive empathy, there is a need for efforts to cultivate the level of elementary school students regarding affective empathy to become more in-depth within the science curriculum. As such, there is a need to seek measures to provide opportunities for students to practice value judgment through discussions in the situations or dilemmas allowing to experience matters such as cognitive value conflicts by considering the developmental features of elementary school students to develop empathic ability for fantasizing. Moreover, active efforts, such as by researching and developing programs or teaching and learning methods applicable in science education, are required while focusing more on the affective factor of empathy when revising the curriculum to develop affective empathic ability. There is also a need for teachers to provide opportunities for students to emotionally experience an empathic situation in classroom and to provide adequate assistance so that such experience may lead to empathic and practical acts. In particular, based on the fact that affective empathy can be effectively developed when having high self-esteem (Chung, 2001), a way to enhance the self-esteem of students may have to be considered again.

On the other hand, although it would be difficult to develop and apply a new teaching method for cognitive and affective education in the current situation of Korea's science education, which shows a serious estrangement phenomenon between the goal of elementary science education and its practice, efforts and attempts to provide education on empathy within the science curriculum must be made, when considering the fact that empathic ability

may actually assist the development of group creativity, which is one of the demands of the new era. In particular, empathic ability starts to develop in full-scale from when students are in elementary school, and the empathic ability developed during this period continuously affects the development during the adolescent period and adulthood, thus, preparation for plans to develop the empathic ability of elementary school students may urgently need to be devised.

Furthermore, there are difficulties for this research to suggest a resolution on what form the education on empathy must take in detail in the elementary science education field while clearly explaining the cause of the empathic ability level of Korean elementary school students, due to the feature of empathy that is considered based on diverse and complex individual propensities. Moreover, there are limitations in generalizing the result due to the limited sample, and there may be issues in translation of the test tool, which is one basic problem of comparative cultural studies in the process of comparing preceding research results with the results of this research. However, this research may have value as it provides basic information on the actual state of empathic ability of Korean elementary school students, while providing an opportunity of informing the importance of education on empathy and related implications within science education and group creativity education to the elementary science sector of Korea at the same time. Based on the results of this research, there would be a need to further perform quantitative and qualitative researches for preparation of strategies and having an in-depth understanding on the empathic ability of Korean elementary school students in the elementary science education sector.

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