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Relationships between self-regulated learning strategies, learning motivation and mathematics achievement

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Abstract

This study aimed at examining the relationships of self-regulated learning strategies with students' learning motivation and academic achievement in mathematics. The study employed a descriptive research design. The participants were 238 ninth grade students in the Sultanate of Oman. The Motivated Strategies for Learning Questionnaire was used to assess the participants' use of self-regulated learning strategies and motivation. Academic achievement was reflected by the total score obtained in mathematics. Results revealed statistically positive relationships of self-regulated learning with intrinsic motivation, extrinsic motivation, task value, control of learning beliefs, self-efficacy and academic achievement. Test anxiety was found to be negatively related to self-regulated learning. The study offers insights on how to develop effective instructional strategies to enhance students' self-regulated learning skills.

Keywords: Self-regulation, learning motivation, learning beliefs, academic achievement, learning.

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1. Introduction

Self-regulated learning is a cognitive motivational approach to learning. It encompasses a holistic view of student acquisition of skills, knowledge and motivation (Paris & Paris, 2001). A great deal of research has been conducted on self-regulated learning due to its importance for student learning (Schunk, 2005). Many studies have highlighted the relationships of self-regulated learning with learning motivation and academic achievement across different grade levels and different subject areas (Duncan & McKeachie, 2005; Ergoz, 2008; Garavalia & Gredler, 2002; Glaser & Brunstein, 2007; Kitsansas, Sten & Huie, 2009; Ruban & Reis, 2006; Zimmerman, Bandura & Martinez-Pons, 1992). Given the importance of actively engaging students in learning, the current study extends previous studies by examining the relationships of self-regulated learning strategies with students' learning motivation and academic achievement in mathematics.

1.1. Theoretical background

Theoretically, self-regulation is an important aspect of student learning. Self-regulated learners have the cognitive and metacognitive abilities as well as the motivational beliefs and attitudes needed to understand, monitor and direct their own learning. According to Schunk and Zimmerman (1997), the following characteristics should be considered so that the learning can be considered as self-regulated: the use of different learning strategies, being self-efficient when applying the strategies, and have commitment to achieving goals. The primary goal of a self-regulation culture is to ensure that the entity involved in it is capable of improving and seeking its inherent quality and that such culture is born from the willing of individuals who are part of it. For that reason, self-regulated learners tend to actively participate in the learning process, monitor and control the basic processes to achieve academic goals (Schunk & Ertmer, 2012). Thus, these students are proactive in their efforts to learn because they are aware of their academic strengths and limitations.

The self-regulated learning construct is related to the ways of independent and effective academic learning, including metacognition process, intrinsic motivation and performance (Perry, 2002). It influences the motivational and emotional aspects of the students in a direct way. If students have the necessary tools and methods to study and learn, they will develop a high level of self-efficacy which lead to improving the academic performance reflected in higher grades. The students will be intrinsically motivated to achieve and will have positive emotions to get high grades. When students are intrinsically motivated for an activity because they consider it useful for their future or they recognise the importance of the skills they might develop through that activity. External and interjected regulation are associated with undesirable behaviours, such as unwillingness or passive compliance (Ryan & Deci, 2000a; 2000b; Vansteenkiste, Lens, & Deci, 2006, Vansteenkiste, Sierens, Soenens, Luyckx & Lens, 2009).

1.2. Relevant literature

The role of self-regulation in academic achievement has been widely investigated in recent years. For example, Zee and Bree (2017) found positive associations between self-regulation and achievement in math and reading skills of elementary students in the Netherlands. Similarly, Kaur, Saini and Vig (2018) found that metacognition and self-regulation contributed positively towards academic achievement of secondary school students in Punjab. Likewise, Dradeka (2018) found significant differences in self-regulation of university students in Saudi Arabia in favour of students with high academic achievement. Also, male students tended to report on average higher levels of academic self-regulation than female students. Furthermore, Annalakshmi (2019) reported that the self-regulation was a significant predictor of resilience and academic achievement of adolescents from low-income rural families in Tamil Nadu. Along the same line of research, Zhou and Wang (2019) found positive correlations among academic achievement, self-regulation and motivated learning

strategies for Chinese students. Overall, recent research has documented the importance of self-regulation in student learning across various educational settings.

1.3. Problem statement and research question

When considering the subject of mathematics in the Omani educational curriculum, important changes have emerged in the mathematics education. A major shift is that mathematics is no longer mainly conceived as a collection of abstract concepts and procedural skills to be mastered, but primarily as a set of human sense-making and problem-solving activities based on mathematical modelling of reality. This instructional change has been illuminated by De Corte, Verschaffel, and Op'teynde (2000, p. 687). From this point of view, self-regulation of learning becomes an important factor to be reinforced for a better academic achievement in mathematics. As such, the present study addressed the following research question: What are the relationships between ninth grade students' self-regulated learning, learning motivation and academic achievement in mathematics?

2. Methods

2.1. Research design

This study employed a descriptive research design (McMillan, 2012). It aimed at describing the current status of self-regulated learning strategies and motivation of the students as well as their academic achievement in mathematics. Then, it described the relationships of self-regulated learning strategies with students' learning motivation and academic achievement in mathematics.

2.2. Sample

Using a convenience sampling method, a total of 238 ninth grade Omani students participated in this study. There were 165 males and 173 females. Their ages ranged between 14 and 16 years old.

2.3. Instrumentation

The primary instrument in this study was the Motivated Strategies for Learning Questionnaire developed by Pintrich and De Groot (1990) to measure students' self-regulated learning strategies and motivation. A total of 22 items assessed self-regulated learning strategies through two dimensions: use of cognitive strategies and self-regulation. The reliability coefficients of the scores on both dimensions were 0.77 for cognitive strategies and 0.68 for self-regulation as measured by Cronbach's alpha. A total of 34 items assessed motivation through six dimensions: intrinsic motivation, extrinsic motivation, task value, control of learning beliefs, self-efficacy and test anxiety. The reliability coefficients of the scores on all dimensions ranged between 0.73 and 0.79 as measured by Cronbach's alpha. Responses were obtained on a 6-point Likert scale ranging from 1 (never) to 5 (always).

2.4. Procedures

Permission was obtained from the Ministry of Education and principals of the selected schools to collect data from the students during a regular scheduled math class period. The students were informed that a study is being conducted to examine their self-regulated learning strategies, motivation and academic achievement in mathematics. They were informed that they were not obligated to participate in the study, and if they wished to participate, their responses would remain confidential. They were also informed that their participation would not influence their grades or relations with the mathematics teacher. No student rejected the participation in the study. The students were asked to respond to the questionnaire and to write their names to enable the authors

to match their responses with the grade received in the subject at the end of the semester. The final subject grades were obtained from the school administration for each student.

2.5. Statistical analyses

In relation to the aforementioned purpose of the study and research question, means and standard deviations were first computed to describe the current status of self-regulated learning strategies and motivation of the students. Then, Pearson product-moment correlation coefficients were calculated to describe the relationships of self-regulated learning strategies with students' learning motivation and academic achievement in mathematics.

3. Results

Table 1 presents means and standard deviations of the variables considered in this study. These variables were use of cognitive strategies and self-regulation, intrinsic motivation, extrinsic motivation, task value, control of learning beliefs, self-efficacy, test anxiety and academic achievement in mathematics. A mean score between 4.36 and 6.0 was considered to reflect high levels of motivation and self-regulation, scores between 2.68 and 4.35 reflect medium levels of motivation and self-regulation, and scores between 1.0 and 2.67 indicate low levels of motivation and self-regulation. As shown in Table 1, the participants generally reported having medium levels of motivational beliefs and using self-regulation strategies.

Table 1. Means and standard deviations of self-regulated learning strategies, learning motivation and academic achievement

Variable	*M*	SD
Intrinsic motivation	3.31	0.87
Extrinsic motivation	3.23	0.91
Task value	3.28	0.82
Learning beliefs	3.14	0.77
Self-efficacy	3.35	0.89
Test anxiety	2.84	1.09
Academic achievement	73.20	3.56
Cognitive strategies	4.23	0.92
Self-regulation	4.28	1.23

Table 2 presents the bivariate correlations of using cognitive and self-regulation strategies with motivational beliefs and academic achievement. As shown in Table 2, use of self-regulation strategies correlated significantly negatively with test anxiety and positively with intrinsic motivation, extrinsic motivation, task value, control of learning beliefs, self-efficacy and academic achievement. The correlations were relatively moderate. They suggested that motivational beliefs tended to account between 9.61% and 39.69% of the variability in using self-regulation strategies. The variability in academic achievement accounted approximately one third of the variability in using self-regulation strategies.

Table 2. Bivariate correlations of using cognitive and self-regulation strategies with motivational beliefs and academic achievement

Variable	Self-regulated learning	
	Cognitive strategies	Self-regulation
Intrinsic motivation	0.56*	0.57*
Extrinsic motivation	0.33*	0.31*
Task value	0.63*	0.62*
Learning beliefs	0.41*	0.47*
Self-efficacy	0.52*	0.59*

Test anxiety	- 0.27*	- 0.39*
Academic achievement	0.56*	0.58*

*$p < 0.05$.

4. Discussion and conclusion

The research in educational psychology has highlighted the importance of students being able to monitor, control and regulate their own learning (Cleary & Platten, 2013; Cleary, Gubi & Prescott, 2010; Shekhar & Rachna Devi, 2012). In line with such research, the present study examined the relationships of self-regulation with motivational beliefs and academic achievement in mathematics. Descriptive statistical analyses showed that students tended to use self-regulated learning strategies at moderate degrees. Correlational analyses revealed moderate positive relationships between self-regulation and positive motivational beliefs and academic achievement. These findings are consistent with previous studies (Daniela, 2015; Komarraju & Nadler, 2013; Kwon, 2001; Pajares, 2007; Smit, Brabander, Boekaerts, & Martens, 2017). Also, the current findings lend further support to both the Expectancy Value Theory and the Social Cognitive Theory, which propose that motivational beliefs are the underlying premises of self-regulated learning (Cosnefroy, 2008; Perry, Phillips, & Hutchinson, 2006; Pintrich, 2000).

On one hand, the study showed that each of intrinsic motivation, extrinsic motivation, task value, control of learning beliefs and self-efficacy contributed positively to self-regulation. This suggests that students who are motivated to learn, perceive the subject as valuable, can control their learning, and confident in their capability to learn are more likely than others to use cognitive and self-regulated strategies. This is might be attributed to the fact that positive personal beliefs of motivation tend to hold students accountable for their learning (Daniela, 2015). As such, teachers could encourage active participation of students in the learning processes by illustrating the value and meaningfulness of the subject and establishing specific, short-term goals that are challenging yet attainable (Schunk & Pajeres, 2002). Specific self-regulated learning strategies, like time management strategy, can also be taught to students to enable them to complete their learning tasks on time and more efficiently.

On the other hand, the negative association between test anxiety and self-regulated learning indicates that as test anxiety increases, students' use of cognitive and self-regulated learning strategies tend to decrease. This is not surprising as anxiety can be a debilitative factor, which causes distraction and disorientation. Students with high levels of test anxiety tend to be worried and not confident about their capability to learn. Thus, it is a lack of motivation to employ cognitive and self-regulated learning strategies. This finding lends support to studies conducted on the relationship between test anxiety and self-regulation (e.g., Bembenutty, 2008; Kozan, Kesici & Baloglu, 2016). Teachers can help students to employ cognitive and self-regulated learning strategies through creating an assessment environment that is conducive to lowering students' anxiety.

The relationship between self-regulation and academic achievement has well been documented in previous research across various grade levels and subject areas (e.g., Altun, 2005; Altun & Erden, 2013; Bembenutty, 2011; Blair, 2003; Bono & Bizri, 2014; Cheng, 2011; Dent, 2013; Duru, Duru & Balkis, 2014; Tekbiyik, Camadan & Gulay, 2013; Yuksel, 2013). The present study confirmed this line of research for the Omani educational context in learning mathematics. The current finding imply that high achieving students tended to be better able to use cognitive and self-regulated learning strategies. As such, teachers need to pay attention to low achieving students by training them on using cognitive and self-regulated learning strategies. One way to do this could be through the development of an instructional environments where the students may express and discuss their feelings and ideas about the learned tasks freely, interact mutually with high achievers on the learning tasks, set gradual targets for themselves and try ways to achieve them, undertake responsibilities for their learning and make self-assessment of their learning. These activities might positively contribute to the development of cognitive and self-regulation skills of the students.

The generalisability of this study might be limited by the use of self-reported questionnaire and by the participating sample. Future research might need to consider multiple data collection methods, including classroom observations and interviews with students, teachers and parents to validate the quantitative data. Also, the data might be collected from a more representative sample selected from different educational governorates across the country. The findings might need to be replicated across different grade levels and subject areas. Finally, the correlational analysis in this study does not permit causality between the variables under investigation. As such, future research might consider testifying the causal nature of the relationships.

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