Defense for Doctor Philosophy

by

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THE RELATIONSHIP AMONG MOTIVATION, SELF-REGULATED LEARNING, AND ACADEMIC ACHIEVEMENT

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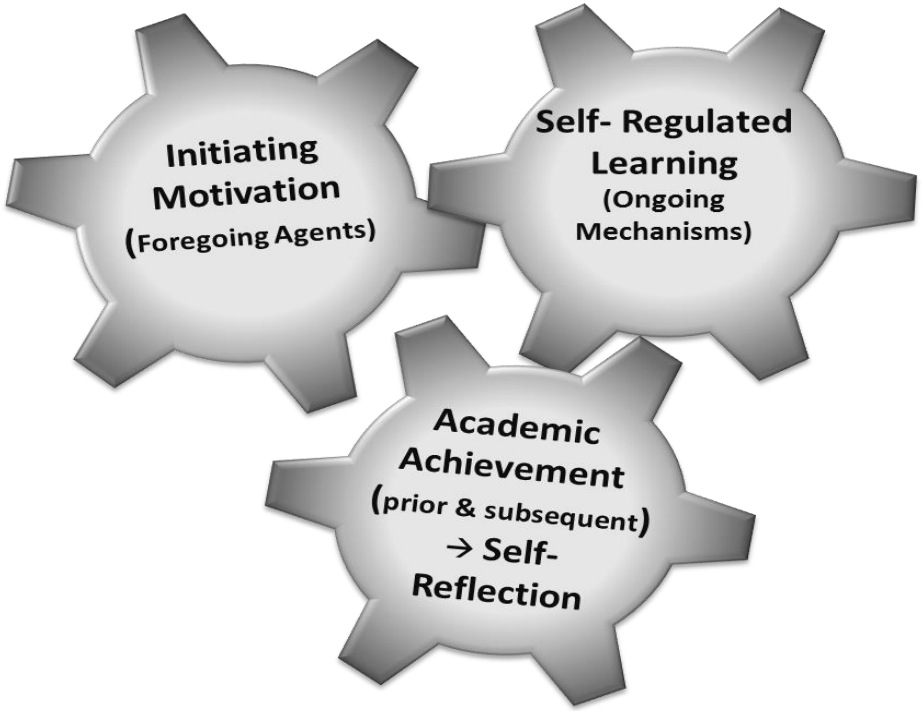
the Relationships among Motivation, Self-Regulated Learning (SRL), and Academic Achievement for Adolescents

1. Meta-Analytic Review
   - A Heuristic framework and Meta-Analytic Findings
   - 1980 ~ 2011 (at prelim)+ 2012, 2013

2. Path Analyses with the data from middle and high school students in South Korea

Assumptions on the relationships among motivation, SRL, and academic achievement based on Bandura's reciprocal determinism of self-system and social cognitivism.



The 1st Paper:
Meta-Analytic Review
the Relationships of Motivation and Self-Regulated Learning (SRL) with Academic Achievement for Adolescents.

1. The existing reviews
2. Objectives of the current review
3. Research Questions
4. Search Method & Criteria
5. Data Collection & Analyses
6. Heuristic Framework
7. Meta-Analytic Findings & Moderator Effects
8. Discussion
9. Limitation & Future Directions
10. Implications

Objectives of the Current Review

- The development of **a heuristic framework** of motivation and SRL for adolescents' academic achievement
- Adopting the heuristic framework, **The investigation of the relationships** among motivation, SRL with academic achievement for secondary school students

Research Questions for the Review

What I did until Prelim Exam.

- How do **the theoretical frameworks and existing instruments** cons truct motivation and SRL for adolescents' academic performance?
- What should be **a heuristic framework** to constitute motivation an d SRL domains for adolescents' academic performance?
- What are the reviewed **studies' methodological characteristics** as r eflected in their methodological quality scores (MQS)?

What I have done since Proposal

- How do the constructs of **motivation and SRL** relate to each other a nd contribute to students' **academic performance**?
- Do school level (middle, high, and mixed secondary school), domain specificity, and MQS **moderate the effects** of motivation and SRL on academic achievement?

Preliminary Criteria for selecting studies

Studies must:

(a) quantitative research studies

(b) a peer-reviewed

(c) English language journals

(d) relationships of both SRL and motivation to academic achievement

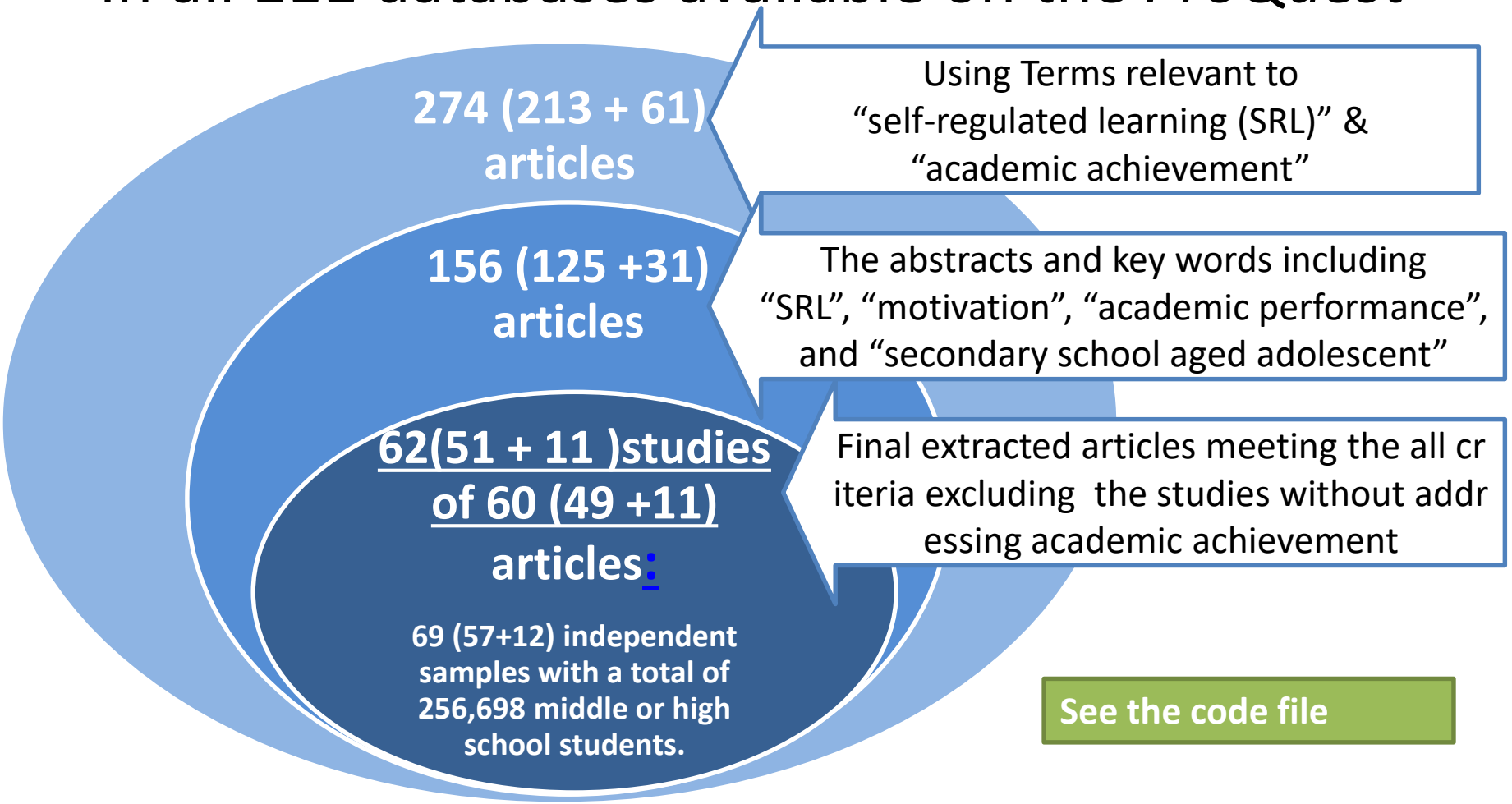
(e) adolescents aging from 13 to 18

(f) academic subject-domains

(g) between **1980 and 2013.**

Search methods for identification of studies

- In all 111 databases available on the *ProQuest*



Data collection and analyses

- Assigning the various scales to the specific constructs in the heuristic framework.

  → multiple subscales for single constructs

- Assessing methodological quality scores (MQS) with 11 criteria (see the section of results)
- Examining the relationships of motivation and SRL with academic achievement

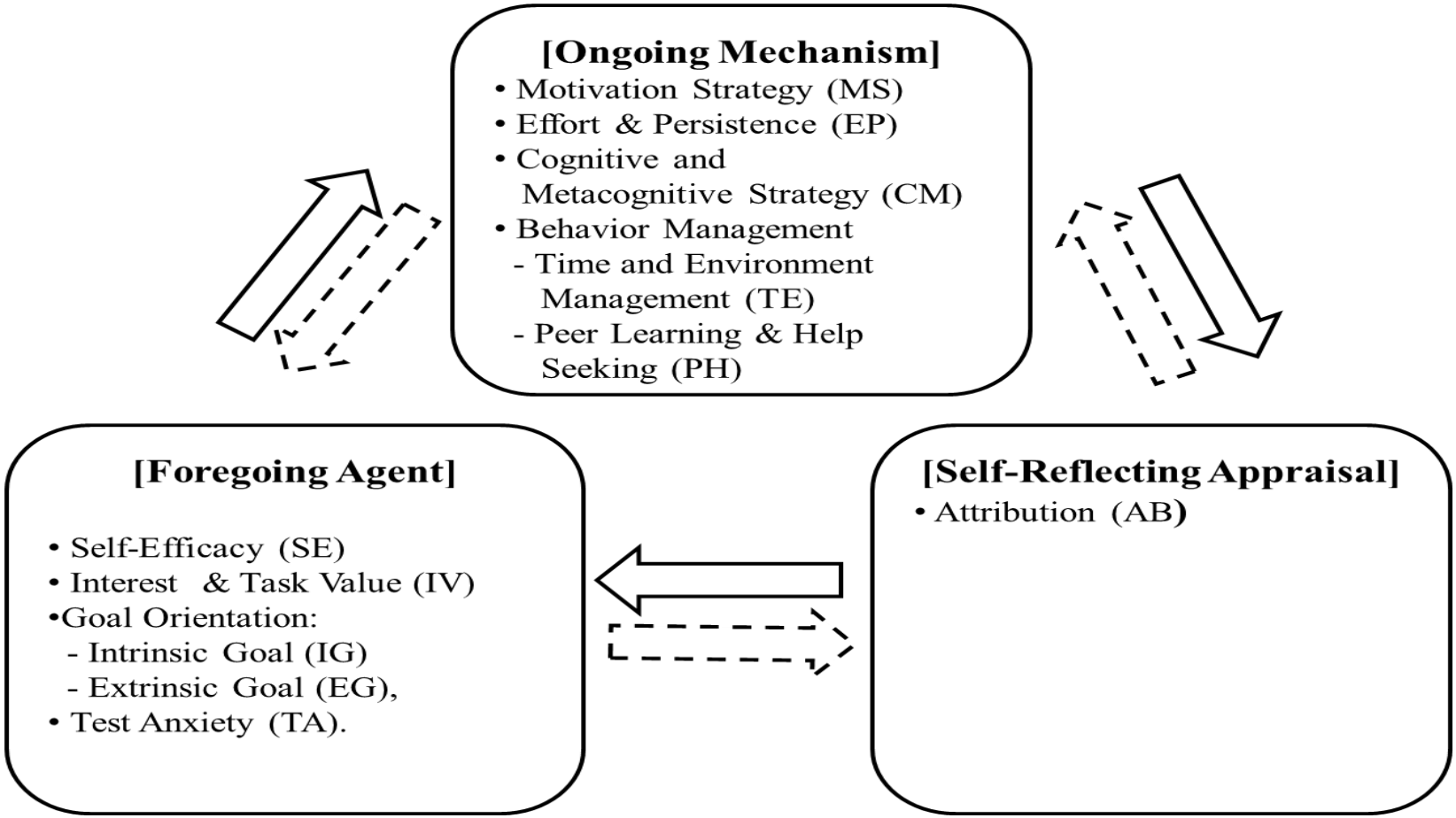
  →the statistical significances (i.e. positive, negative , non-significant)

Data collection and analyses

Meta-analysis as guided in **Hunter and Schmidt (2004),**

- Corrected correlation coefficients (ρ)
- Calculated separate effect sizes for multiple independent groups in a single study
- Corrected for missing reliability data by applying artifact distributions
- Used average correlations for studies reporting multiple subscales for single constructs
- Estimating moderator effects on the contribution of motivation and SRL to academic performance, using the weighted least squared (WLS) regression analysis
  - School level (middle or high school), Whether domain specificity or not , and MQS

The Heuristic Framework of Motivation and SRL



Distribution of the Statistical Significances on the Relationships between 11Constructs and Learning Outcome -1

Construct	Nature of Findings/Relationship							
	Positive		Negative		No Relationship		Total	
	k	%	k	%	k	%	k	%
Foregoing Agent	***192***	***59.44***	***48***	***14.86***	***83***	***25.70***	***323***	***55.88***
Self-Efficacy	83	86.46	5	5.21	8	8.33	96	16.61
Interest & Task Value	42	75.00	0	0.00	14	25.00	56	9.69
Extrinsic Goal	27	31.76	24	28.24	34	40.00	85	14.71
Intrinsic Goal	38	62.30	0	0.00	23	37.70	61	10.55
Test anxiety	2	8.00	19	76.00	4	16.00	25	4.33

Notes: k = # of findings for the subscales of single constructs

Underlined numbers indicate the highest number of positive relationships with aca demic achievement for the 11 constructs

Distribution of the Statistical Significances on the Relationships between 11 Constructs and Learning Outcome-2

Construct	Nature of Findings/Relationship							
	Positive		Negative		No Relationship		Total	
	k	%	k	%	k	%	k	%
Ongoing Mechanism	***132***	***55.46***	***17***	***7.14***	***89***	***37.39***	***238***	***41.18***
Motivational Strategy	2	14.29	3	21.43	9	64.29	14	2.42
Cognitive & Metacognitive Strategy	99	56.25	10	5.68	67	38.07	176	30.45
Effort and Persistence	23	85.19	0	0.00	4	14.81	27	4.67
Time &Environment	7	50.00	2	14.29	5	35.71	14	2.42
Peer Learning & Help Seeking	1	14.29	2	28.57	4	57.14	7	1.21
Self-Reflecting Appraisal	***5***	***29.41***	***4***	***23.53***	***8***	***47.06***	***17***	***2.94***
Attribution	5	29.41	4	23.53	8	47.06	17	2.94
Total	**329**	**56.92**	**69**	**11.94**	**180**	**31.14**	**578**	**100**

Note. k = # of findings for the subscales of single constructs

Meta-Analytic Correlations between the Proceeding Constructs and Academic Achievement

See Effect size calculation Matrix

- corrected correlations (ρ) with learning outcome
  - the strongest : SE (ρ = .48, *k* = 30, *N* = 19,880) of foregoing agents, and EP (ρ = .43, *k* = 11, *N* = 7,932) of ongoing mechanisms.
  - moderate : IV (ρ = .27, *k* = 22, *N* = 16,908); IG (ρ = .26, *k* = 29, *N* = 19 ,076); CM (ρ = .26, *k* = 43, *N* = 25,728); and AB (ρ = .29, *k* = 8, *N* = 1,54 6).
  - negative : test anxiety (ρ = - .35, *k* = 13, *N* = 11,810)
  - statistically no significance: EG, MS, TE, PH present the weakest c orrelations less than .10 and their confidence intervals included z ero.
- The population variance (i.e., variance of true score correlations) of this meta-analysis extended .00 to .11, indicating some variations across the examined studies other than corrected artifacts.

Disattenuated Correlations among the Proceeding Constructs

See Effect size calculation Matrix

Intra-Correlations

- The strong intra-correlations enough for internal consistency:
  SE (ρ = .86, *k* = 8, *N* = 5,705), EG (ρ = .64, *k* = 14, *N* = 7,904), IG (ρ = .79, *k* = 3 , *N* = 820), EP (ρ = .79, *k* = 2, *N* = 714), and CM (ρ = .94, *k* = 21, *N* = 15,078)
- moderate intra-correlation: MS (ρ = .54, *k* = 3, *N* = 550),
- weak intra-correlation: AB (ρ = .39, *k* = 2, *N* = 292)
- no availability: IV, TA, TE, and PH.

Inter-Correlations: Of 55 inter-correlations,

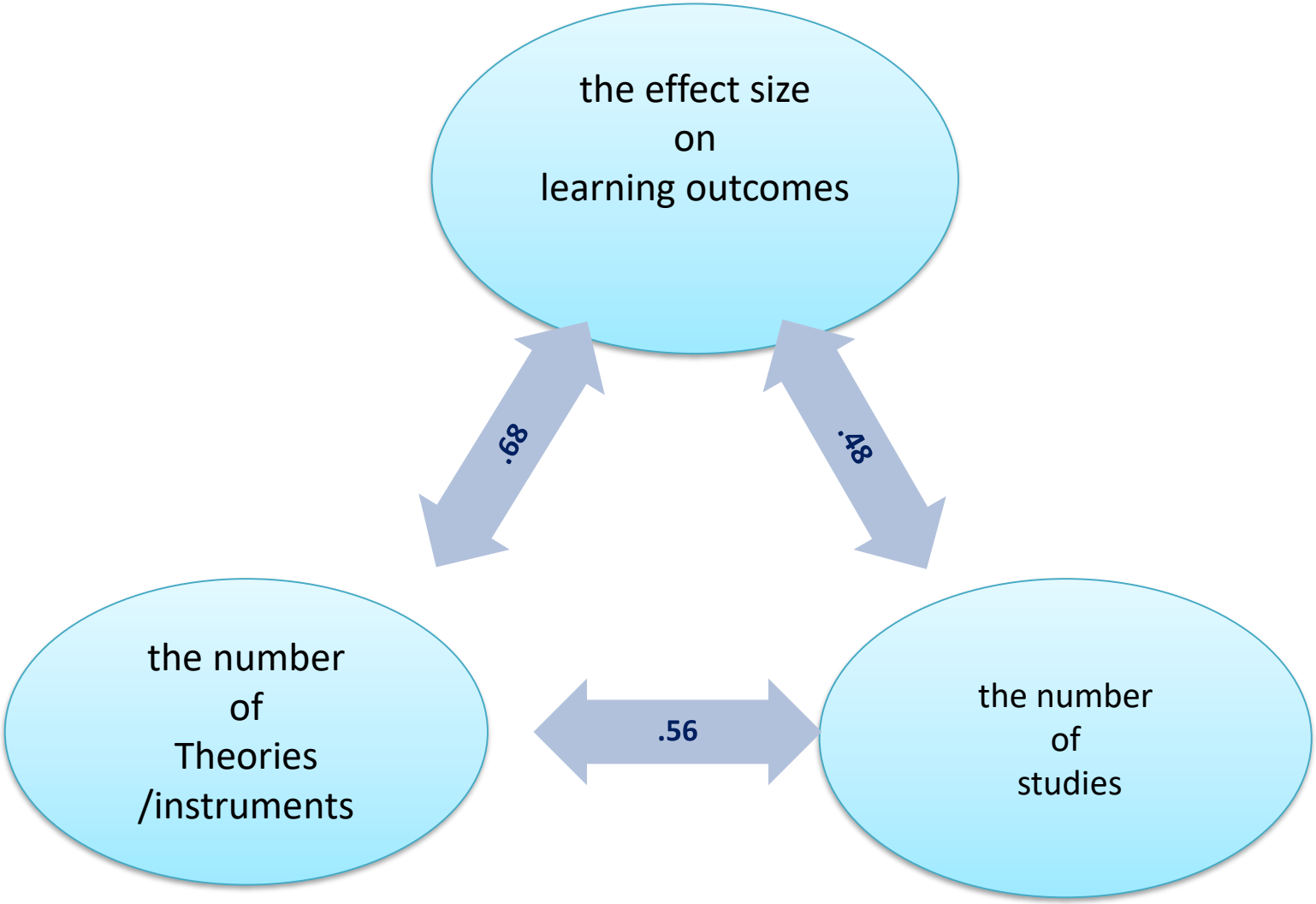
- 46 relationships were available and nine were not available for disattenuated correlations.
- large corrected inter-correlations: 54 % (*k* = 25/46) ranging ρ = .47 to .90
- medium inter-correlations: 39 % (*k* = 18/46) ranging ρ = .19 to .40
- Small inter-correlations: 6 % (*k* = 3/46), ρ < .10
- the strong inter correlations about or over .7 among SE, IV, IG, EP, CM, PH, AB
  →SE, IV, and IG of foregoing agents are immediately connected to EP, CM, a nd PH of ongoing mechanisms, and, in turn, AB of self-reflecting appraisal is closely linked to IV of foregoing agents.

Moderator Effects on the Criterion Correlations through Weighted Least Squares Regression Analysis

The following moderators explained 7 % to 78 % of the varia nces for the criterion correlations of 10 constructs, showing fair to strong moderator effects on the meta-analytic findin gs.

- Middle school : SE (β = .32, $p < .01$), CM (β = .25, $p < .01$), and EP (β = .82, $p < .01$)
- High School: SE (β = .40, $p < .01$), IG (β = .37, $p < .01$), and AB (β = -.70, $p < .05$)
- Domain specificity: SE (β = .46, $p < .01$), EG (β = - .28, $p < .01$), IG (β = .36, $p < .01$), TA (β = -.74, $p < .01$), TE (β = -.90, $p < .05$), and AB (β = -.62, $p < .05$)
- MQS: EG (β = .52, $p < .01$) and TE (β = -1.01, $p < .05$)

Correlations among effect sizes and the numbers of theory/instrument/ studies for 11 constructs



The Comparison of Findings on the Relationships of Motivation and SRL with Academic Achievement among Three Meta-Analyses

Strength of Impact on Learning Outcome	Salzmann and Ely, 2011 (adults: training outcomes)	Credé and Phillips, 2011 (College students: course grades)	Current Review (adolescents: academic outcomes)
Strong ρ = .50	Goal level		Self-efficacy
	Self-efficacy		Effort & persistence
		Effort regulation	Test anxiety (reversely)
		Self-efficacy	
		Time and study environment	
Medium ρ = .30	Effort		Attribution
	Persistence		Cognitive and metacognitive strategy
	Attention	Meta-cognitive self-regulation	Interest & task value
	Time management	Task value	Intrinsic goal
	Environmental structuring	Intrinsic goal orientation	
	Motivation	Control of learning beliefs	
	Attribution	Test anxiety (reversely)	
	Monitoring	Elaboration	
	Meta-cognition	Critical thinking	
	Learning strategy	Rehearsal	
	Planning	Organization	
Weak ρ = .10	Help seeking	Extrinsic goal	Time and environment management
	Emotion control	Peer learning	Extrinsic goal
		Help seeking	Motivational strategy
			Peer learning & help seeking

Discussion

- As for the heuristic framework,
  - **Adequacy of the heuristic framework of motivation and SRL for construct specification**.
- Regarding the meta-analytic findings,
  - Substantial contribution of the seven constructs to academic performance: **SE,** IV, IG, TA, CM**, EP**, AB , and **SE and EP:** the strongest
  - Not significant effects on academic performance:

    EG, MS, TE, PH involving contextual states
  - TA was a significant disturbance to learning.
- Reciprocal and cyclic functions of students' learning performance: showed
  - the strong inter-correlations among the substantial constructs (i.e., SE, IV, IG, EP, CM, and AB)

Discussion-continued

- Curvilinear relationships (Credé & Phillips, 2011).
  - Particularly, PH should be more favorable and effective for those students with middle level of academic ability than high or low performing students.
- As shown in the moderator effects,
  - Middle school students were likely to take advantages of SE, CM, and EP, while high school students were likely to have benefit from SE and IG.

Limitations & Future directions

1. More databases needed
2. A review based on longitudinal research accounting for causal and mutual relationships
3. More moderator variables

Implications

- A precise and parsimonious framework
- Effective approaches
- the need for differentiated interventions between two school levels.

  → SE, CM, and EP for middle school students, SE and IG for high school students.

Continue to 2nd paper

The existing reviews

- There were NO reviews encompassing the contributions of both motivation and SRL to academic outcomes in the **adolescents'** learning activities.

  But, a few narrative reviews and meta-analyses on the topic for college students or older adults rather than teenagers

- The meta-analysis by Cellar et al. (2010):
  - findings from 102 studies with 16,000 subjects
  - **mastery goal** had a positive relationship with self-regulation constructs and performance
  - **performance avoidance** had negative relation with those variables.
  - **However,** the constructs of self-regulation were categorized into four variables (i.e., self-monitoring, self-evaluation, self-efficacy, and self-reaction), and NEITHER include the specific components such as effort management, cognitive and metacognitive strategy use, and resource management NOR address the effects of SRL on academic achievement.

The Existing Reviews-Continued

- Credé and Phillips (2011) reviewed studies in which the construct validity of the MSLQ:
  - 2158 correlations from 67 samples of 19,900 college students
  - moderate or weak relationships between the scores of the MSLQ and academic performance.
  - **Effort regulation** was the best predictor of GPA and current class grades, followed by **self-efficacy.**
- Sitzmann and Ely (2011) a meta-analysis
  - 430 studies of 90,380 adults
  - The heuristic framework: 16 constructs
  - **Strong interrelationships** among the constructs of SRL and achievement in adulthood.
  - **Goal level (**self-set goal for performance**), self-efficacy, effort and persistence** were the strongest factors on adults' learning achievement.

Reliability Artifact Distribution

Construct	Mean r_{xx}	SD r_{xx}	*k*
Foregoing Agents			
Self-Efficacy	.82	.07	80
Interest & Task Value	.83	.18	38
Extrinsic Goal	.77	.08	70
Intrinsic Goal	.78	.09	52
Test anxiety	.78	.10	23
Ongoing Mechanisms			
Motivational Strategy	.81	.06	14
Cognitive and Metacognitive Strategy	.76	.10	145
Effort & Persistence	.78	.06	22
Time and Environment Management	.76	.07	11
Peer Learning & Help Seeking	.73	.00	3
Self-Reflecting Appraisal			
Attribution	.74	.09	13
Academic Outcome	.78	.09	12

Domains Motivation and SRL from the Theories and Inventories Adopted in the Studies

Construct	Pintrich (2000, 2003)	Ryan &Deci (2000)	Eccles & Wigfield (2002); Wigfield et al., (2006)	Schunk & Zimmerman (2008)	Boekaerts (1996)	Corno (2001)	Zimmerman & Moylan (2009)	MSLQ	PALS	SAL
Foregoing Agent										
Self-Efficacy	X		X	X	X		X	X	X	X
Interest & Task Value	X		X	X	X		X	X		X
Test Anxiety	X							X		
Goal Orientation										
Extrinsic Goal	X	X	X	X	X		X	X	X	X
Intrinsic Goal	X	X	X	X	X		X	X	X	X
Ongoing Mechanism										
Motivational Strategy	X				X	X	X		X	
Effort &Persistence	X			X	X	X	X	X		X
Cognitive & Metacognitive Strategy	X				X	X	X	X		X
Behavior Management										
Time &Environment	X					X	X	X		
Peer Learning & Help Seeking	X					X	X	X		X
Self-Reflecting Appraisal										
Attribution	X		X	X	X		X	X		

See the summary of the theoretical frameworks

Motivation and SRL Constructs -1

Construct	Definition	Scales on the Construct	Sample Item	# of Studies (/62)
Foregoing Agent				
Self-Efficacy	Personal expectations and beliefs about one's abilities to accomplish a task	**Eight Scales**: Academic Self-Concept, Academic Self-Efficacy, Cognitive Competence, Control Expectation, Expectancy, Self-Concept, Self-Confidence, Self-Esteem	Academic Self-Efficacy (MSLQ) : I am sure that I can do an excellent job on the problems and tasks assigned for this class Control Expectation (SAL) : If I decide not to get any problems wrong, I can really do it	40
Interest & Task Value	Students' interests and task values for learning	**Eight Scales**: Attitude, Choice, Interest Enhancement, Interest in school, Interest, Motivation, Task Value, Instrumental Motivation	Task Value (MSLQ) : I like what I am learning in this class Interest (Artelt, Baumert, Julius-McElvany, & Peschar, 2003) : When I read, I sometimes get totally absorbed.	34

Motivation and SRL Constructs -2

Construct	Definition	Scales on the Construct	Sample Item	# of Studies (/51)
Extrinsic Goal	Students' learning reasons as means for outcomes such as grades, rewards, and exhibitive competence	**14 Scales**: Autonomous Performance Goal, Competitive Goal, Controlled Performance Goal, Educational Goal, Ego Orientation, Extrinsic Motivation, Goal Investment, Performance Avoidance, Performance Avoidance Structure, Performance Goal Structure, Performance Goal, Relative Ability Goal, Social Motivation, Work Avoidance Goal	Extrinsic Motivation (PALS) : The main reason I do my work is because we get grades. Performance Goal (Elliot & McGregor,2001) : To me it is important that I outperform other students in this class.	31
Intrinsic Goal	Students' challenge, curiosity, mastery, and learning as an end all to itself	**Seven Scales**: Intrinsic Motivation, Intrinsic Value, Learning Goal, Mastery Avoidance, Mastery Goal Structure, Mastery Goal, Task Orientation	Learning Goal (PALS) : In this class, understanding the work is more important to me than the grade I get. Mastery Goal (Elliot & McGregor's,2001) : I want to learn as much as possible from this class.	36
Test Anxiety	Students' affective reactions to a task, and usually the worry of negative thoughts disrupting performance	**Three Scales**: Negative Affect, Test-Anxiety, Coping Focused on Emotion	Test Anxiety (Spielberger, 1980) : My thoughts about failure distract me from focusing efficiently on questions in a test	15

Motivation and SRL Constructs -3

Construct	Definition	Scales on the Construct	Sample Item	# of Studies (/62)
Ongoing Mechanism				
Motivational Strategy	students' selection and adaptation to manage motivation and emotion	**10 Scales**: Emotional Regulation, Enhancement of Situational Interest, Mastery Self-Talk, Non-Productive Coping, Performance Self-Talk, Self-Consequating, Self-praise, Success encouragement, Task-value encouragement, Enhancement of Personal Significance	Self-Consequating (Schwinger, Laden,& Spinath,2007): I tell myself that after work I can do something nice, if I first keep on learning now. Mastery Self-Talk (Wolters, 1998): I tell myself that I should keep working just to learn as much as I can.	7
Effort & Persistence	Students' volitions and willingness and driven into purposeful behaviors toward successful accomplishment	**Five Scales**: Coping Focused on Solving the Problem, Effort & Persistence, Effort, Homework-Engagement, Persistence	Effort & Persistence (MSLQ):When the work in math is difficult, I give up (Reversed).	17

Motivation and SRL Constructs -4

Construct	Definition	Scales on the Construct	Sample Item	# of Studies (/62)
Ongoing Mechanism				
Cognitive & Metacognitive Strategy	Students utilize strategy use during their learning experiences to accomplish academic tasks.	**33 Scales**: Attention Regulation, Awareness, Control Strategies, Checking and Correcting, Class-Engagement, Cognitive Strategy Use, Concentration, Control Strategies, Critical Thinking, Deep Strategy, Elaboration, Eliciting Context, Information Processing, Learning Strategy, Memorizing, Meta-Cog., Monitoring Content, Organization, Planning, Planning Ahead, Proximal Goal Setting, Reader awareness, Reading Strategy, Rehearsal, Selecting Main Ideas, Self-Checking, Self-Discipline, Self-evaluation, Self-Regulation, Study Approach, Surface Processing Strategy, Test Taking Strategies, Understanding, Verbalization	Planning (Malpass, 1994): I made sure I understood just what had to be done and how to do it Cognitive Strategy Use (O'Neil, Baker, Ni, Jacoby, &Swigger, 1994): I use multiple thinking techniques or strategies to solve a problem. Control Strategies (SAL): When I study, I start by figuring out exactly what I need to learn.	54

Motivation and SRL Constructs -5

Construct	Definition	Scales on the Construct	Sample Item	# of Studies (/62)
Ongoing Mechanism				
Behavior Management				
Time & Environment	Students arrange time and environmental contingencies for efficiency to gain successful achievement.	**Four Scales**: Academic Delay Gratification, Procrastination, Time & Study Management, Environmental Control	Time Management (MSLQ): When I learn math, I make good use of my study time. Academic Delay Gratification (Bembenutty &Karabenick, 1998): I do my homework before I meet my friends.	12
Peer Learning & Help Seeking	Students can understand course materials more clearly and insightfully through collaborative learning with peers and help from the advanced peers and teachers	**Four Scales**: Cooperative, Coping with Reference to Others, Help seeking, Peer Learning	Cooperative Learning (SAL): I like to work with other students. Help Seeking (MSLQ): I ask the instructor to clarify concepts I don't understand well	6
Self-Reflecting Appraisal				
Attribution	Students' judgment on the causes of outcomes such as their ability, effort, task difficulty and luck	**Eight Scales**: Ability Attribution, Control of Learning Beliefs, Effort Attribution, External Attribution, Locus of Control, Personal Control Belief, Strategy Attribution, Learned Helplessness	Control of Learning Beliefs (MSLQ): It is my own fault if I don't learn the material in this course. Locus of Control (Trice, 1985): Grades most often reflected the effort you put into classes.	12

Descriptive Statistics of the Reviewed Studies -1

See the study characteristics

Variables		Frequency (# of studies)	%
Pub-Year	1988	1	2 %
	1990-1999	14	23 %
	2000-2009	26	42 %
	2010-2013	21	34 %
Gender %	less than 5% male	0	0 %
	between 5% and 50% male	28	45 %
	50% male	4	6 %
	between 50% and 95% male	23	38 %
	greater than 95% male	0	0 %
	Cannot tell	7	11 %
School	Mid	23	37 %
	High	24	39 %
	Secondary	15	24 %
Academic Ability Level	At Risk	4	6 %
	Gifted	3	5 %
	High and Low	1	2 %
	Normal	54	87 %
Theoretical Frameworks for MV & SRL	Social Cognitive	25	40 %
	Self-Determination Theory	5	8 %
	Expectancy	4	6 %
	Self-Regulation Theory by Boekaerts	3	5 %
	Others	4	6 %
	Not reported	24	39 %

Descriptive Statistics of the Reviewed Studies -2

Variables		Frequency (# of studies)	%
Inventory	**MSLQ**	**25**	**40 %**
	PALS	8	13 %
	SAL	7	11 %
	Others	**35**	**56 %**
	Not Reported	1	2 %
# of adopted Constructs	1-3	24	39 %
	4-9	**37**	**60 %**
	10	1	2 %
Relationship with Academic Achievement	ANOVA	4	6 %
	Regression	11	18 %
	Correlation	**47**	**76 %**
# of Relations with Academic Achievement	1	1	2 %
	2-10	**47**	**76 %**
	11-30	**11**	**18 %**
	31-50	2	3 %
	60	1	2 %

The MQS Criteria and Distributions for the Reviewed Studies -1

See the MQS Matrix

Variables of Methodological Characteristics	Scoring options (Maximum total score 24 points)	# of studies	%
Construct Classifications into Motivation and SRL	**Unspecified = 1 point**	**41**	**66 %**
	Specified = 2 points	21	34 %
Subject-Domain Specificity	General = 1 point	23	37 %
	Subject Specific = 2 points	**39**	**63 %**
Report of Reliabilities for the Scales on Motivation and SRL	Not reported = 0 points	5	8 %
	Reported = 1 point	**57**	**92 %**
Report of Reliabilities for Academic Outcomes	**Not reported = 0 points**	**49**	**79 %**
	Reported = 1 point	13	21 %
Report of Validities	**Not reported = 0 points**	**41**	**66 %**
	Reported = 1 point	21	34 %
Descriptions of Data Distribution	Not reported = 0 points	7	11 %
	Mean and Standard Deviation Reported = 1 point	**45**	**73 %**
	Mean, Standard Deviation, and Normality Reported = 2 points	10	16 %
Addressing Missing Data	**Not reported = 0 points**	**48**	**77 %**
	Reported = 1 point	14	23 %

The MSQ Criteria and Distributions for the Reviewed Studies -2

Variables of Methodological Characteristics	Scoring options (Maximum total score 23 points)	# of studies	%
Theoretical Frameworks	Not reported = 0 points	24	39 %
	Reported = 1 point	38	61 %
Research Design	**Correlational/Cross-sectional Design = 1point**	**55**	**89 %**
	Longitudinal Design = 2 points	7	11 %
Sampling Method	Cannot tell = 0 points	3	5 %
	Non-random, convenience = 1 point	**47**	**76 %**
	Non-random, post hoc matching = 2 points	1	2 %
	Random after matching, stratification, blocking, etc.= 3 points	3	5 %
	Random, simple (also includes systematic sampling) = 4 points	8	13 %
Sample Size	Small sample (<100) = 1 point	7	11 %
	Medium sample (≤ 100 and < 300) = 2 points	22	35 %
	Large sample (≥ 300) = 3 points	**33**	**53 %**
Statistical Techniques	Univariate statistics/descriptive = 1 point	0	0 %
	Bivariate statistics/ANOVA = 2 points	5	8 %
	Multiple/logistic regression = 3 points	**22**	**35 %**
	Multivariate statistics (canonical correlation/ path analysis/ SEM = 4 points	**35**	**56 %**

Note. **The MQS of the studies ranges 10 to 21 of the full score 24 with a mean of 14.79 and standard deviation of 2.50. for 62 studies**

The Constructs of the Heuristic Frameworks

A Meta-Analysis of Self-Regulated Learning in Work-Related Training and Educational Attainment (Sitzmann and Ely, 2011)	The Present Review
Regulatory Agent	**Preceding Agents**
Goal Level (Self-setting goals for performance)	Self-Efficacy
Regulatory Mechanisms	Interest & Task Value
Planning	Test Anxiety
Monitoring	*Goal Orientation*
Metacognition	Extrinsic Goal
Attention	Intrinsic Goal
Learning Strategies	**Ongoing Mechanisms**
Persistence	Motivational Strategy
Time Management	Effort & Persistence
Environmental Structuring	Cognitive & Metacognitive Strategy
Help Seeking	*Behavior Management*
Motivation	Time & Environment
Emotion Control	Peer Learning & Help Seeking
Effort	**Self-Reflecting Appraisals**
Regulatory Appraisals	Attributions
Self-evaluation	
Attributions	
Self-Efficacy	

Meta-Analytic Correlations between the Proceeding Constructs and Academic Achievement

See Effect size calculation Matrix

Construct	K	Total *N*	R_{obs}	ρ	Var_{obs}	$Var_{ρ}$	Var_{res}	Variance due to artifacts (%)	95% CI		80% CrI	
									Lower	Upper	Lower	Upper
Foregoing Agent												
Self-Efficacy	31	19,880	.31	**.48**	.03	.07	.03	9.95	.24	.37	.13	.83
Interest & Task Value	22	16,908	.17	.27	.01	.03	.01	21.78	.12	.22	.06	.47
Extrinsic Goal	25	13,011	.01	.02	.03	.07	.02	7.42	-.05	.08	-.31	.36
Intrinsic Goal	29	19,076	.16	.26	.01	.02	.01	23.72	.12	.19	.08	.44
Test Anxiety	13	11,810	-.21	-.35	.04	.10	.03	6.52	-.32	-.11	-.75	.04
Ongoing Mechanism												
Motivational Strategy	5	776	.01	.03	.01	.02	.01	49.08	-.08	.12	-.14	.19
Cognitive and Metacognitive Strategy	43	25,728	.16	.26	.01	.03	.01	20.62	.12	.19	.06	.47
Effort & Persistence	11	7,932	.26	**.43**	.01	.02	.01	23.70	.20	.33	.24	.63
Time and Environment Management	11	4,451	.05	.08	.04	.11	.04	6.37	-.07	.16	-.34	.49
Peer Learning & Help Seeking	2	108,186	-.01	-.03	.00	.00	.00	26.64	-.02	.00	-.04	-.01
Self-Reflecting Appraisal												
Attribution	8	1,546	.17	.29	.04	.10	.03	14.75	.03	.31	-.11	.69

Note. **r_{obs} = mean of observed score correlations weighted by sample size; ρ = mean of true score correlations weighted by s ample size and corrected for study artifacts; Var_{obs} = variance of observed score correlations; $Var_{ρ}$ = variance of true score c orrelations; Var_{res} = variance of observed correlations after removal of variance due to study artifacts.**

Disattenuated Correlations among the Proceeding Constructs

See Effect size calculation Matrix

Constructs	1. Self-Efficacy		2. Interest & Task Value		3. Extrinsic Goal		4. Intrinsic Goal		5.Test Anxiety	
	k (N)	ρ	k (N)	ρ	k(N)	ρ	k (N)	ρ	k (N)	ρ
1. Self-Efficacy	8 (5,705)	.86								
2. Interest & Task Value	16 (14,567)	.58	NA							
3. Extrinsic Goal	11 (5,358)	.06	10 (5,376)	.28	14 (7,904)	.64				
4. Intrinsic Goal	17 (12,605)	.58	10 (9,751)	.90	25 (12,310)	.28	3 (820)	.79		
5.Test Anxiety	10 (9,813)	-.40	6 (8,279)	-.25	8 (4,488)	.24	9 (9,905)	-.52	NA	
6. Motivational Strategy	1 (201)	.63	1 (88)	.54	4 (894)	.54	3 (663)	.60	NA	
7. Effort & Persistence	5 (6,744)	.69	7 (7,022)	.70	8 (3,503)	.02	7 (3,314)	.65	2(1,887)	-.19
8. Cognitive and Metacognitive Strategy	27 (18,438)	.66	16 (14,073)	.68	26 (12,492)	.23	29 (17,846)	.83	11(11,126)	-.15
9. Time and Environment Management	3 (2,472)	.25	5 (3,033)	.37	8 (4,977)	.22	6 (3,091)	.50	2(1,887)	-.00
10. Peer Learning & Help Seeking	2 (488)	.54	2 (574)	.64	2 (488)	.26	2 (488)	.69	NA	
11. Attribution	7 (1334)	.09	4 (989)	.77	2 (159)	.27	2 (411)	.54	NA	

Disattenuated Correlations among the Proceeding Constructs

Constructs	6. Motivational Strategy		7. Effort & Persistence		8. Cognitive and Metacognitive Strategy		9. Time and Environment Management		10. Peer Learning & Help Seeking		11. Attribution	
	k(N)	ρ	k(N)	ρ	k(N)	ρ	k(N)	ρ	k(N)	ρ	k(N)	ρ
1. Self-Efficacy												
2. Interest & Task Value												
3. Extrinsic Goal												
4. Intrinsic Goal												
5.Test Anxiety												
6. Motivational Strategy	3 (550)	.54										
7. Effort & Persistence	3 (550)	.37	2 (714)	.79								
8. Cognitive and Metacognitive Strategy	3 (550)	.54	11 (9,398)	.77	21 (15,078)	.94						
9. Time and Environment Management	3 (550)	.54	9 (5,107)	.47	13 (6,330)	.60	NA					
10. Peer Learning & Help Seeking	NA		1 (107,899)	.31	2 (108,186)	.33	NA		NA			
11. Attribution	NA		NA		5 (942)	.19	NA		NA		2 (292)	.39

Moderator Effects on the Criterion Correlations through Weighted Least Squares Regression Analysis

Moderator / Construct	Middle School	High School	Domain Specificity	MQS	R^2
Self-Efficacy	.32**	.40**	.46**	-.0700	.35
Interest & Task Value	.1600	-.0400	-.2500	-.1000	.14
Extrinsic Goal	.0300	-.1100	-.28**	.52**	.27
Intrinsic Goal	-.0300	.37**	.36**	-.1900	.22
Test Anxiety	.0500	-.2000	-.74**	.1400	.63
Motivational Strategy	NA	-.5600	NA	.2200	.33
Cognitive & Metacognitive Strategy	.25**	-.0200	-.0400	.0700	.07
Effort and Persistence	.82**	.3900	-.2100	.1800	.58
Time &Environment	.5000	.6800	-.90*0	-1.01*0	.65
Peer Learning & Help Seeking	NA	NA	NA	NA	NA
Attribution	-.2300	-.70*0	-.62*0	.2000	.78

Moderator Effects on the Criterion Correlations through Weighted Least Squares Regression Analysis

Moderator / Construct	Middle School	High School	Domain Specificity	MQS	R^2
Self-Efficacy	.32**	.40**	.46**	-.0700	.35
Interest & Task Value	.1600	-.0400	-.2500	-.1000	.14
Extrinsic Goal	.0300	-.1100	-.28**	.52**	.27
Intrinsic Goal	-.0300	.37**	.36**	-.1900	.22
Test Anxiety	.0500	-.2000	-.74**	.1400	.63
Motivational Strategy	NA	-.5600	NA	.2200	.33
Cognitive & Metacognitive Strategy	.25**	-.0200	-.0400	.0700	.07
Effort and Persistence	.82**	.3900	-.2100	.1800	.58
Time &Environment	.5000	.6800	-.90*0	-1.01*0	.65
Peer Learning & Help Seeking	NA	NA	NA	NA	NA
Attribution	-.2300	-.70*0	-.62*0	.2000	.78