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META-ANALYSIS OF SELF-REGULATED LEARNING STRATEGIES AND ACADEMIC ACHIEVEMENT

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ABSTRACT

Purpose: Self-regulated learning (SRL) has been established in the literature as beneficial for students in learning. It is believed that SRL promotes learner autonomy and successful academic outcomes. Although SRL strategies are quite popular and heavily researched, this research analysed how SRL contributes to positive academic outcomes.

Methodology: A meta-analysis was carried out to identify the patterns and gaps in this research area. A total of 65 studies were identified based on a keyword search related to SRL and academic achievement.

Findings: It was found that all studies included in this review emphasised different research methods and reported significant changes in students' academic outcomes.

Significance: How SRL strategy usage as a tool can promote SRL, this study offers insights to those who wish to use SRL strategy usage as a medium to foster self-regulated learning and enhanced learning outcomes. The results of the meta-analysis may also help researchers to explore this area of study and address research gaps in relatable contexts.

Keywords: Self-Regulated Learning, Academic Achievement, Meta-Analysis.

Introduction

"Research is to see what everybody else has seen and to think what nobody else has thought."

–Albert Szent Gyorgyi

According to Zimmerman (1986), self-regulated learners are metacognitively, motivationally and behaviourally active participants throughout their learning process. SRL demands that learners be intrinsically motivated to achieve the goals they set for themselves as they self-monitor throughout the learning process. This requires students to plan, monitor and access their learning independently (Zumbrunn et al., 2011). In SRL, the keywords are self and regulation and how these two concepts are connected to learning. Following the Socratic model of learning, Tweed and Lehman (2002) view the 'self' as responsible for its own learning and that knowledge should be generated by the 'self', whereby the learner initiates learning through "overt and private questioning, expression of personal hypotheses, and a desire for self-directed tasks" (p. 93). Wang and Lu (2016), following the Confucian view of 'self', emphasise that the 'self' is substantially formed by various socio-cultural factors. The "learner must actively work to acquire, understand, and apply essential concepts coming mainly from outside the self. In this sense, Confucian acquisition of essentials occurs not through passive absorption but through constructing within the self the knowledge that the collective considers essential" (Tweed & Lehman, 2002, p. 96). Wang and Lu (2016) further assert that learning is inevitably shaped by values and social contextual factors. Both the Socratic and Confucian views of 'self' learning are applicable in the concept of self-learning for different types of learners, whereby more advanced and able learners are seen as more independent. Such learners can advance their learning through acquired knowledge and require less or no guidance from a teacher. On the other hand, learners who are considered beginners and in the path of acquiring new knowledge will need some form of guidance (external push) for self-learning before they can emerge as totally independent learners. This concept is similar to the sociocultural construct of zone of proximal development, where learners learn with assistance of other capable peers and later gain the capacity to further develop through mediation and regulation. According to Zimmerman (2002), regulation is "not a mental ability or academic performance skills [but rather refers to] a self-directive process of transforming mental abilities into learning skills" (p. 65) based on the learners' effort. It is the learners' proactive learning process, in which they initiate efforts for themselves through self-thoughts, feelings and behaviour regardless of how such effort is self-driven, as they are aware of their abilities. Ormrod (2009) adds that regulation deals with an ability to control and develop one's learning. The concept of 'regulation' in SRL involves three significant elements: (a) personal regulation, referring to the adjustment of cognitive and affective factors; (b) behavioural self-regulation, which takes into account the process of monitoring oneself and modifying performance; and (c) environmental self-regulation, which involves analysing the learning context and making adaptations to maximise performance (Zimmerman, 2000). According to Zimmerman (2000), the interactions of these components occur in the forethought of task, performance and self-reflection. In order to have reflections on researches done globally literature review was done and 65 studies were explored to have glimpses of effect of intervention and also to see correlations among two variables.

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Sr.No	Name of Researcher and Year of study	Method and Sample Size	SRL strategy	Findings
1.	Helen (2001)	Quantitative middle school Science classes	Groups of students were given the opportunity to use self-regulated learning strategies with and without prompting.	Enhanced Achievement Enhanced Strategy use Gender differences in favour of females
2.	Kusiak (2001)	Quantitative intermediate learners.	metacognitive strategy training	Enhanced their metacognitive knowledge of themselves as readers, their perceptions of the reading process and reading strategies, and their motivation as well as self-evaluation of reading skills.
3.	Savithiri (2006)	single group design with pre, progressive and post-test. N=50 high school students in learning Geometry	metacognitive strategies training	Enhanced perceptual skills in learning Geometry.
4.	Camahalan and Faye (2006)	Quantitative (N=60	self-regulated learning strategy intervention	Enhanced Mathematics achievement, Mathematics self-regulated learning, and Mathematics school grade
5.	Cleary, Platten,and Nelson. (2008)	Group of urban 9th class high school students This study utilized a mixed-model pre and post test research design	Self regulation empowerment program (SREP) SRC field notes and structured microanalytic assessment procedures 1) explicit instruction in core forethought processes, such as task analysis, goal-setting, and strategic planning. 2). After training students in these forethought phase processes students were taught empirically supported learning tactics, such as concept maps and mnemonic devices	SREP impacted students' motivation beliefs, such as self-efficacy and interest in biology. Across both self-efficacy for self-regulated learning, and self-efficacy for biology outcomes, Enhanced achievement in biology test scores
6.	Nbina and Viko (2010)	. A non-equivalent control group pretest and posttest design on senior secondary school students'	Metacognitive self assessment strategy on senior secondary school students' Chemistry self-efficacy and achievement. The study also explored the interaction effect of instruction in metacognitive self assessment strategy and gender in their Chemistry self-efficacy and achievement	Improvement in the students' chemistry achievement and self-efficacy.
7.	Shamshiri (2010)	. A non-equivalent control group pretest and posttest design 56 intermediate level Malaysian college students in listening comprehension	cognitive and metacognitive explicit strategy instruction	Improvement in listening comprehension
8.	Kistner, Rakoczy, Otto, Dignath-van Ewijk, Büttner, and Klieme (2010).	. N=538 students (grade 9) N= 20 maths teachers	Assessment of the teachers' implicit or explicit instruction of cognitive strategies (e.g., organisation), metacognitive strategies (e.g., planning), and motivational strategies (e.g., resource management).	great amount of strategy teaching takes place in an implicit way, whereas explicit strategy teaching and supportive learning environment are rare. In contrast to implicit strategy instruction, explicit strategy instruction was associated with a gain in performance
9.	Meshkatie, Allahvirdiyani, Kahnamouei and Lohrasbi (2011)	N=60 (30 girls and 30 boys).	instructing cognitive and metacognitive and motivational strategies	The effects of these instructions were different for various lessons and maximum effect observed in mathematics. Furthermore,these effects were different for two genders.
10.	Leidinger and Perels (2012)	N= 135 Grade 4 Maths quasiexperimental pre-/postcontrol-group design combined with a time series design	training self-regulated learning in the classroom self-regulated learning questionnaire, mathematics test, and process data gathered through structured learning diaries for a period of six weeks.	Enhanced self regulation Enhanced achievement in Maths
11.	Johnson and Ramganesh (2012)	N=90 higher secondary students from standard XII Experimental research method with control design	Physics Problem solving through Self-regulatory strategies with interactive multimedia.	Reduced mistakes Enhanced problem solving in Physics

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12.	Puspitasari (2012)	Randomized control-group pretest-posttest design	learning strategy intervention and study time management intervention combined and separately	No significant effects of the combined intervention(s) in improving the students' use of SRL, Learning Strategy Intervention significantly improving the students' use of SRL
13.	**Mehrda, Ahghar and Ahghar (2012)**	N=180 elementary and advanced students control and experimental groups	Cognitive and meta-cognitive strategies on reading comprehension across proficiency levels.	"teaching cognitive and metacognitive strategies" had no significant effects on the reading comprehension of elementary and advanced students. However, teaching such strategies had significant effects on the reading comprehension of intermediate students.
14.	Quince (2013)	General education online course at community-college SRL Intervention N=35 and structured diary use N=45 mixed-methods within-subjects pretest-posttest design with intact groups	Curriculum-embedded SRL interventions focused on, goal setting, actions, monitoring, and evaluation (GAME) of self-regulated learning processes,	self-regulated learning strategy intervention was successful in raising the metacognitive awareness and self-regulated learning skill levels of online students Results indicated that throughout both studies, students most frequently set goals that were associated with completing assignments, course readings, test preparation, and increased comprehension of course materials; all of which supported the overarching learning goals of improved online course performance.
15.	Cleary and Platten (2013)	N=4 high school students in Biology class Pre test –post test design Mixed method Case study and quantitative data	Self-Regulation Empowerment Program (SREP), Data gathered by Survey and field note observations and contextualized structured interviews.	. improve their classroom-based positive effects on achievement of biology exam scores, and motivated behaviors, and strategy use
16.	Fouché (2013)	N=215 9th-grade, residential physics students nonequivalent pretest-posttest control group	Metacognitive and self-regulatory strategy use The think-alouds, self-diagnostic interventions,	Enhanced achievement In Physics
17.	Ganbari-Taleb, Ghanbari, Yousefi and Botlani (2013)	semi-experimental with pretest, post-test, experimental and control groups. N= 126 students, who were selected with cluster sampling method, N= 64 in the experimental group and 62 in control group	Cognitive strategies instruction	Positive effect on students' attitude toward learning and academic functioning of Science
18.	Amzil1(2013)	Pre test –Post test control group design	Metacognitive intervention, with explicit training in monitoring and control reflective dialogue, modeling, and group-practice.	Positive effects on college students' reading performance and metacognitive skills.
19.	Bergstresser (2013)	27 students ranging in age from 17 to 18 in two separate senior calculus classes in a private religious high school.	Metacognitive training	Enhanced achievement and retention on a post-test of Math calculus
20.	Aurah and Catherine (2013).	2,138 form four (12th grade) biology students mixed-method study consisted of a quasi-experimental approach and in-depth interviews	Metacognitive prompts	Enhanced metacognitive skills. Gender effects were also noted with female students outperforming male students
21.	Narang (2013)	Rural adolescents (13-16 years).. The sample comprised of 240 rural adolescents equally distributed over four grades (7th, 8th, 9th and 10th grade), The study was carried out in rural schools of block-I, Ludhiana District	Impact of Metacognitive skill on academic performance	Knowledge of Cognition' and 'Regulation of Cognition' significantly contributed towards the academic performance of the adolescents
22.	Wilkins (2014).	N=51 undergraduate students of biology Experimental method	Generative learning strategies and metacognitive awareness.	One-way ANOVA's did not reveal significant differences between the treatment and control groups' mean scores on the metacognitive awareness or achievement measures. Students who generated primarily application questions scored higher on the exam than recall questions.

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23	Banarjee and Kumar (2014)	300 college students from Varanasi District were selected as the sample.	Explored the relationship between self regulated learning and academic achievement of male and female science graduate students.	Results reveal that SRL is moderately positive correlated with academic achievement. Male and female science graduate students do not differ significantly at different dimensions of the SRL except environment.
24	Amini and Shamlou (2014)	N=94 female EFL learners	Explicit instruction of 5 metacognitive strategies on listening comprehension	Perfectionists and non-perfectionist EFL learners did not differ with regard to the effect of metacognitive instruction on their top-down listening comprehension though a significant moderating effect was observed for the bottom-up listening comprehension.
25.	Lixia Pei (2014)	N=66 lower-intermediate learners Experimental method with control group	Metacognitive strategy instruction in reading lasting 8 weeks.	No difference was observed in experimental and control group in reading and strategy use
26.	Kumari and Jinto (2014)	Social Science and Secondary Standard Students. Pre-test Post-test single group design	KWL Metacognitive Strategy on Achievement Metacognitive Ability	Enhanced Achievement in social science and metacognitive ability
27	Panahandeh and As (2014)	N=60 intermediate EFL learners'	Planning and monitoring skills as metacognitive strategies	positive effect in the experimental group's writing performance
28.	Movahed (2014)	N=55 Iranian beginner EFL students	Metacognitive strategy instruction of experimental group based on Vandergrift and Tafaghodtari (2010) model of strategy instruction	Positive effect on listening performance, metacognitive awareness, and reduction of listening anxiety
29.	Nejabati (2015)	Upper intermediate undergraduate EFL students (N=24, each group containing 12 students) were assigned to experimental and control groups.	Self-regulated learning strategies.	Enhanced EFL students' reading comprehension
30	Eissa (2015)	N=40 9th graders with reading disabilities. pre-post design	Self-regulated learning intervention program	Positive effect on cognitive and metacognitive EFL reading comprehension
31.	Nwafor, Abodo, and Okafor (2015)	junior secondary school Quasi-experimental design was used for the study.	Self-regulated learning approach	Enhanced student's achievement in basic Science.
32	Yu and Lu (2015)	N=120 university students. Experimental group	Self-regulated learning intervention program focussing goal setting, self efficacy, time and study environment management, language learning strategies, and attribution.	Enhanced motivational beliefs, Enhanced students' strategy use, and Enhanced students' academic performance Results of a path analysis reflected Zimmerman's process model of self-regulation (2000, 2004) and suggested that there are causal influences of self-regulated learning variables across three phases (forethought, performance, and reflection phase)
33.	Shaine (2015)	A random sample of N=169 Primary School Students (42 males and 127 females) Descriptive	Self-Regulated Learning Strategies and Self-Efficacy	Self-regulation and cognitive strategy use were not found to be significant predictors of academic achievement
34.	Safari and Meskini (2015).	N= 40 undergraduate iranian students of health sciences. quasi-experimental research with pretest-posttest design.	Metacognitive instruction	Enhanced problem solving skills experimental and control groups indicated a significant difference between them. No significant difference, however, was found between the students' mean scores in terms of gender
35.	*Iqbal, Sultana and Afzal (2016*	Experimental research design; specifically the pretest-posttest control group design with 80 subjects (40 + 40) of Sixth class students	Metacognitive instruction was compared to traditional method of teaching for teaching mathematical word problems	Metacognitive strategy instruction proved to be an effective method for teaching mathematical word problems at elementary level.
36.	Yildizli and Saban (2016).	N=45 sixth-grade student's Mixed method. Two classes of the school were randomly appointed as experimental group (6B, 22 students) and control group (6C, 23 students), quantitative method interviews and document analysis	Self-regulated learning intervention Instructional activities developed according to Zimmerman's cyclical model,	Enhanced Mathematics achievement and Enhanced motivational beliefs (self-efficacy and goal orientations)
37.	Gomez (2016)	The study used a pretest-posttest design. One intact class was used with N=39 students	Self-regulating learning strategy. In relation to student's motivation and use of learning strategies and	Enhanced student's achievement in Biological Science

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38.	Pourmohammad and Esmaeilpour (2016)	N=50 students of high schools pretest and post-test experimental design with control group	Self-regulation training in science	Enhanced academic achievement.
39.	Mozafari1, Safari, Abasifard, Safari, Sharafi (2016)	Sample of N=200 high school students selected through multistage cluster sampling. Correlational research	correlation between both cognitive skills, metacognitive skill and academic achievement	Positive correlation between both cognitive skills, metacognitive skill and academic achievement.
40.	Tabibian and Heidari-Shahreza (2016)	The participants of the study were 60 Iranian EFL intermediate students.	cognitive and metacognitive strategy use	The findings revealed that both listening and reading comprehension scores of the participants were positively and significantly correlated with cognitive and metacognitive strategy uses.
41.	Tavakoli and Koosha (2016)	University students Randomized pretest posttest control group design	Explicit metacognitive strategy instruction	Enhancement of reading comprehension and self-efficacy in English for experimental group.
42.	Albazi and Shukri (2016)	Randomized pretest posttest design	Metacognitive strategy training by metacognitive reading strategies: planning, monitoring and evaluating	Metacognitive strategy awareness and as a result enhance their reading comprehension
43.	Wischgoll (2016)	(N = 60) undergraduates, English Randomized pretest posttest control group design	Combined cognitive strategies with (summarization) and without a metacognitive strategy self-monitoring in the writing process. One group received no further strategy treatment.	Learners who received the additional self-monitoring strategy intervention benefited significantly more in terms of acquisition of academic writing skills and the quality of their texts than others.
44.	Teng (2016)	A quasi-experimental Mixed method Randomized pretest posttest control group design N=80 English-major university students 1) Survey 2) case study 3) semi-structured interviews 4) journals.	Self-regulated strategies-based writing intervention with (metacognition, cognition and social behaviour) strategies as text processing, idea planning, goal-oriented monitoring and peer learning .	Enhanced use of SRL strategies, Enhanced perceived motivational beliefs (extrinsic goal orientation and task value) Enhanced self efficacy as well as writing performance
45.	Martínez and Maldonado (2016)	N=30 seventh grade students through cluster sample an experimental design with a pre and posttest and a comparison group cognitive strategies considered in this study were strategies for the management and organization of information, and strategies for the interpretation and the representation of information inseventh grade science course, The metacognitive strategies considered were self-monitoring, selfevaluation, self-reflection, and teacher feedback.	The two interventions were: a) the direct and explicit instruction of Cognitive and metacognitive self-regulation strategies in in Science the experimental group (Group A), and b) self-directed learning in the comparison group (Group B).	cognitive and metacognitive SRL strategies has a greater effect on the academic achievement than self-directed instruction
46.	Nerbes (2016)	pretest posttest control group design?	Self regulated learning strategy intervention Summarize Notes while studying core curriculum science text.	summarizing notes did not have an effect on test scores for students Positive correlation was found between summarization and academic achievement in science.
47.	Olakanmi and Gumbo (2017)	N=60 secondary school students' in Chemistry. Mixed method pretest posttest control group design using 1.Survey 2. classroom observation 3. interviews.	Self-regulatory training by self-regulated learning (SRL) exercises based on Zimmerman's (2002) cyclical model.	Enhanced metacognition and self regulated learning Enhanced achievement in Chemistry
48.	Dike, Mumuni, Chinda and Worokwu (2017)	N=360 senior secondary chemistry students Pretest post test quasi experimental design.	Metacognitive teaching strategies (thinking-aloud and self assessment)	Improved performance in chemistry of experimental group
49.	Ashlaghi, Mahmud, Morad, and Jooybari (2017)	This is an quasi-experimental research. N=40 paramedical students were selected by systematic sampling method.	Self-regulation skills training	Improved motivational orientation and academic achievement of students.of experimental group
50.	Ergen, Binnur and Sedat. (2017)	metaanalytical review method 47 studies	Meta analysis of the effect of (or relationship with) self-regulated learning strategies on academic achievement, and to determine whether the common effect size shows a significant difference in	self-regulated learning strategies had a "large" effect (d = 0.859) on academic achievement. Moreover, the calculated common effect size showed no significant difference according to the type of self-regulated learning strategy, course type, study design, and school level.

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			terms of course type, self-regulated learning strategy type, school level, and study design.	
51.	Godfrey (2017)	Four eighth-grade history sections taught by one teacher and two sections taught by a second teacher participated in the study. Three sections were randomly assigned to the intervention group and the other three to the control group.	Self-Regulated Learning Intervention: Teaching Metacognition to Enhance School Performance and Motivation of Middle School Students	Enhanced motivation / metacognition? No effect on performance Metacognition related positively to both
52.	Baez- Estradas and Alonso-Tapia (2017)	A total of 178 High School students, 16 to 19 years old (Mean: 16.7) participated in the study.	Training strategies for self-regulating motivation and volition:	Improved academic –writing composition- and non- academic – learning to solve problems of the Tangram, a Chinese puzzle-.by strategy of self regulation of volition
53.	Tian, Fang and Li (2018)	569 students of Grade 10	relationship between metacognitive knowledge (MK) and mathematics performance	Mathematics performance predicted by metacognitive knowledge (MK)
54.	Khalaj and Savoji (2018)	N=40 elementary school girl students quasi-experimental type with pretest-posttest with control group.	Cognitive self-regulation intervention	Learning of cognitive self-regulation strategies 1.reduced the students' academic burnout and cognitive dissonance but increased the students' academic performance.
55.	Asgari and Rafiee (2018)	N=50 Pretest and posttest plan with control group design	training strategies on memorizing, comprehension and the speed of reading Biology text	Enhanced memorizing, comprehension but no effect on speed of reading
56.	Thamrin, Akbar and Tola (2018)	N=360 students were determined by using multi-stage area cluster random sampling causal survey by using path analysis approach	self-efficacy, academic anxiety, and self-regulated learning towards mathematics achievement	self-regulated learning has a positive effect towards Mathematic achievement academic anxiety has a negative effect in both learning achievement and self-regulated learning
57.	Li , Ye , Tang , Zhou and Hu (2018)	Fifty-five cross-sectional studies and four intervention studies (which generated 264 independent samples)	Meta analysis Random effects model was chosen in the current meta-analysis	The effect sizes of self-efficacy, task strategies, and self-evaluation were relatively higher than other strategies. Self-regulated learning strategies have the largest effect size on science disciplines (including mathematics and physics). was relatively higher than that of language (including performances of Chinese and English). Performance phase and self-reflection phase are key phases of self-regulated learning
58	Mansi (2018)	N=20	Investigated effect of self regulated strategy development and paired writing method on written expression skills of children with learning disability	There was significant difference between effect of SRSD and paired writing in improving content component of picture writing.
59	Lata and Bala (2018)	N=120 IX standard students	Investigated the effect of metacognitive strategies on learning in mathematics	Results revealed significant positive effect of metacognitive strategies on learning of mathematics.
60	Mehar and Kad (2018)	The sample of 120 students was taken from class VII students of two schools of Mohali district of Punjab	Explored the effect of self regulated learning strategies on achievement in mathematics in relation to mathematics anxiety	(2×3) Analysis of Variance revealed that the performance of group taught through self regulated learning strategies was found significantly higher as compared to control group;
61	Chechi and Gupta (2018)		Explored the self regulated learning strategies of first year undergraduate students of Commerce. In order to assess the self regulated learning strategies of first year students of B.Com,	The results revealed that female students outperformed male students in the use of self regulated learning strategies
62	Turkben (2019).	5th grade students. pre-test and post-test control group design	self-regulation based strategic reading	Enhancement of comprehension, reading motivation and self-regulation skills
63	Nabizadeh, Hajian, and Rafiei (2019)	N= 380 medical students selected by Multi-stage sampling	Prediction of academic achievement based on learning strategies and outcome expectations	There was a direct and significant relationship between the motivational strategies' structures as well as learning strategies and the CGPA, while there was no relationship between outcome expectations and CGPA.

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64	Zheng and Zhang (2020)	N=146	Explored which self regulated learning skills affect in a flipped classroom environment	The use of peer learning and help-seeking positively affected the performance of first- and second-year students.
65	Aman Deep (2021)	N=240	Cogitive, metacognitive and motivational strategies under GAME plan in Science	Positive effects of SRL strategies on learning outcomes were observed.

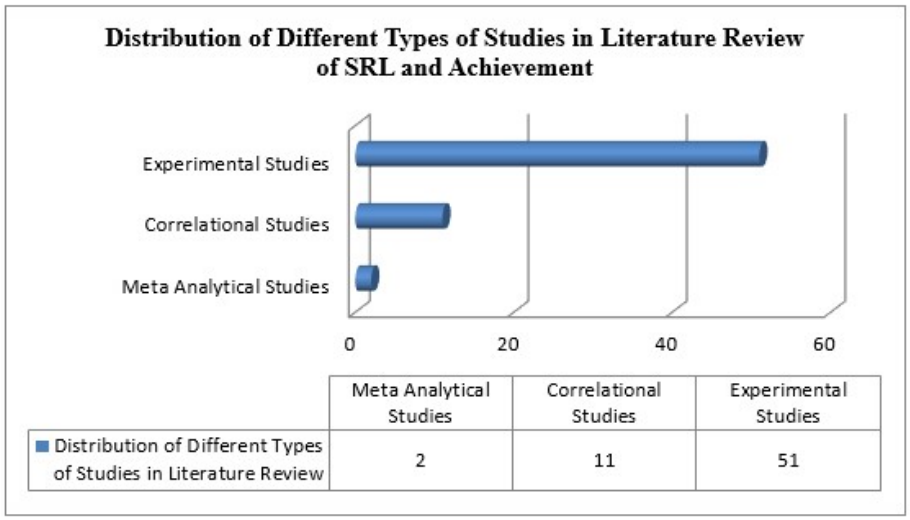

Figure 1.1: Bar graph showing distribution of different studies in literature review of Self regulated learning and Achievement

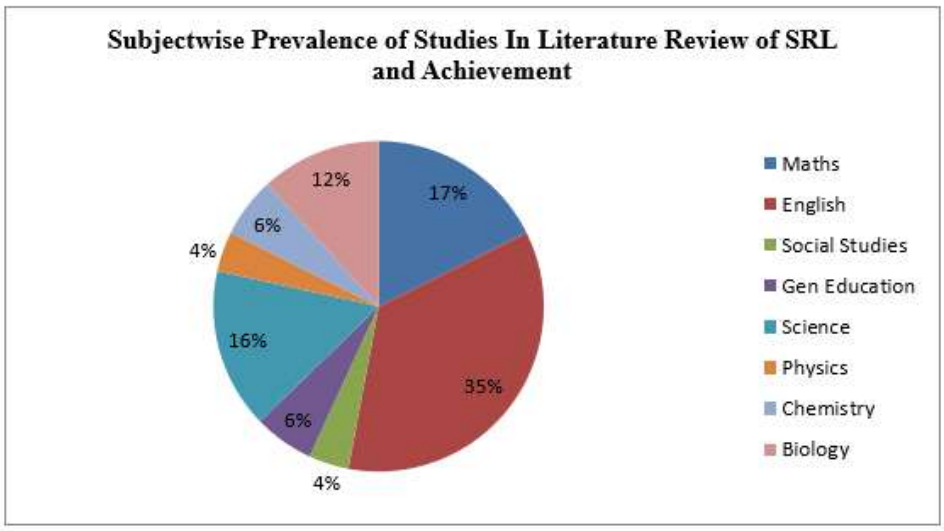

Figure: 1.2: Pie chart showing subject wise prevalence of experimental studies in literature review of Self regulated learning and Achievement


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To conclude Helen (2001), Ganbari-Taleb, Ghanbari, Yousefi and Botlani (2013), Nwafor, Abodo and Okafor (2015), Safari and Meskini (2015)., Zhila and Khalil (2016), Martínez and Maldonado (2016), Ashlaghi, Mahmud, Morad and Jooybari (2017), Aman Deep (2021) have found enhancement of academic achievement in Science as a result of self regulated learning interventions while Nerbes (2016) found no significant difference in experimental and control group as a result of intervention. Specifically research has shown enhancement of academic achievement in different disciplines of Science like Cleary, Platten, and Nelson (2008), Cleary and Platten (2013), Aurah and Catherine (2013). Gomez (2016), Asgari and Rafiee (2018), found enhancement of academic achievement in Biology learning as a result of self regulated learning interventions while Wilkins (2014) found no significant difference in experimental and control group as a result of intervention.

Nbina and Viko (2010), Olakanmi and Gumbo (2017), Dike, Mumuni, Chinda and Worokwu (2017), found improvement of post-test scores in Chemistry learning and on similar lines Johnson and Ramganesh (2012), Fouché (2013) found improvement in Physics scores too.

Godfrey (2014) found no significant difference in History post-test scores between experimental and control group as a result of intervention.

Kusiak (2001), Shamshiri (2010), Amzil1(2013), Amini and Shamlou (2014), Panahandeh and As (2014), Movahed (2014), Nejabati (2015), Eissa (2015), Yu and Lu (2015), Tavakoli and Koosha (2016), Albazi and Shukri (2016), Wischgoll (2016), Teng (2016), Baez-Estradas and Alonso-Tapia (2017), Turkben (2019) have found enhancement of academic achievement in English reading and comprehension, De La Paz and Graham (2002) and Mansi (2018) found enhancement of written expression skills as a result of self regulated learning interventions while **Mehrdad, Ahghar and Ahghar (2012),** Pei (2014) found no significant difference in experimental and control group as a result of intervention.

Savithiri (2006), Camahalan and Faye (2006), Meshkatie, Allahvirdiyani, Kahnamouei and Lohrasbi (2011), Leidinger and Perels (2012), Bergstresser (2013), Yildizli and Saban (2016), Iqbal, Sultana and Afzal (2016), Mehar and Kad (2018), Lata and Bala (2018) have found enhancement of academic achievement in Mathematics as a result of self regulated learning interventions.

Quince (2013), Khalaj and Savoji (2018 found enhancement of academic achievement in general education while Puspitasari (2012), found no significant effects of the combined interventions i.e. learning strategy intervention and study time management intervention in improving the students' use of SRL, however, Learning Strategy Intervention significantly improved the students' use of SRL.

Correlational Research

However descriptive and correlational researches done by Kistner, Rakoczy, Otto, Dignath,, Büttner and Klieme (2010), Narang (2013), Banerjee and Kumar (2014), Mozafari1, Safari, Abasifard, Safari, Sharafi (2016), Tabibian and Heidari-Shahreza (2016), Tian, Fang and Li (2018), Thamrin, Akbar and Tola (2018), Chechi and Gupta (2018), Nabizadeh, Hajian and Rafiei (2019), Zheng and Zhang (2020) revealed positive correlation between self regulated learning strategies and academic achievement while Shaine (2015) found that Self regulation and cognitive strategy use were not significant predictors of academic achievement.

Meta Analytical Research

Besides that meta-analytical study done by Ergen, Binnur and Sedat (2017) revealed that self regulated learning strategies had a "large" effect on academic achievement. Meta analysis of fifty-five cross-sectional studies and four intervention studies done by Li, Ye, Tang, Zhou and Hu (2018) Self regulated learning strategies have the largest effect size on science disciplines (including mathematics and physics) and was relatively higher than that of language (including performances of Chinese and English). Moreover performance phase and self reflection phase are key phases of self regulated learning.

Conclusion

From the above discussion it is clear that review of literature revealed more of experimental studies that too in the field of languages and mathematics. It also revealed that except a few studies positive effect of self regulated learning strategies interventions has been observed leading to enhancement of academic achievement.

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