Gifted and Talented High School Students' Self-Regulated Motivation and Learning Strategies

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Abstract

The current research investigated self-regulated motivation and the use of learning strategies in gifted and talented high school students using large-scale data from the Korea Education and Employment Panel (KEEP). First, we found that gifted and talented high school students had a greater tendency to adopt autonomously regulated motivation and employ elaboration than their public high school counterparts. Second, regardless of their academic domain of giftedness (science or foreign language), gifted and talented students adopted autonomous motivation and elaboration as a higher order thinking skill. This study expands on the current literature into the gifted and talented population. It also provides instructional implications for educators on how to motivate gifted and talented students to learn and enhance their academic success with effective learning strategies.

Key words: gifted students, language gifted students, science gifted students, self-regulated motivation, elaboration

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Ⅰ. Introduction

Researchers in education and psychology have long been fascinated by Gifted and Talented (GT) students. Traditionally, researchers believed that exceptionally IQ score meant giftedness. However, Renzulli (1978) was interested in how to identify those who are gifted, emphasizing on GT students' creativity and task commitment as well as exceptional intelligence.

In Korea, there are many types of GT programs and educations, such as science high schools and foreign language high schools and a center for science gifted and talented education at universities aimed at GT elementary, middle, and high school students. Korean scientists, educators, parents and GT students indicate that the most important trait of giftedness is cognitive ability, followed by academic motivation and task commitment (Shim, & Kim, 2003). Past research on Korean GT students focused on exploring broad academic-related attitudes or GT students' traits (Shim, & Kim, 2003; Song, Choi, Kim, & Youk, 2009) and is limited to a comparison of high achieving and underachieving GT students (Lee, Ho, Lee, Yu, & Yee, 2009). Therefore, an examination into cognitive and motivational aspects is needed in order to understand fully their giftedness.

Researchers in educational psychology have been interested in learners' cognitive and motivational constructs (Elliot, 2006). In the 1980s and 1990s, researchers on motivation studied how learners' intrinsic motivation and extrinsic regulation influence their academic motivation to learn (Ryan, 1993; Ryan & Deci, 2000). More recently, researchers have presented self-regulated motivation models in the self-determination theory (Ryan & Deci, 2000, 2002). They are also interested in learners' goal orientations as future-directed cognitive representation from goal theory, which is rooted in a social cognitive framework (Elliot, 2006). While motivation research has revealed Korea GT students' goal orientation, attitudes toward school (Moon, Eman, & Montgomery, 2010), and self-regulated motivation as a mediator (Lee, & Lee, 2009), the majority of researches on Korean GT students deals with gifted science students and science-related

learning strategies and learning attitudes (Lee et al., 2009; Shim, & Kim, 2003).

Research on cognition from an information processing perspective focuses on elaboration, connecting previous knowledge to new information (Atkinson & Shiffrin, 1968; Bransford, Franks, Morris, & Stein, 1979; Lockhart, 2002). Empirical studies (Dunning, Johnson, Ehrlinger, & Kruger, 2003; Kruger & Dunning, 1999) provide evidence that the use of elaboration makes a difference between high achieving students and underachieving students.

The current study used large-scale quantitative studies to expand our knowledge on achievement motivation and learning strategies of GT students and contribute to the emerging body of gifted education research by providing empirical evidence. The three aims of this study are to; (1) investigate GT students' self-regulated motivation (e.g., autonomous and external motivation) and cognitive aspects (e.g, elaboration and rehearsal); (2) compare GT school students and public high school students to determine GT high school students' motivational and cognitive traits; and (3) compare two GT groups (science high school students and foreign language high school students) to determine the self-regulated motivation and learning strategies they employ. Although we compared student from two types of GT high schools, the school factor was not taken into account in the influence on students' motivational and cognitive factors. According to the dynamic model of educational effectiveness (Creemers, & Kyriakides, 2010), four multilevel factors (e.g., student, classroom, school, and system) influence students' academic achievement. Interrelationships between the factors were found, where the student factor was highly related to the school factor. Thus, the current study excluded the school factor since the student level factors of self-regulated motivation and cognitive learning strategies may have been related.

A. Self-Regulated Motivation

Self-regulated motivation including intrinsic motivation and

three types of extrinsically regulated motivation (Ryan & Deci, 2000, 2002), are grounded in self-determination theory. External regulation refers to extrinsic motivation in which an individual learner learns due to external influences such as parental pressure. Introjected regulation refers to a kind of extrinsic motivation in which an individual learner studies in order to avoid a guilty feeling. Identified motivation is a more internalized extrinsic motivation among the three extrinsic regulations where an individual learner values what he/she studies.

Korean students' self-regulated motivation mediates their environmental factors and goal orientation (Kim, Schallert, & Kim, 2010). In Korean GT student studies, self-regulated motivation is viewed as a mediator between metacognition and self-regulated learning (Lee, & Lee, 2009). The current study views self-regulated motivation as an important motivational construct to reveal GT students' academic motivation.

The current study differentiates external motivation and autonomous motivation. Literature on Western students identified four types of self-regulated motivation mentioned above. However, Lee and Jung (2008) found that these four types of self-regulated motivation did not explain Korean students' self-regulated motivation. Rather, it was explained by two types of self-regulated motivation - external motivation and autonomous motivation. Therefore, this study used these two self-regulated motivational constructs to investigate Korean GT students' academic motivation.

B. Learning Strategies

Students employ various learning strategies from rehearsal and simple repetition, to higher order thinking skills such as argumentation (taking one position or another position for argumentive discourse) (Kuhn, & Udell, 2003), metacognition (knowing about his/her own thinking process) (Flavell, 1979) and elaboration (Brown, & Craik, 2000; Craik & Lockhart, 1972). Learning strategies influence students' academic performance.

Among the cognitive theories, information processing theory presents what are effective learning strategies and what are not. According to this theory, rehearsal is a less effective learning strategy while elaboration is a better learning strategy because it results in deep processing of information (Craik & Lockhart, 1972). Metacognition is a significant factor in predicting students' future academic success (Dunning et al., 2003; Kruger & Dunning, 1999). Gifted students employ more and better learning strategies, elaboration, and metacognition because they are aware of their prior knowledge and learning strategies (Cho & Ahn, 2003). Previous studies on GT students explored the use of metacognition (Lee, & Lee, 2009), and a science-specific learning strategy (Chung & Kang, 2007). Lee and Lee (2004) found that metacognitive and elaborative strategies were positively correlated with academic performance in Korean middle school students. We assume that GT students use elaboration more than rehearsal if they are high achievers in gifted education, but there is a lack of empirical evidence to support this hypothesis.

C. Gifted Students' Motivation and Learning Strategies

Cognitive and motivational constructs are important predictors of academic achievement. Cognitive and motivational constructs are not discrete, but rather are interrelated, influencing GT students' learning process and their academic achievement. However, previous studies tended to examine either motivational constructs or cognitive constructs, with only a few taking into account both constructs concurrently. Most studies placed self-regulated motivation as a mediator construct even though self-regulated motivation is closely related to learning strategies GT students employ (Kim et al., 2010; Lee, & Lee, 2009). For example, Lee and Jung (2008) reported that autonomous motivation is positively related to academic achievement while external motivation is negatively related. Lee and Lee (2009) found that high achieving GT students used more metacognition to monitor their learning process and evaluate their goal attainment as well as more autonomous motivation, which

suggests a relationship between self-regulated motivation and metacognition. However, there is limited knowledge on how Korean GT students' self-regulated motivation is integrated with their learning strategies (e.g., elaboration).

Literature on Korean GT students mainly focus on gifted science students (Chung, & Kang, 2007; Lee et al, 2009). A few studies were conducted on foreign language school students as language GT students. Yang and Kim (2007) compared how science high schools and foreign language schools as gifted education identified their students' giftedness. Others attempted to investigate foreign language high school students' goal orientation as a motivational construct (Song, Choi, Kim, & Youk, 2009). However, little within GT education is known about how science high school students and foreign language school students differ in autonomous motivation, external motivation, elaboration, and rehearsal.

Overall, the literature suggests that academic motivation and learning strategies are positively related to academic high achievement. Despite the nature of these interwoven constructs, questions remain regarding how self-regulated motivation and learning strategies of GT students are interrelated and how different GT school students employ different motivational and cognitive strategies.

Large-scale data is necessary to conduct a methodologically strong study with national data from the GT population. A self-determination theoretical framework was employed to understand self-regulated motivation of high school GT students and a cognitive theoretical framework was used to investigate their use of learning strategies.

D. Research Questions

1. Is there a significant relationship between GT students' self-regulated motivation and learning strategies and public high school students' self-regulated motivation and learning strategies?

2. Is there any difference in self-regulated motivation and learning strategies between GT students and their counterparts?

3. Is there any group difference in self-regulated motivation and learning strategies between foreign language GT students and science GT students?

Ⅱ. Method

A. Participants

This study used the longitudinal dataset from the Korean Education and Employment Panel (KEEP), a nationally representative longitudinal survey of 6,000 9th grade and 12th grade male and female students. The current study used data from 1,462 high school students as of 2007. Table 1 presents the sample size of the GT high school students and their public high school counterparts. There were 343 GT students in the sample. GT high school students were divided into two groups – foreign language school students (n=272) and science high school students (n=71). The control group included 1,119 public high school students.

Table 1. Student Sample Size by Group

Group	School type	*N*	%
GT Group	Foreign Language High School	272	18.60
	Science High School	71	4.86
Control Group	Public High School	1,119	76.54
Total		1,462	100

1. Foreign Language and Science High School GT Students

The current study's GT groups included students from two types of gifted education schools in Korea. Foreign language high schools specialize in educating gifted students in the

language arts. Students who have a talent for science attend science high schools that specialize in science education. These high schools in the gifted education system select students through highly competitive entrance examinations and admission standards that are based on previous academic outcomes (i.e., GPA). Gifted education schools are controlled by the Ministry of Education, Science and Technology in terms of their standards and curriculum. While, these schools deeply integrate national standards into their curriculum, they do not view them as a target but as a basic requirement.

2. Public High School Students

Public high school students included all high school students in Korea except those in vocational high schools and gifted education schools. Public high schools include public high schools and private high schools because both are overseen by the Ministry of Education, Science, and Technology, which allocates school funding, determines standards and curriculum, and supplies standardized textbooks across the country. High school is not compulsory, and students in public high schools range in age from 15 to 18 in grades 10 through 12.

B. Measure

1. Self-Regulated Motivation Questionnaire

One of the primary dependent variables is self-regulated motivation based on self-determination theory and was measured by a 12-item self-report questionnaire developed by KEEP. According to self-determination theory (Ryan & Deci, 2000), types of self-regulation motivation includes intrinsic motivation and three types of extrinsic motivation, represented on a continuum from externally regulated motivation to introjected regulation and identified regulation. However, Korean students show different types of self-regulated motivation (Bak, Lee, & Hong, 2005; Lee & Jung, 2008). In particular, Bak et al. (2005) claimed that

self-determination theory's four types of motivation do not fit for Korean adolescents, but, instead, only two types (autonomous regulation and external regulation) can explained their self-regulation motivation. A factor analysis confirmed that the questionnaire included two factors (Table 2). Factor 1 is identified as autonomous motivation and Factor 2 as external motivation.

Participants responded on a 5-point Likert scale to the 12 items. The scale ranged from 1 (strongly disagree) to 5 (strongly agree) for items on self-regulated motivation. Higher scale scores indicated higher endorsement of self-regulated motivation. Internal consistency reliability (Cronbach's α) of the autonomous motivation and external motivation avoidance scales were .73 and .75, respectively.

Table 2. Factor Matrix for Self-Regulated Motivation

Self-Regulated Motivation Factor	Factor	
	Autonomous	External
Enjoyment of learning	.40	.11
Better person	.75	.04
Decent job	.78	.04
Money	.60	.08
Dream job	.70	-.14
Society's needs	.61	.15
Compliment	.25	.67
Popular person	.09	.75
Better than others	.30	.57
Parents and teachers	-.18	.65
Not to be ignored	.26	.65
Punishment	-.28	.68

2. Learning Strategies Questionnaire

To measure the use of learning strategies, an 8-item self-report questionnaire by KEEP was used. The two subscales were elaboration (5 items) and rehearsal (3 items). Table 4 illustrates the items for each subscale. A factor analysis confirmed that the questionnaire included two factors (Table 3). Factor 1 was identified as elaboration and Factor 2 as rehearsal.

Four planning and monitoring-related items were excluded because they represent self-regulation cognitive strategies but did not fit either elaboration or rehearsal.

Similar to the self-regulated motivation questionnaire, participants responded on a 5-point Likert scale. Internal consistency reliability (Cronbach's α) of the elaboration and rehearsal scales were .78 and .64, respectively.

Table 3. Factor Matrix for Learning Strategies

Learning Strategy Factor	Factor	
	Elaboration	Rehearsal
Application	.77	.10
Connection	.65	.07
Elaboration	.74	.04
Important contents	.69	.22
Other sources	.74	.11
Memorization	-.01	.81
Recall	.14	.81
Recognition memory	.19	.65

3. Quantitative Analysis

Correlation was used to investigate the relationship between the dependent variables. Generally, a correlation between |.3| and |.7| is assumed to be appropriate to employ MANOVA. A correlation over .7 is interpreted to mean that the two variables measure the same construct.

MANOVA (Multivariate Analysis of Variance) tests were conducted to determine if there were any significant differences in self-regulated motivation or the use of learning strategies between the GT students and public high school students (Dimitrov, 2009). We estimated partial Eta-squared (η^2) to examine the effect sizes. We interpreted η^2 with Cohen's convention (as cited in Grice & Iwasaki, 2007, p. 202) where η^2=.14, 06, and .01 are large, medium, and small effects, respectively.

Ⅲ. Results

Table 4 presents descriptive statistics of GT students and their counterparts in terms of self-regulated motivation and learning strategies. In general, the GT students' autonomous motivation mean is higher and their external motivation mean is lower than their public high school counterparts'. On learning strategies, the GT students' elaboration strategy mean is higher and their rehearsal strategy mean is lower than their counterparts'. On self-regulated motivation, the GT students' mean ranged from 2.31 to 3.95 and standard deviation ranged from .54 to .67. The control group's mean ranged from 2.40 to 3.72 and standard deviation ranged from .55 to .66. On learning strategies, the GT group's mean ranged from 3.03 to 3.79 and standard deviation ranged from .56 to .82. The control group's mean ranged from 3.13 to 3.40 and standard deviation ranged from .56 to .69.

Table 4. Descriptive Statistics

	GT (n=343)		Public (n=1119)		Total (n=1462)	
	M	SD	M	SD	M	SD
Self-Regulated Motivation						
Autonomous motivation	3.95	.54	3.72	.55	3.77	.56
External motivation	2.31	.67	2.40	.66	2.38	.66
Learning Strategies						
Elaboration	3.79	.56	3.40	.56	3.48	.60
Rehearsal	3.03	.82	3.13	.69	3.10	.72

A. Correlation between Self-Regulated Motivation and Learning Strategies

The first research question explores the relationship between self-regulated motivation and learning strategies. We calculated the product-moment correlations among the four dependent variables and analyzed the correlation between self-regulated motivation and learning strategies of the GT students and public

school students (Table 5). Both groups of students showed positive correlations between the variables. In general, the GT students' correlations were higher than their peers'. For instance, the GT students' correlation coefficient between autonomous and elaboration variables is .21, indicating that the GT students' correlation is more positively correlated than their counterparts'.

Table 5. Correlations of Variables in Two Groups

GT\Public	Autonomous	External	Elaboration	Rehearsal
Autonomous	1	.18**	.21**	.11*
External	.21**	1	-.05	.11*
Elaboration	.27**	.01	1	.17*
Rehearsal	.24**	.18**	.33**	1

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

B. Comparison between GT Students and Public School Students

The second research question compares the Gt and public high school students on self-regulated motivation and learning strategies. Table 6 illustrates the results of the MANOVA, revealing significant group differences with Wilk's Lamda=.89, (F(1, 1460)=47.35, p<.001) in the usage of self-regulated motivation and learning strategies.

In terms of self-regulated motivation, the GT students tended to orient significantly more towards autonomous motivation (M=3.95, SD=.54) than their public high school peers (M=3.72, SD=.55), F(1, 1460)=42.79, p<.001, η^2=.028. Autonomous motivation as a univariate accounted for the largest group difference, with 2.8% of the variability accounted for by the group difference. According to Cohen's convention (as cited in Grice & Iwasaki, 2007, p. 202), the group difference in autonomous motivation scores (η^2=.028) is a small effect. However, we need to be careful in interpreting this difference. Second, the GT students (M=2.31, SD=.67) showed significantly less extrinsic motivation than the public school students (M=2.40,

SD=.66), F(1, 1460)=4.60, p<.05, η^2=.003. This difference is a small effect according to Cohen's convention.

Table 6. Contrast of GT Students with Public School Students

Variable	GT (n=343)		Public (n=1119)			
	M	SD	M	SD	*F*	η^2
Self-Regulated Motivation						
Autonomous Motivation	3.95	.54	3.72	.55	42.79***	.028
External Motivation	2.31	.67	2.40	.66	4.60*	.003
Learning Strategies						
Elaboration	3.79	.56	3.39	.56	130.15***	.082
Rehearsal	3.03	.82	3.13	.69	5.16*	.004

*** p <.001, * p <.05

In learning strategies, Table 6 shows the MANOVA results, revealing statistically significant group differences. First, the GT students employed significantly more elaboration (M=3.79, SD=.56) than the public high school students (M=3.39, SD=.56) F(1, 1460)=130.15, p<.001, η^2=.0.82, accounting for 8.2% of the variability, which is a medium effect. Second, the GT students used significantly less rehearsal (M=3.03, SD=.82) than their counterparts (M=3.13, SD=.69) F(1, 1460)= 5.16, p<.05, η^2=.004, which is a small effect.

C. Comparison between Language vs. Science GT Students

The third research question compared two GT groups (language GT students and science GT students) on self-regulated motivation and learning strategies. Table 7 illustrates the results of the MANOVA, which shows no statistically significant group differences with Wilk's Lamda=.99, (F(1, 341)=1.18, p>.05). Only the learning strategy varible of rehearsal showed a group difference. Language GT students employed significantly more rehearsal (M=3.07, SD=.83) than science GT students (M=3.03, SD=.63) F(1, 341)=4.15, p<.05, η^2=.012, accounting for 1.2% of the variability. Due to this small effect, we need to be careful in interpreting the group difference in the usage of rehearsal.

Table 7. Contrast of Language GT with Science GT Students

Variable	Language (n=272)		Science (n=71)			
	M	SD	M	SD	*F*	η^2
Self-Regulated Motivation						
Autonomous Motivation	3.96	.51	3.90	.65	.59	.002
External Motivation	2.32	.65	2.26	.71	.60	.002
Learning Strategies						
Elaboration	3.80	.54	3.75	.63	.43	.001
Rehearsal	3.07	.83	3.03	.63	4.15*	.012

* p <.05

Ⅳ. Discussion

A. Autonomous Motivation and Elaboration in GT students

The main finding was that GT students tend to adopt a more autonomous form of motivation and employ higher order thinking skills (e.g., elaboration). The interrelated factors of academic motivation and learning strategies were the most important predictor of students' academic achievement (Bong, 2001; Zimmerman & Bandura, 1994). This study confirmed that Korean GT students' successful academic achievement can be predicted by forms of autonomous self-regulated motivation and use of elaboration. This finding supports previous research on academic motivation where academically high achieving students are generally more interested in learning and, as a result, have a strong motivation to learn more and to study harder (Ames, 1992).

GT students have pointed out that creativity and task commitment are important for cognitive giftedness (Renzulli, 1987; Shim, & Kim, 2003). However, the current study examined only the elaborative strategy of simplifying complex cognitive aspects and focused on exploring high achieving GT students' motivational and cognitive aspects concurrently. Thus, taking into account all other cognitive traits of GT students is beyond the scope of this study.

In terms of learning strategies, as we expected, GT students generally used higher order thinking skills in their learning so that they spent less effort but maximized the effectiveness of their learning. This suggests that GT students deeply processed their learning by connecting what they had already known and what they learned. This study did not account for the casual relationship of whether smart students employed efficient learning strategies that enabled them to enter their gifted education program or they were taught effective learning strategies in their gifted education program so that their use of learning strategies improved. Our fundamental study of GT students provides empirical evidence that GT high school students prefer efficient learning strategies such as elaboration rather than repetition.

Another finding was the relationship between self-regulated motivation and cognitive learning strategies. In GT students, autonomous motivation was only related to elaboration. Moreover, when GT students adopted externally regulated motivation, their cognitive learning strategy was not effective enough to use higher order thinking skills. This indicates that it is necessary for GT students to adopt autonomously regulated motivation to employ an effective learning strategy.

In contrast, the public high school students tended to employ both elaboration and simple repetition in their learning process. This study showed that autonomous motivation is highly correlated with elaboration in the public high school students. This has implications for high school teachers to foster high school students' autonomous regulation of motivation and support their use of higher order thinking skills (e.g., elaboration, metacognition, and organization).

A notable finding in this study was that across academic domains, GT students adopted academically better motivation and an effective cognitive strategy. We need to interpret this result because our sample of GT students is academically successful students and proved their high achievement by passing the GT high school entrance exam. Thus, we hypothesized that regardless of academic domain (science or

foreign language), high achieving GT students may employ effective motivational and cognitive strategies in learning. Also, we postulated that the current study's autonomous motivation and external motivation in self-determination theory (Ryan & Deci, 2000; 2002) and elaboration in cognitive theory (Craik & Lockhart, 1972), may partially explain motivational and cognitive aspects of GT students. Our finding contributes to the discussion on why GT students academically succeed. This study emphasizes the importance of autonomously regulated motivation and higher order thinking skills in academic success.

B. Implications for Teaching

Our findings can help educators better understand GT students' motivation and cognition and offer two implications for teaching. First, students' autonomous motivation is positively related to effective learning strategies. Thus, high school teachers need to teach effective cognitive strategies as well as foster students' autonomy in learning. Second, educators should provide information in a more organized way to GT and non-GT students and empower them to be actively involved in their learning tasks for deeper learning. Thus, secondary education teachers should guide and teach students how to employ more effective learning strategies through modeling. Educators need to design curriculum to connect students' prior knowledge and their current learning to foster the use of elaborative strategies.

C. Theoretical Implications

The theoretical frameworks of this study were grounded in self-determination theory (Ryan & Deci, 2000, 2002) and cognitive theory (Craik & Lockhart, 1972). Theoretically, this study extends the current literature on self-determination theory and cognitive theory from the general K-12 student population (non-GT) into the GT high school population. We found that general knowledge on autonomous regulation as a motivational construct and elaboration as a cognitive construct in a non-GT population

can be transferable to the GT population.

Previous GT studies focused on the comparison between high achieving and underachieving GT students, or on either cognitive variables or motivational variables (Han, & Shin, 2007; Lee et al., 2009). Previously, self-regulated motivation was studied as a mediator between motivational or cognitive factors and academic achievement (Kim et al., 2010). However, this study concurrently investigated motivational and cognitive factors in GT populations. Lee et al., (2009) argued that empirical research on the Korean GT population and their cognitive and motivational constructs is needed. Therefore, this study extends the current literature by comparing GT high school students with their non-GT peers and comparing GT students according to their academically gifted domain (e.g., science and language). Additionally, a notable feature of this study was the use of large-scale data. Therefore, the results of this study provide reliable empirical evidence in the gifted education literature.

D. Limitations

The current study has two limitations. The first limitation is that we cannot account for where GT students' effective learning strategies stem from. We verified that GT high school students generally employed more effective learning strategies than general high school students. The casual relationship between GT students' innate ability and the school environment on learning strategies was beyond the scope of this study. However, it is important to understand GT students' cognition. Thus, future research needs to examine if GT students' gifted education is an educational factor or if it is their innate ability that results in their effective use of learning strategies.

The second limitation is that this study did not test GT students' creativity and task commitment. Moreover, the current study only used elaboration as the cognitive aspect of the GT population. Thus, future research should investigate other cognitive constructs.

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