

Relationship of Self-Regulated Learning to Science Inquiry and Effective Domain

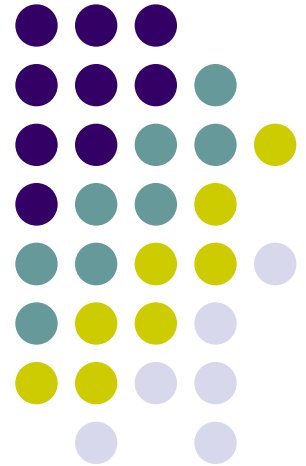
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Relationship of Self-regulated Learning Ability to Science Inquiry and Affective Domain

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1. Introduction

- Science teaching in Korea has been mainly focused on achieving high scores in college entrance examination and inquiry teaching with laboratory is less emphasized.
- Although Korea has ranked top on the results of international comparative studies in science and mathematics (OECD PISA, TIMSS), it was reported that Korean students' attitude toward science, efficacy of science learning and the extent of science teaching with inquiry were below average of OECD participating countries' scores.
- Korean students' attitudes in terms of affective domain (enjoyment, self-efficacy, general value, and person value) seem to be the lowest among participating countries.



1. Introduction

Affective domain of science has been known that it is important due to the followings for science learning (Schunk, 1989).

- Encouraging logical thinking
- enhancing creative problem solving and motivation
- nurturing Positive attitude and preference to future jobs in the areas of science and engineering
- Being able to solve science-engineering related social problems with sound value systems
- Increasing self-efficacy in science learning



1. Introduction

- It can be assumed that affective domain influences on characteristics of self-regulated learner since SRL's characteristics include:
- SRL is divided into four categories: cognitive strategies, meta-cognition, motivation, environments (Jung, et al., 2004).
- For example, intrinsic motivation as SRL's characteristics
- Students present a high level of intrinsic motivation
- They have tendency to explore more than given tasks by teachers, keep pursuing learning with their own will, investigate more materials and information related to science learning at schools (Zimmerman et al, 1988).
- Such characteristics of SRL can also positively influence on science inquiry and problem solving ability.



1. Introduction

- **Self-regulated learning ability consists of four elements** (Pintrich & De Groot, 1991; Yang, 1999)
 - **Cognitive strategies** : Elaboration, Organization
 - **Meta-cognition** : Planning, Monitoring, Regulation
 - **Motivation** : Goal Orientation, Self-Efficacy, Value
 - **Environment** : Control, Time Management, Help Seeking
- **The affective domain of science (PISA 2006)**
 - **Self-Efficacy; Enjoyment; General value & Personal value**



2. Research Questions

- What level is self-regulated learning ability of middle school students?
- How does the relationship between self-regulated learning ability and science inquiry look like?
- How does the relationship between self-regulated learning ability and affective domain look like?



3. Research Methods

● Three Questionnaires

- Questionnaire of self-regulated learning ability (Jung et. al., 2004) (22 items of 5-likert scale)
- Questionnaire of science inquiry: Scientific problem finding ability, and scientific experiment designing ability (Jung et. al., 2004).
- Questionnaire of science affective domain (27 items of 5- likert scale; adopted from 2006 PISA Student questionnaire, 2006)



3. Research Methods

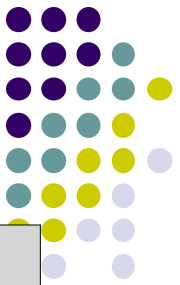
- **Research Subjects**
 - 300 semi-randomly selected 7th grade students
 - from ten middle schools
 - In Busan, Ulsan, and Kyungnam

Number of Students in Busan, Ulsan, Kyung-nam



No of Students	Grades (7 ~ 9)		Grade 7		Grade 8		Grade 9	
	Total	Female	Total	Female	Total	Female	Total	Female
National	2,006,972	943,231	656,572	310,933	676,887	318,756	673,513	313,542
Busan	134,976	62,220	43,557	20,242	45,339	21,004	46,080	20,974
Ulsan	53,625	24,477	17,415	8,031	18,125	8,275	18,085	8,171
Kyung-nam	137,403	63,268	45,434	20,948	46,310	21,375	45,659	20,945

Characteristics of subjects



Variables		M (%)
Gender	boy	35 (27.1)
	Girl	94 (72.9)
	Total	129 (100.0)
Achievement Score	High Rank 30%	41 (31.78)
	Medium Rank 40%	48 (37.21)
	Low Rank 30%	39 (30.23)
	Total	128 (99.22)
Private Tutoring	Yes	52 (40.3)
	No	77 (59.6)
	Total	129 (100.0)
Studying Time	0~1 hour	46 (35.6)
	2~3 hour	41 (31.7)
	4 hour ~	42 (32.4)
	Total	129 (100.0)



4. Research Results

- The level of Self-regulated learning ability

Total (N=129)	Cognitive Strategies	Meta- Cognition	Motivation	Environment
M	2.97	2.97	2.89	3.07
SD	0.793	0.744	0.753	0.735
Minimum	1	1	1	1
Maximum	5	5	5	5

4. Research Results



- Correlation (Self-regulated learning ability)

Total (N=129)	Cognitive Strategies	Meta -Cognition	Motivation	Environ -ment
Meta -Cognition	.714(**)	1		
Motivation	.578(**)	.561(**)	1	
Environ -ment	.536(**)	.666(**)	.551(**)	1



4. Research Results

- Correlations among elements of Self-Regulated Learning Ability (SRLA) (cognitive strategies, meta-cognition, motivation, and environments) were significantly (.001) high
- In particular, correlation between cognitive strategies and meta-cognition was higher than others.



4. Research Results

- The level of Affective domain of science

Total (N=129)	Self-Efficacy	Enjoyment	General value	Personal value
M	2.76	2.86	2.97	3.04
SD	0.892	0.734	0.878	0.836
Minimum	1	1	1	1
Maximum	4.8	4.5	5	5

4. Research Results



- Correlation (Affective domain of science)

Total (N=129)	Self -Efficacy	Enjoyment	General Value	Personal Value
Enjoyment	.606(**)	1		
General Value	.776(**)	.579(**)	1	
Personal Value	.529(**)	.544(**)	.628(**)	1



4. Research Results

- Correlations among elements of affective domain of science (personal value, general value, enjoyment, and self-efficacy) were significantly ($.001$) high.
- In particular, correlation between general value and self-efficacy was higher than others.

Gender differences SRL and Affective domain



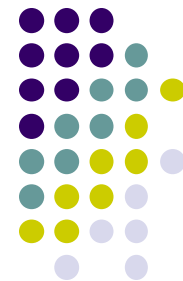
Gender		Male (n=35)	Female (n=94)	F	P
Cognitive Strategies	M	2.6	3.1	6.895	0.010
	SD	(0.89)	(0.78)		
Meta-Cognition	M	2.5	3.1	13.433	0.000
	SD	(0.85)	(0.71)		
Motivation	M	2.8	2.9	0.734	0.393
	SD	(0.87)	(0.76)		
Environment	M	2.8	3.2	7.098	0.009
	SD	(0.81)	(0.75)		
Self-Efficacy	M	2.8	2.7	0.165	0.685
	SD	(0.99)	(0.86)		
Enjoyment	M	2.8	2.9	0.119	0.731
	SD	(0.80)	(0.71)		
General value	M	2.9	3.0	0.736	0.393
	SD	(1.05)	(0.81)		
Personal Value	M	3.0	3.1	0.380	0.539
	SD	(1.01)	(0.77)		



4. Research Results

- Gender differences
- Girls showed significantly higher scores in cognitive strategies, meta-cognition, and environment than boys.

Achievement Score Differences of SRL and Affective Domain of Science



Achievement Score		High 30% (n=41)	Middle 40% (n=48)	Low 30% (n=39)	F	P
Cognitive Strategies	M	3.3	3.0	2.5	12.842	0.000
	SD	(0.67)	(0.75)	(0.88)		
Meta-Cognition	M	3.3	2.8	2.7	8.254	0.000
	SD	(0.70)	(0.67)	(0.88)		
Motivation	M	3.3	2.9	2.4	18.928	0.000
	SD	(0.71)	(0.64)	(0.75)		
Environment	M	3.2	3.1	2.8	2.521	0.084
	SD	(0.81)	(0.62)	(0.89)		
Self-Efficacy	M	3.3	2.8	2.2	17.604	0.000
	SD	(0.69)	(0.81)	(0.88)		
Enjoyment	M	3.2	2.7	2.7	6.642	0.002
	SD	(0.59)	(0.75)	(0.75)		
General value	M	3.4	2.9	2.5	11.457	0.000
	SD	(0.86)	(0.73)	(0.87)		
Personal Value	M	3.6	3.0	2.6	16.311	0.000
	SD	(0.81)	(0.69)	(0.77)		



4. Research Results

- Achievement differences
- High achievers showed significantly higher scores in all elements of SRLA and affective domain.
- On the other hand, environment scores of high achievers were relatively low compared to low achievers.

Private Tutoring Differences SRL and Affective Domain of Science



Private Tutoring		Yes (n=52)	No (n=77)	F	P
Cognitive Strategies	M	3.0	2.9	0.064	0.801
	SD	(0.80)	(0.86)		
Meta-Cognition	M	2.8	3.0	2.303	0.132
	SD	(0.71)	(0.83)		
Motivation	M	2.9	2.8	0.134	0.715
	SD	(0.74)	(0.83)		
Environment	M	2.9	3.1	2.340	0.129
	SD	(0.68)	(0.83)		
Self-Efficacy	M	2.9	2.6	3.313	0.071
	SD	(0.86)	(0.90)		
Enjoyment	M	2.9	2.9	0.000	0.983
	SD	(0.73)	(0.74)		
General value	M	3.0	2.9	0.594	0.442
	SD	(0.87)	(0.89)		
Personal Value	M	3.1	3.0	0.335	0.564
	SD	(0.83)	(0.84)		



4. Research Results

- Private tutoring
- There was no significant difference in SRLA and affective domain of science between students who take private tutoring in science and students who do not take.

Study Hour Differences of SRL and Affective Domain of Science



Studying Time		~1 hour (n=41)	2~3 hour (n=48)	4 hour ~ (n=39)	F	P
Cognitive Strategies	M	2.9	2.8	3.1	1.553	0.216
	SD	(0.81)	(0.83)	(0.84)		
Meta-Cognition	M	2.9	2.9	3.0	0.298	0.743
	SD	(0.79)	(0.85)	(0.72)		
Motivation	M	2.8	2.9	3.0	0.732	0.483
	SD	(0.77)	(0.88)	(0.73)		
Environment	M	3.0	3.0	3.1	0.164	0.849
	SD	(0.79)	(0.89)	(0.67)		
Self-Efficacy	M	2.5	2.8	3.0	4.516	0.013
	SD	(0.82)	(0.90)	(0.89)		
Enjoyment	M	2.8	2.8	2.9	0.325	0.723
	SD	(0.71)	(0.79)	(0.71)		
General value	M	2.8	3.0	3.2	2.043	0.134
	SD	(0.93)	(0.85)	(0.82)		
Personal Value	M	2.9	2.9	3.3	3.601	0.030
	SD	(0.84)	(0.81)	(0.81)		



4. Research Results

- Hours of study science after school
- There was no significant difference in SRLA and affective domain of science between students who spent more hours in studying science after school than students who spent less hours



Correlations: Gender - boys

Male (n=35)	Cognitive Strategies	Meta -Cognitive	Motiva -tion	Environ -ment	Self- Efficacy	Enjoy- ment	General Value	Personal Value
Meta -Cognitive	.866(**)	1						
Motivation	.756(**)	.747(**)	1					
Environment	.690(**)	.552(**)	.665(**)	1				
Self -Efficacy	.736(**)	.684(**)	.834(**)	.471(**)	1			
Enjoyment	.693(**)	.733(**)	.741(**)	.459(**)	.824(**)	1		
General Value	.773(**)	.735(**)	.830(**)	.678(**)	.818(**)	.767(**)	1	
Personal Value	.716(**)	.632(**)	.811(**)	.787(**)	.625(**)	.645(**)	.751(**)	1

Correlations: Gender- girls



Female (n=94)	Cognitive Strategies	Meta -Cognition	Motiva -tion	Environ -ment	Self -Efficacy	Enjoy -ment	General Value	Personal Value
Meta -Cognition	.659(**)	1						
Motivation	.558(**)	.552(**)	1					
Environment	.506(**)	.749(**)	.572(**)	1				
Self -Efficacy	.578(**)	.359(**)	.553(**)	.240(*)	1			
Enjoyment	.227(*)	.254(*)	.470(**)	.264(**)	.506(**)	1		
General Value	.463(**)	.283(**)	.655(**)	.259(*)	.763(**)	.481(**)	1	
Personal Value	.359(**)	.382(**)	.638(**)	.359(**)	.483(**)	.491(**)	.549(**)	1



Correlations: Achievement Score

High (n=41)	Cognitive Strategies	Meta- Cognition	Motiva- -tion	Environ- -ment	Self- Efficacy	Enjoy- -ment	General Value	Personal Value
Meta- -Cognition	.705(**)	1						
Motivation	.706(**)	.620(**)	1					
Environment	.679(**)	.691(**)	.715(**)	1				
Self-Efficacy	.690(**)	.511(**)	.824(**)	.599(**)	1			
Enjoyment	.530(**)	.407(**)	.603(**)	.519(**)	.598(**)	1		
General Value	.752(**)	.513(**)	.733(**)	.555(**)	.812(**)	.557(**)	1	
Personal Value	.670(**)	.505(**)	.822(**)	.629(**)	.702(**)	.506(**)	.675(**)	1



Correlations: Achievement Score

Middle (n=48)	Cognitive Strategies	Meta -Cognition	Motiva -tion	Environ -ment	Self -Efficacy	Enjoy -ment	General Value	Personal Value
Meta -Cognitive	.643(**)	1						
Motivation	.090	.232	1					
Environment	.313(*)	.517(**)	.414(**)	1				
Self -Efficacy	.451(**)	.314(*)	.304(*)	.160	1			
Enjoyment	.235	.350(*)	.541(**)	.386(**)	.565(**)	1		
General Value	.242	.252	.587(**)	.386(**)	.555(**)	.616(**)	1	
Personal Value	.069	.096	.595(**)	.434(**)	.213	.506(**)	.449(**)	1

Correlations: Achievement Score



Low (n=39)	Cognitive Strategies	Meta -Cognition	Motiva -tion	Environ ment	Self -Efficacy	Enjoy -ment	General Value	Personal Value
Meta -Cognition	.789(**)	1						
Motivation	.801(**)	.752(**)	1					
Environment	.684(**)	.840(**)	.620(**)	1				
Self -Efficacy	.460(**)	.266	.534(**)	.035	1			
Enjoyment	.228	.270	.403(*)	.066	.558(**)	1		
General Value	.513(**)	.347(*)	.634(**)	.181	.841(**)	.448(**)	1	
Personal Value	.408(**)	.499(**)	.418(**)	.372(*)	.354(*)	.457(**)	.500(**)	1



5. Conclusion and Discussions

- Gender differences in SRLA and affective domain of science suggested that different strategies in teaching may be considered
- Achievement difference in SRLA and affective domain of science suggested that
 - Students in middle and low ranks showed lower correlations between cognitive strategies and enjoyment; and between self-efficacy and environment. It suggested that further in-depth study is needed.