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Relationship between Self-regulated Learning with Academic Buoyancy: A Case Study among Malaysia FELDA Secondary School Students

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ABSTRACT

Prior studies offer descriptive accounts of empirical evidence on the positive relation between self-regulated learning towards various academic outcomes. However, lack of studies looks into the relation between self-regulated learning specifically with academic buoyancy in secondary school mathematics learning. Therefore, this correlational study aims to assess the relationship between self-regulated learning and academic buoyancy in the context of mathematics learning. Using a sample of 463 secondary school students from FELDA area (southern and east coast area), data were collected from Academic Buoyancy Scale and Self-regulated Learning Questionnaire. Results showed that, overall students' self-regulated learning was positively and significantly correlated with academic buoyancy (r=.696**). Besides, academic buoyancy was also positively correlated with all three phases of self-regulated learning namely forethought (r=.634**), performance (r=.535**) and reflection (r=.622**) phase. The findings of the study offer insights into the importance of having good self-regulated learning skills to be the protective factor in dealing with daily academic challenges in the mathematics learning setting.

1. Introduction

The development of self-regulation skills is an essential component of socio-cultural learning theories that have shaped mathematics curricula in recent years. These curricula have transitioned from emphasizing traditional goals of fact and procedure mastery to prioritizing flexible thinking, problem-solving, understanding and communication. Consequently, students are expected to acquire self-regulatory knowledge and skills that enable them to actively and constructively engage with mathematical concepts [1]. Developing self-regulation skills in mathematics learning can be a daunting task for many students due to several challenges. The absence of self-awareness, which

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can prevent students from identifying their strengths and weaknesses [2-6], setting managing goal effectively, which lead to lack of motivation and poor time management [7-9].

Possessing a greater level of self-regulated learning is associated with students' achievement [10]. However, students may also struggle with the metacognitive aspects of self-regulated learning as well as identifying and using appropriate strategies for problem-solving [11]. Inadequate support from teachers and parents can hinder students' development of self-regulation skills in mathematics [2, 4, 6, 12-13]. Several researchers have attempted to explore how classroom environments can support the development of self-regulation in mathematics.

The study from Darr and Fisher [14] shows that students who lack self-regulation skills often rely on direct translation methods to solve problems that involve memorizing and applying procedures without comprehending the underlying concepts when tackling mathematical problems. This implies that self-regulated learning is a pivotal factor in shaping students' problem-solving strategies when it comes to mathematics. Students who possess strong SLR skills are capable of effectively managing their time and goals, taking an active role in their own learning and promoting lifelong learning, being highly motivated, enhancing self-awareness and engaging in critical thinking to a greater degree [15]. By acquiring these skills, students can enhance their ability to learn effectively and attain their maximum potential for academic success.

Self-regulated learning is important in academic buoyancy because it provides students with tools and strategies to navigate academic challenges effectively. Regulating their own learning can enable students to decrease anxiety, stay focused and maintain a positive attitude even when faces with setbacks. These abilities are all essential to the development of academic buoyancy, which may lead to academic success and improved well-being [2, 16-21].

Also, the development of academic buoyancy is a key determinant of both academic success and overall well-being, since it enhances students' resilience and self-confidence in facing future challenges. The significance of self-regulated learning in developing academic buoyancy cannot be overstated, as it has the potential to significantly influence the academic and personal lives of students. Previous studies shows that there is a relationship between self-regulated learning in the development of academic buoyancy which can lead to success in academic and personal life. Rameli and Kosnin [22], propose a framework for understanding academic buoyancy in mathematics among school students by investigating the impact of achievement goal orientations and self-regulation. The framework emphasizes the importance of self-regulatory strategies such as goal setting and monitoring to enhance academic buoyancy. Studies from Xu and Wang [23] in a university in Hong Kong and involve 200 undergraduates students studying a second language (L2) writing courses suggest that academic buoyancy and positive emotions have a positive and negative impact on students' self-regulated learning strategies such as goal setting, planning, monitoring and evaluation. Besides, several lines of studies have confirmed the association between various affective, behavior and cognitive-related factors with academic buoyancy [24].

Despite on that, however, lack of studies looking into the relation between self-regulated learning specifically with academic buoyancy in FELDA (Federal Land Development Authority) areas of secondary school mathematics learning. By understanding the relationship between self-regulated learning with academic buoyancy, educators and researchers can identify effective strategies to enhance students' academic buoyancy which can improve students' academic performance and overall well-being. Moreover, understanding the importance of self-regulated learning in developing academic buoyancy emphasizes on higher order thinking skills and self-directed learning in contemporary education. Therefore, the purpose of this study is to address three main research questions: (1) Does a correlation exist between forethought phase of self-regulated learning and academic buoyancy in mathematics learning among secondary students in FELDA area? (2) Is there a significant positive relationship between the performance phase of self-regulated learning and academic buoyancy in mathematics learning among secondary students in the FELDA area? (3) Does the self-regulated learning reflection phase among secondary students in the FELDA area have any significant relationship with academic buoyancy in mathematics learning?

2. Literature Review

2.1 Academic Buoyancy in Mathematics

Challenges in learning are definitely experienced by either low or high-achieving students. Efforts to face these challenges are one of the important learning processes. To reach academic wellbeing, students need to have a satisfactory level of academic buoyancy. Academic buoyancy reflects students' capability in dealing with academic setbacks, difficulties and adversities [21, 25-26]. To be specific, academic buoyancy refers to capacity in managing daily and minor schooling setbacks [17, 21]. Academic buoyancy is conceptualised as highly domain-specific psychological attributes that can predict learning outcomes [27]. In the context of mathematics learning, a series of recent studies has indicated that academic buoyancy is a significant predictor of mathematics achievement [28-29]. Studies have also provided evidence for the relation of academic buoyancy with achievement emotion [30], metacognition [31] and self-concept [29] in the mathematics classroom settings.

Despite the important role of academic buoyancy in determining the students’ mathematics performance, there are evidences to report that students still struggle in the process of learning mathematics. Students are not only poor in self-efficacy [32] but are also unable to regulate their emotions [33] when faced with the challenges of learning mathematics. Furthermore, lack of social support also makes students have a negative attitude towards mathematics which in turn can lead to the phenomenon of math avoidance [34]. Considering the fact that students have weaknesses in managing emotions and monitoring learning, we can infer that low academic buoyancy in mathematics occurs among students.

2.2 Self-regulated Learning in Mathematics

Self-regulated learning is a highly important style of activity for problem-solving that consists of three phases: forethought, performance control, and self-reflection [13,20]. Learners in mathematics, in particular, successfully pursue pre-determined goals through self-regulated learning by controlling, monitoring, and regulating their cognitive or metacognitive processes and learning behaviors [6,13,35]. Researchers have agreed that self-regulated learning is important for students' performance in mathematics domains [36,37].

Specifically, high achievers are used to activate prior mathematics knowledge, set goals for the learning mathematics process, and plan strategies to be used during the forethought phase [38,39]. Self-control and self-monitoring of cognitive strategies, like the first phase, are crucial for students learning mathematics because a high level of self-guiding to organize or monitor actions helps students productively analyse and decide mathematics problem conditions and outcomes [40]. Furthermore, the more responsibility students can take for their own learning, the more likely they are to attribute success to their own efforts [41] which means that during the third phase of student self-reflect, mathematic performance is strongly related to self-judgement and self-reaction.

Despite the importance of self-regulated learning in mathematics, research has shown that learners struggle with it. For instance, mathematics learners attribute their poor performance to a lack of goal-orientation and self-motivation beliefs. A few researches found challenges in mathematics learning may lead to students’ failure, a lack of intrinsic motivation and proximal goals in gaining mathematics achievement, and a detrimental decrease in engagement and subsequent learning in mathematics [40]. Besides, studies found when compared to high-performing students, low-performing students usually have inefficient self-regulated learning strategies in promoting their mathematics achievement [42,43]. This interpretation is in line with the research on self-regulation of learning that suggests students do not understand the what of cognitive strategies, as well as the how and when to use them appropriately (e.g., [44,45]).

Wong *et al.,* [46] also demonstrated students forge ahead without considering alternatives of their decisions, get bogged down in logistical details of their work, and focus on superficial measures of progress, leading learners to appear unable to deeply evaluate their learning progress based on information derived from cognitive monitoring during the performance phase and the feedback they are given. That is, they find it difficult to reflect on their goals, plans, and strategies and use this information to develop new goals and plans [46,47].

2.3 Relationship between Self-regulated Learning and Academic Buoyancy

Self-regulation is important in developing students who are able to control their cognitive, behaviour and affective aspects to achieve their academic goals [13]. According to Kosnin [48], many studies have proved that self-regulated learning plays significant roles and give positive impacts to students learning process. Gardner [49] once Asim [50] said, "the ultimate goal of the education system is shift to the individual the burden of pursuing his own education" (p.21). This statement aligns with the facts that self-regulated learning has impact on students' learning process and academic performance [48,51-55].

Academic performance is one of the pivotal components of academic success. Academic performance is a great motivator to lead students in achieving higher goals in life as long as he or she could develop effective self-regulation. A large number of existing studies in the broader literature have reported that self-regulated learning has significant effects on student's academic performance [51, 56-61]. In the context of mathematics learning, self-regulated learning does not only affect the performance of primary school students [62-64], secondary school students [41,57,65] and university students as well [48,58,60,61].

Besides its great influence on the cognitive aspect, self-regulated learning also could affect students' behavior and actions in learning [66]. This has also been explored in prior studies [13, 48, 53], which proved that student with higher self-regulation is more persistent in learning. Regulated learners will strive to achieve goals even in facing tough challenges. Students with higher self-regulated learning will put more effort into learning [67], feel more motivated [64], have positive achievement emotions [38] and will apply deep learning strategies [65] to achieve learning goals. In addition, students who are able to control their self-regulated learning will be more successful. Due to the positive effect of self-regulated learning on students' cognitive, affective and action, therefore the current study hypothesized that a high level of self-regulated learning could contribute to students' academic buoyancy.

3. Methodology

3.1 Participant

A total of 463 secondary school students were recruited to be the respondents of this study. The students were randomly selected from four FELDA area schools located in the southern and east coast region of Malaysia. All the respondents were aged between 15 and 16. Of the 463 respondents, 54% were female and 46% were male.

3.2 Measures

Data were collected using two survey instruments. The Academic Buoyancy Scale [68] was adopted to capture students' ability to overcome daily challenges in mathematics learning. It consists of 28 items designated to capture eight subscales: self-perception, learning practice, teachers' character, teachers' teaching practice, parents' internal support, parents' external support, peer support, knowledge and skills. The survey has good internal consistency with α=0.91.

The Self-Regulated Learning Questionnaire [69] was used to measure self-regulated learning in mathematics. This instrument consists of 35 items covering all three phases in self-regulated learning (forethought, performance and reflection) and was developed based on the framework of the self-regulation model by Bandura [70], Pintrich *et al.,* [71,72], Schunk [73], and Zimmerman [74]. There is evidence from past studies on the reliability of this instrument (α for each subscale >0.7) [75]. For all three surveys, respondents have to give their feedback on a four-point scale (1=strongly disagree; 2=disagree; 3=agree; 4=strongly agree).

3.3 Analysis

Data management and analysis were performed using the Statistical Package for the Social Sciences (SPSS) 16.0. Descriptive analysis was performed to identify the mean for each subscale of academic buoyancy and also the three phases of self-regulated learning. Pearson correlational analysis was applied to explore the intercorrelation between each phase of students' self-regulated learning and academic buoyancy in mathematics. Significance levels were set at the 5%.

4. Results and Discussion

Findings on academic buoyancy found that students' ability to face challenges, obstacles, and difficulties in learning mathematics was relatively moderate (Figure 1). The findings are in line with past studies, which also reported moderate levels of student academic buoyancy [27,76-77]. The results of this study indicate that students' academic buoyancy was better against challenges related to friends and personal but slightly less for the challenges associated with teachers, family, and the nature of mathematics. However, the mean gap between the constructs is small. These findings parallel with a study by Miller *et al.,* [77] which found that academic buoyancy indicators for the peer aspect recorded the highest mean value followed by parents, while academic buoyancy indicators for school recorded lower mean values.

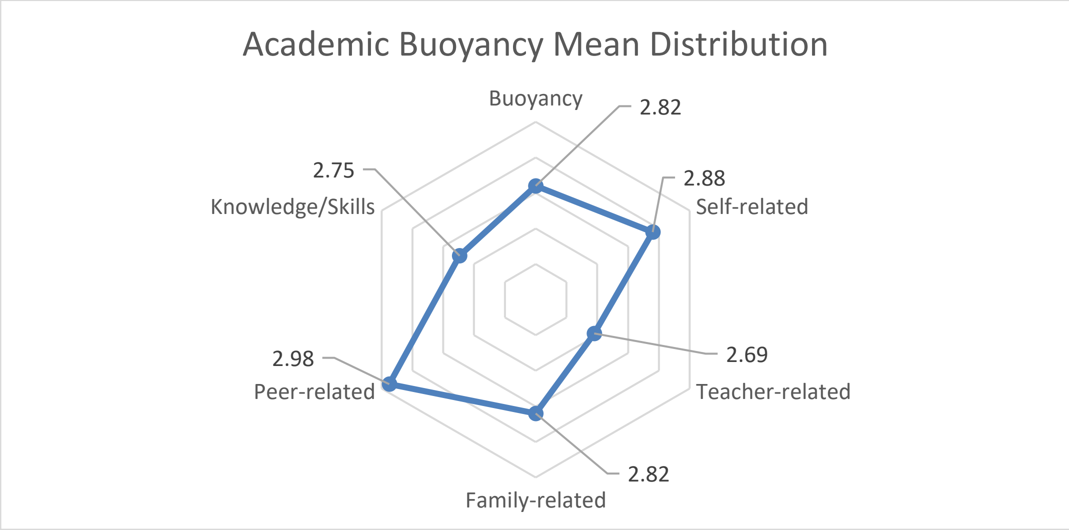

Fig. 1. Mean analysis for academic buoyancy

The descriptive analysis of student self-regulation in mathematics showed that the students' overall self-regulation was relatively moderate (Figure 2). The students' self-regulation behavior is specifically better for the forethought phase (prior to learning) than the performance phase (during learning) and the reflection phase (after learning). The moderate level of self-regulation in this study is in line with past studies that involved the measurement of self-regulation of primary school students in mathematics and college students in online learning, respectively [78].

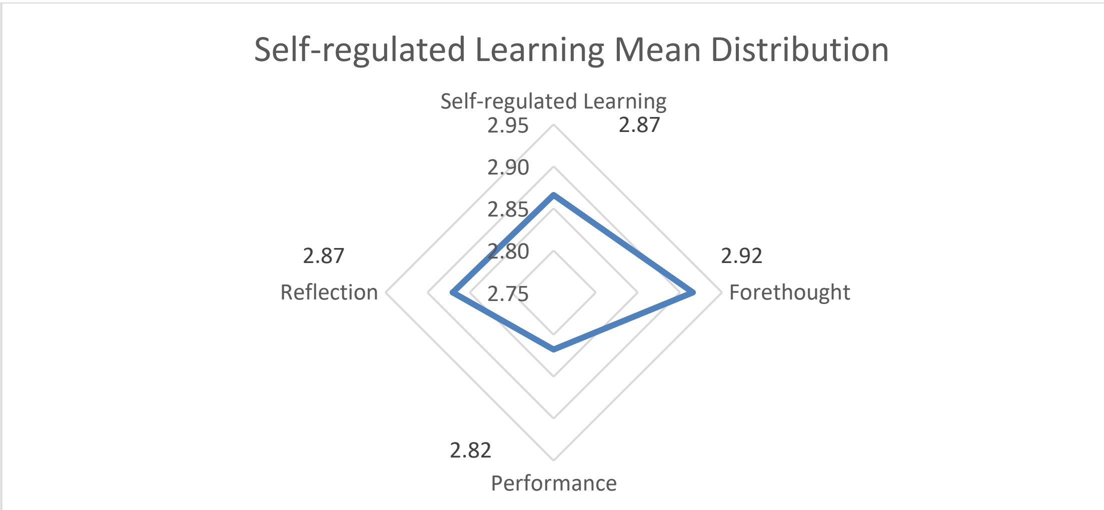

Fig. 2. Mean analysis for self-regulated learning

A more positive self-regulation behavior of the forethought phase can also be attributed to the rationale that the elements in this phase only involved thinking, belief, and student perception, which does not require much effort and energy investment. Thus, self-regulation of the forethought phase, such as belief in self-efficacy and perception towards subjects' value, is relevant to most students. For example, subjects' value that revolves around the perception of the usefulness and significance of learning mathematics [74] was highly rated by respondents because it is undeniable that mathematics is considered important by all groups of students with different abilities. This is because high school students put high task values on tasks that have benefits for their future [79-80]. This situation corresponds to the respondents of this study involving upper secondary students who rely on mathematical achievement to determine their future learning and career pathways.

The results of bivariate correlation, r (refer Table 1) showed that overall students' self-regulated learning was positively and significantly correlated with academic buoyancy. Besides, all three phases of self-regulated learning were also positively correlated with academic buoyancy (r ranged from .535 to .634). In line with that, the results of linear regression, r^2 (refer Figure 3) also showed that the highest and lowest regression coefficient was found in the relationship between academic buoyancy with forethought phase and performance phase respectively.

Table 1
Correlation between academic buoyancy and self-regulated learning

	Academic Buoyancy	Forethought Phase	Performance Phase	Reflection Phase	Overall Self-regulated Learning
Academic Buoyancy	1				
Forethought Phase	.634**	1			
Performance Phase	.535**	.551**	1		
Reflection Phase	.622**	.659**	.524**	1	
Overall Self-regulated Learning	.696**	.857**	.855**	.828**	1

**correlation is significant at the 0.01 level (2-tailed)

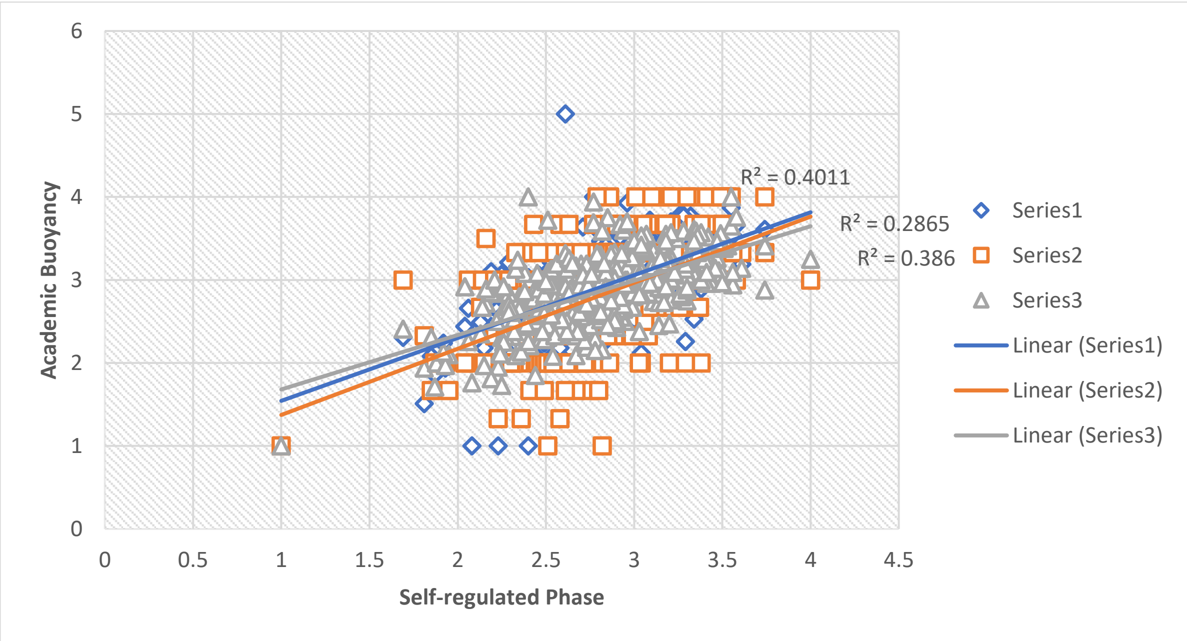

Fig. 3. Regression between academic buoyancy and self-regulated learning

Finding related to research question (Does the forethought phase of self-regulated learning has a positive significant relationship with academic buoyancy in mathematics learning among FELDA area secondary students) reflected that the forethought phase is related to academic buoyancy. This implied that the motivation element is an important foundation to determine students' capacity in dealing with academic setbacks in learning mathematics [81] explains well the important role of motivational indicator of academic buoyancy. Confidence, coordination, commitment, composure and control are all the motivation predictors that can enhance students' ability to face learning challenges [81]. In terms of mathematic learning, self-efficacy could enhance the capability to bounce back from academic setbacks [28] mention that students have a better ability to cope with failure if they possess higher self-efficacy.

Finding related research question (Does the performance phase of self-regulated learning has a positive significant relationship with academic buoyancy in mathematics learning among FELDA area secondary students) indicated the relationship between the performance phase and academic buoyancy was exists. Students who monitor their learning will have more control and be able to deal with learning challenges well. This can be explained as past studies [21] provide evidence that reports self-regulated learners will face challenging tasks by proactively and frequently applying various learning strategies (cognitive, metacognitive, and resource management strategies) [82-83]. In the mathematics learning context, there is also an empirical study proved that using effective learning strategies will boost students' confidence in coping with setbacks as they believe adjustment of strategies could lead them to achieve learning goals [68].

Furthermore, results showed that the relationship between the reflection phase of self-regulated learning and academic buoyancy is significant. McKay [84] explain that: reflection on your own practice is an essential skill for lifelong learning. Students who practice the concept of a systematic reflection approach will be more inclined towards a positive direction in facing learning challenges. Based on this study, students who reflect on their mathematics learning are able to face challenges in their learning process. Through reflection, students are able to enhance their academic efficacy and motivation [85] and also detect their weaknesses and strengths. Indirectly, existing weaknesses can be fixed and they can generate proactive instead of reactive responses. Besides, reflecting on how much effort and to what extent of their persistence and engagement in learning while dealing with setbacks can direct students to read just their goals, strategies and planning to rebound. As mentioned by Chen *et al.,* [86], exercising reflective thinking could enhance students learning engagement and participation behavior in class. This progress offers students an opportunity to participate in STEM education, a field that has gained significant emphasis in recent years [87].

5. Conclusions

Self-regulated learning (SLR) and academic buoyancy are two interrelated constructs that play a crucial role in achieving academic success. SLR pertains to the ability to manage and direct one's own learning process, while academic buoyancy refers to the ability to recover from academic obstacles and challenges. Studies indicate that there was a positive and significant correlation found between SLR and academic buoyancy and additionally, all three phases of SLR (reflection phase, forethought phase, performance phase were also positively correlated with academic buoyancy among FELDA secondary school students in mathematics learning. Specifically, students who possess SRL skills are more likely to cope with academic setbacks and challenges, given the capacity to reflect on the students' learning process, establish achievable goals and adapt students' strategies accordingly. Motivation, learning monitoring, and students who apply a systematic approach are more likely to have better control over students' learning process. Consequently, they are more likely to sustain a positive attitude and persevere in the face of adversity, which is a vital element of academic buoyancy.

In contrast, students who struggle with SLR may face greater risks of experiencing academic setbacks and challenges. As a result, students may feel discouraged and lack motivation, which can negatively impact student's academic buoyancy and less likely to persist when faced with difficulty. Overall, the relationship between SLR and academic buoyancy underscores the importance of cultivating self-regulatory skills in achieving mathematics academic success. By enabling students to cope with academic challenges and setbacks and maintain a positive attitude toward mathematics learning, SRL skills can enhance academic buoyancy and contribute to better educational outcomes.

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