

Learning Processes and Academic Achievement among Omani School Students

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Received: July 14, 2016

Accepted: August 12, 2016

Online Published: September 29, 2016

doi:10.5539/res.v8n4p62

URL: <http://dx.doi.org/10.5539/res.v8n4p62>

Abstract

This study examined the competing role of cognitive and affective learning processes used by students on predicting their academic achievement. The sample included 342 students from different schools in Oman (female=74.6%). The participants responded to a group of measures as part of a national study examining different learning variables. For the purpose of the current study, the participants' data of six measures (i.e., critical thinking strategies, organizational strategies, memory strategies, intrinsic motivation, extrinsic motivation, and anxiety) were obtained. In addition, the students' grade average point (GPA) using their reported grades were also used. The findings showed that out of the affective model, anxiety level and intrinsic motivation were significant predictors of students' academic achievement. However, critical thinking was the only predictor of academic achievement from the cognitive model.

Keywords: learning process, academic achievement, Omani students

1. Introduction

Apparently, one of students' concerns is how well they can do in school. Achievement is a crucial part of students' academic life and its development should be a primary goal in any school's plan. Academic achievement contributes to the way students form their self-concept (e.g., Marsh, 2004; Pinxten, Fraine, Damme, & D'Haenens, 2013; Retelsdorf, Köller, & Möller, 2014). Also, researchers have found significant relationships between academic achievement and different motivational constructs which may contribute to subsequent accomplishments (e.g., Roskam & Nils, 2007; Ju, Zhang, & Katsiyannis, 2012). A variety of factors can affect academic achievement. This paper focuses on two major types of factors which are cognitive and affective factors. Examples of cognitive factors include intelligence or cognitive ability (e.g., Beaujean et al., 2011; Steinmayr & Spinath, 2009), cognitive styles (e.g., field-dependent vs. field independent and convergent vs. divergent thinkers) (Danili & Reid, 2006), and cognitive processes (e.g., memorization, critical thinking and organization) (e.g., Mall-Amiri & Sheikhy, 2014; Mouziraji & Mouziraji, 2015; Oxford, 1990). On the other hand, examples of affective factors include motivation (e.g., Steinmayr & Spinath, 2009), attitude (e.g., Singh, Granville, & Dika, 2002), self-concept and self-efficacy (e.g., Berg & Coetzee, 2014; Levpušček & Zupancič, 2009; Matovu, 2014).

Students simultaneously utilize both cognitive processes and affective variables to facilitate their learning. Thus, this research paper attempts to investigate the competing role of these two types of factors (i.e., cognitive processes and affective variables) on predicting students' academic achievement.

1.1 Cognitive Processes and Affective Variables: Definition and Importance

Learners' manipulation of both cognitive processes and affective variables is essential for learning development as each set has its distinctive properties and advantages to learning. Cognitive processes are used for understanding and producing learning outcomes; it is a "whole-brain" approach of solving problems (Oxford, 1990; Strang, 2014). Examples of cognitive processes are memorization, critical thinking, organization and elaboration (e.g., Yusri, Rahimi, Shah, & Wah, 2013; Zusho, Pintrich, & Coppola, 2003). On the other hand, affective variables are a way of regulating emotions while learning (Oxford, 1990). Students are able to learn how to control their emotions such as motivation or anxiety to manage developing their performance (Garcia &

Pintrich as cited in Ting & Chao, 2013). Some examples of affective variables are motivation, anxiety, self-efficacy and self-concept (e.g., Deci & Ryan, 2008; Lynch, 2006; Singh, Granville, & Dika, 2002).

Using cognitive process and affective variables has many advantages on learning process. Some of these processes allow students to become more self-directed and autonomous learners (Lee, 2010; Oxford, 1990). Furthermore, research has shown that there is a positive relationship between the frequency of using cognitive processes and affective variables and the level of competence in different academic areas (Ansarin, Zohrabi, & Zeynali, 2012; Ghafournia, 2014; Oxford, 1990; Ting & Chao, 2013). Moreover, cumulative research has found positive impacts of cognitive processes and affective variables on academic achievement (e.g., Ghafournia, 2014; Strang, 2014; Ting & Chao, 2013).

1.2 Affective Versus Cognitive Factors and Effects on Academic Achievement

Since the past two centuries, affective and cognitive aspects of learning have attracted much attention that led to the construction of different psychological theories and educational framework. One example of these theories is Self-Determination Theory (SDT) that dates back to the mid of 1980s (Deci & Ryan, as cited in Rayan & Deci, 2000). This theory exemplifies the “affective part of learning” focusing on different types of motivation such as controlled motivation and autonomous motivation as well as the effect of motivation on wellbeing and performance (Deci & Ryan, 2008). A second example is Self-Regulatory Learning (SRL) approach that represents both affective and cognitive models of learning. It concerns one’s ability to “self-monitoring” behaviors, thoughts, motivation and feelings in order to achieve a goal, either an academic or a socioemotional goal (Pintrich, 2004; Santrock, 2009). Learners are assumed to go through four main phases accompanying different strategies in each phase which are planning, monitoring, control and regulation (Pintrich, 2004). A third example is Oxford’s model (1990) of learning strategies which also carefully attends to the cognitive and affective aspects of a learning process. Oxford’s model encompasses six main types of learning strategies: memory, cognitive, compensation, social, affective and metacognitive strategies.

Cumulative research has studied the effect of affective variables on academic achievement. For example, Singh, Granville and Dika (2002) showed that math and science motivation and attitude significantly affect math and science achievement. Other researchers have also proved the positive contribution of motivation on academic achievement of different school subjects (e.g., Bipp & Dam, 2014; Froiland & Oros, 2014; Hayenga & Corpus, 2010). Moreover, various motivational constructs, such as self-concept, self-efficacy beliefs, anxiety, value and attitude have been found to affect academic achievement (e.g., Mahyuddin et al., 2006; Seaton, Parker, Marsh, Craven, & Yeung, 2014; Steinmayr & Spinath, 2009; Wolters, Denton, York, & Frances, 2014).

Similar to affective variables, the use of cognitive processes in learning was also found to influence academic achievement. The motion of cognitive psychology that stresses the importance of cognition and memory on learning has started several years ago (e.g., Little, Das, Carlson, & Yachimowicz, 1993; Shiffrin & Steyvers, 1997). Recently, research on cognitive processing have investigated the relationship between some cognitive processes, such as memorization, rehearsal, elaboration, organization, and critical thinking, and different academic outcomes including achievement (e.g., Aldhafri, Alkharusi, & Al Ismaili, 2015; Areepattamannil & Caleon, 2013; Areepattamannil, 2014a; Mall-Amiri & Sheikhy, 2014; Strang, 2014).

1.3 The Current Study

The current study contributes to the literature by comparing the competing effects of three cognitive processes (memorization, organization and critical thinking) and three affective variables (extrinsic motivation, intrinsic motivation, and anxiety) on predicting Omani students’ academic achievement, as well as, examining the differences within these two sets of factors. The following paragraphs demonstrate a detailed description of each process and variable and its effects on academic achievement.

Memory is defined as “the retention of information over time which involves encoding, storage and retrieval” (Santrock, 2009, p. 277). Memorization techniques include creating mental links, making associations and reviewing (Oxford, 1990). Since a long time ago, memorization has been recognized as an easy, a traditional and a reliable technique of learning that most learners depend on. For example, in mathematics, students typically tend to memorize the multiplication table to use it in further calculation processes. Researchers supported the effectiveness of memorizing multiplication table in academic performance (e.g., Djemil, 2010). Also, many researchers advocate the use of memorization in learning a foreign language (e.g., Chu, Huang, Shih, & Tsai, 2012; Yu, 2010). However, by the beginning of 20th century, some critiques have stood against memorization by discovering its drawbacks as a strategy of learning. Therefore, recently, memorization is recognized to have a double-edged effects since both negative (e.g., Areepattamannil & Caleon, 2013; Areepattamannil, 2014a) and positive (e.g., Oxford, 1990; Mouziraji & Mouziraji, 2015; Ygzaw & Fentie, 2013) impacts of memorization on

academic achievement have been documented in the literature. Thus, it is essential that learners do not depend solely on memorization while learning. Areepattamannil (2014a) contended that learners should have adequate “declarative knowledge” as well as “procedural” and “conditional” knowledge.

Organization is pertaining to learning techniques such as grouping, outlining, concept mapping and differentiating ideas (Keng, 1996; Lynch, 2006). Ygzaw and Fentie (2013) suggested that learners who cognitively use organization techniques in their learning are more likely to score higher in reading tests. Organization techniques differ in their usage and influence on learning. For instance, Keng (1996) found that students who used concept mapping scored higher on their written test than those who used outlining and note-taking. The author concluded that using concept mapping as a learning strategy can contribute in making meaningful learning. Other researchers found positive influences of organizational techniques while lectures’ note-taking such as illustrative diagrams and outlines on post-test performance (Bui & McDaniel, 2015).

Critical thinking assists learners to ameliorate problems or make essential evaluations by using their prior knowledge (Lynch, 2006). Learners should be encouraged to be critical thinkers while learning through searching for meaning, struggling with ideas and using logic in arguments (Karbalaee, 2012). Fahim, Barjesteh and Vaseghi (2012) suggested that critical thinking activities used in the classroom can help students “stay with” or “go beyond” the presented information. Hohmann and Grillo (2014) designed a critical thinking rubric program to evaluate and strengthen students’ use of critical thinking skills. The researchers found that the repeated use of these rubrics with the students contributed to increasing course grades. Likewise, the positive effects of critical thinking on academic achievement have been shown by researchers (e.g., Afshar & Movassagh, 2014; Alrubaei, 2009; Ayub, 2014; Mall-Amiri & Sheikhy, 2014; Stewart, 2000).

One of the affective variables that gained popularity among scholars and educators and was proved to significantly affect academic achievement is motivation. The self-determination theory has differentiated between different types of motivation. Based on Deci and Ryan (2008), motivation basically can be divided into autonomous and controlled motivation. Autonomous motivation consists of intrinsic motivation and a sort of extrinsic motivation in which people perceive the task’s value and “ideally” integrate it in their “sense of self”. On the other hand, controlled motivation involves external regulation, in which one’s action is the result of rewards and punishment, and introjected motivation, in which motivation is “partially internalized” and empowered by factors such as self-esteem, approval, or avoiding shame. In this study, the focus is on two clearly defined types of motivations: intrinsic and extrinsic motivation. Simply, intrinsic motivation is about doing something for its own sake; while extrinsic motivation entails doing something to gain something else (Santrock, 2009). Intrinsically motivated students believe on the value of learning for seeking knowledge, whereas, extrinsically motivated learners seek learning to attain external goals such as gaining grades or pleasing others (Lynch, 2006). Motivation can influence students’ engagement inside the classroom since learners with high motivation may feel bored if the learning process is very slow and low-motivated learners may face difficulties to cope with fast learning process (Yusri et al., 2013). It was found that intrinsic motivation pushes learners towards using multiple learning resources and higher order learning strategies (Yusri et al., 2013). Also, intrinsic motivation, but not extrinsic motivation, was reported to significantly predict course grades of students (e.g., Areepattamannil, 2014b; Lepper, Corpus, & Iyengar, 2005; Lynch, 2006).

Another affective variables that can crucially affect learning, generally, and academic achievement, particularly, is anxiety. Anxiety is “the worry that the students may experience” in a specific task, a subject or a test (Wolters et al., 2014, p. 505). Anxious students could be less likely to perform well at school. Anxiety was found negatively correlated with students’ expectations of success (Virtanen, Nevgi, & Niemi, 2015). Moreover, Sideridis (2008) found that mastery avoidance goal orientation was associated with anxiety. Many other researchers have pinpointed to the negative impact that anxiety leaves on students’ academic achievement (e.g., Puteh & Khalin, 2016; Rana & Mahmood, 2010; Singh & Thukral, 2009; Zusho et al., 2003).

While some studies have examined the effect of affective variables and cognitive processes on academic achievement separately (e.g., Areepattamannil & Caleon, 2013; Mahyuddin et al., 2006; Steinmayr & Spinath, 2009; Strang, 2014), there are only few studies that investigated the competing effects of both cognitive and affective aspects of learning. One example of those studies is Ygzaw and Fentie (2013) who found that unlike motivational beliefs and metacognitive processes, cognitive processes (rehearsal, elaboration, and organization) used by the students were the only significant predictors of reading performance. Consistently, similar results were reported by other researchers (e.g., Gagne’ & Pe’re, 2001). In contrast, Zusho et al. (2003) found that motivational constructs of task value and self-efficacy beliefs were better predictors of final performance than cognitive processes. Other researchers have also supported the surpassing role of motivational constructs over some information processing or cognitive processes (e.g., Albaili, 1997). However, Spinath, Harlaar and Plomin

(2006) indicated that general mental ability (i.e., cognitive factors) was the only predictor of academic achievement in science; but, ability self-perception and intrinsic value (i.e., affective factor) were the strongest predictors, beyond general mental ability, in mathematics and English.

Whereas those studies examined the competing effects of cognitive processes versus affective variables, some studies have looked at the various effects on achievement within each set of variables. To illustrate, affective variables (i.e., extrinsic motivation, intrinsic motivation, anxiety) and cognitive processes (memorization, critical thinking, organization) may differently influence academic achievement when differences within each model are examined. Despite the lack of research, to the researchers' knowledge, that focused on this scope, some few studies were documented in the literature. For example, with regard to affective variables, Lynch (2006) found that unlike extrinsic motivation, intrinsic motivation was associated with course grades. In addition, according to Hayenga and Corpus (2010), students who have low-extrinsic motivation coupled with high intrinsic motivation got higher grades than students in two other clusters (i.e., students with low levels of both extrinsic and intrinsic motivation, and students with high levels of both extrinsic and intrinsic motivation). Despite the high quantity the students had of both types of motivations, it is considered as a poor quality motivation. Thus, the "ratio of intrinsic to extrinsic motivation" is a stronger predictor of academic achievement than the amount of motivation the students have. However, the researchers couldn't find any study that compared between the role of motivation in contrast to anxiety (as two affective factors) in predicting academic achievement.

Regarding cognitive processes, although many studies have examined the frequencies of each type of processes used by students (e.g., Ghafournia, 2014; Riazi & Rahimi, 2005; Srisupha, 2012), very few research, according to the researchers' knowledge, compared how each process differs in its effects on achievement or which process is a stronger predictor of achievement.

Another important area of research is the examination of cross-cultural differences according to which the role of cognitive processes and affective variables on academic achievement varies. For example, Areepattamannil and Caleon (2013) examined the relationship between two cognitive processes, memorization and elaboration, and mathematics achievement across four East Asian educational systems: Singapore, Korea, Shanghai-China and Hong Kong-China. The findings presented that memorization was negatively associated with academic achievement in all educational systems. However, elaboration processes were not associated with mathematics achievement in Shanghai-China and Korea; and they were negatively linked to mathematics achievement in Hong Kong-China and Singapore. Similar results were found by the same researcher, Areepattamannil (2014a), in which students' self-reported use of memorization and elaboration demonstrated various relationships (i.e., positive, negative or no relationship) on students' course grades across two Indian states: Tamil Nadu and Himachal Pradesh.

In brief, this study will add to the literature by examining not only the competing role of cognitive processes versus affective variables, but also it examines the competing role of each process/variable within each set of factors (cognitive and affective). In addition to the lack of studies conducted to examine these two areas of interest, little research, if any, has been done in the Omani context to compare the predictive role of cognitive processes and affective variables in predicting students' academic achievement. Therefore, this study examines Omani students' perceptions of their usage of cognitive processes (i.e., memorization, organization and critical thinking) and affective variables (i.e., extrinsic and intrinsic motivation, and anxiety) and their prediction role of academic achievement.

2. Methodology

2.1 The Sample

The sample of the current study consisted of 342 students from different school districts in the Sultanate of Oman. Female students represented 74.6% of the total sample. Students were in grades 5 to 11 of public schools and their ages ranged from 10 to 19 ($M=14.22$, $SD=1.73$). Students' grade average point (GPA) ranged from 50 to 95 ($M=75.87$, $SD=14.04$). The students came from families where 75% of mothers and 56.5% of fathers having less than secondary school certificate. The participants responded to the questionnaires during class session. Permission to collect data was obtained from the districts' administrations and then from schools' administrations. Students were assured confidentiality and they were granted the option to participate in the study or not. All students attended classes during data collection chose to participate.

2.2 Measures

The participants responded to a group of existing measures as a part of a national study examining different learning variables. For the use of the current study, the participants' data in six measures were reported in

addition to their grade average point (GPA) using their reported grade. The first measures examined students' use of critical thinking strategies and consisted of 4 items ($\alpha=0.48$). The second measure consisted of 5 items and examined students' organizational strategies ($\alpha=0.46$). The third measure dealt with students' use of memorization strategies and included 6 items ($\alpha=0.48$). For the affective model, the participants responded to three questionnaires examining their levels of intrinsic motivation (5 items, $\alpha=0.53$), extrinsic motivation (6 items, $\alpha=0.45$), and anxiety levels (5 items, $\alpha=0.58$). All measures used a 5-point Likert scale that ranged from strongly agree (5) to strongly disagree (1). More validity and reliability indicators for the measures when used with Omani students are reported somewhere else (Aldhafri et al., 2015; Aldhafri et al., 2012).

3. Results

Data were screened for outliers and no threats were identified. Descriptive analyses of the main variables of the study showed that the participants have high levels of using the affective variables (i.e., intrinsic motivation, extrinsic motivation, anxiety) and high levels of using the cognitive variables (i.e., memorization, organization, critical thinking). The participants also showed high mean score of GPA.

To examine the predictive role of the two competing models in predicting students' academic achievement, two separate regression models were used. In the first model of predicting students' academic achievement, the affective variables (i.e., intrinsic motivation, extrinsic motivation, anxiety) were used as predictors. In the second model, the cognitive variables (i.e., memorization, organization, critical thinking) were used to predict students' academic achievement.

As it can be seen in Table 1, the results of the first regression model show that two affective variables were significant predictors of students' academic achievement. The model indicates that students' intrinsic motivation ($t=2.14$, $p<0.05$) and their anxiety level ($t=-3.79$, $p<0.001$) significantly predicted their academic achievement. This affective model, however, explained only 5.4% of variance in the independent variable, students' academic achievement.

Table 1. Results of the multiple regression models to predict students' academic achievement

Model	<i>B</i>	<i>S.E</i>	β	<i>t</i>	<i>sig</i>	<i>R</i> ²
Affective Model						
Constant	94.56	7.54		12.45	0.000	
Test Anxiety	-7.64	2.01	-0.02	-3.79	0.000	
Extrinsic Motivation	-2.89	2.33	-0.07	-1.24	0.215	0.054
Intrinsic Motivation	4.34	2.02	0.13	2.14	0.032	
Affective Model						
Constant	104.83	6.76		15.49	0.00	
Organization	1.84	1.78	0.06	1.03	0.30	
Memorization	2.90	1.91	0.09	1.51	0.13	0.073
Critical Thinking	8.17	2.06	0.24	3.96	0.00	
Affective & Cognitive Models						
Constant	104.45	7.71		13.54	0.000	
Test Anxiety	-4.61	2.16	-0.13	-2.13	0.033	
Extrinsic Motivation	-1.11	2.34	-0.03	-0.47	0.636	
Intrinsic Motivation	6.51	2.12	0.20	3.06	0.002	
Organization	1.29	1.93	0.04	0.67	0.503	
Memorization	3.76	1.93	0.12	1.94	0.053	0.110
Critical Thinking	7.74	2.18	0.22	3.54	0.000	

In the second regression model, the results show that only one cognitive variable significantly predicted students' academic achievement. The model demonstrates that students' critical thinking was the only predictor of their academic achievement ($t=3.96$, $p<0.001$). This cognitive model explained 7.3% of variance in students' academic achievement.

The results from the second regression model show that the cognitive model is stronger than the affective model in predicting students' academic achievement. However, the two models together (see Model 3 in Table 1) explained only 11% of variance in students' academic achievement.

4. Discussion

The current study aimed to examine the possible relationship between a group of affective and cognitive variables and students' academic achievement. Specifically, the researchers investigated the competing effects of the affective model compared to the cognitive model in predicting the levels of students' academic achievement using underrepresented sample of Arab students from the Sultanate of Oman.

The results presented that only some cognitive and some affective variables were significant predictors of students' academic achievement. Within the affective model, students' intrinsic motivation and their anxiety levels, but not their extrinsic motivation, were significant predictors of their academic achievement. This supports the importance of promoting students' intrinsic motivation as a significant factor affecting students' academic achievement. Model learning theories such as self-determination emphasizes the core role of intrinsic motivation in influencing students' learning (e.g., Deci & Ryan, 2008). As supported by previous studies, intrinsic motivation can predict course grades (e.g., Lepper et al., 2005; Lynch, 2006); also, it pushes students' toward using higher order learning resources and strategies (Yusri et al., 2013). In addition, the results show that it is important to control the levels of students' anxiety and work to minimize it as much as possible considering its negative effects on students' academic achievement. The findings of the current study suggested that students' anxiety level is a possible threat to their academic achievement. Past research stresses that high level of anxiety is most likely to undermine their ability to achieve well in their schoolwork (Puteh & Khalin, 2016; Rana & Mahmood, 2010; Singh & Thukral, 2009). The effects of this affective model were limited looking at the percentage of variance in students' academic achievement accounted for by this model. In addition, the results show that extrinsic motivation was not a significant predictor of students' academic achievement in the presence of the other two affective variables (i.e., intrinsic motivation and anxiety level). This result is consistent with other studies which found that extrinsic motivation is less effective on students' achievement compared with intrinsic motivation (e.g., Areepattamannil, 2014b; Lemos & Verissimo, 2014; Lin, McKeachie, & Kim, 2003).

The cognitive model was a significant predictor of students' academic achievement. The effect of this model, however, was limited to the significant effect of students' critical thinking on their academic achievement. The other two cognitive variables were not significant predictors (i.e., organization and memorization) when examined along with students' critical thinking. Recent research of critical thinking shows the importance of training students to develop different critical thinking strategies considering the cumulative evidence of their positive effects on increasing students' academic achievement (e.g., Afshar & Movassagh, 2014; Alrubaei, 2009; Ayub, 2014; Mall-Amiri & Sheikhy, 2014; Stewart, 2000). The cognitive model, however, did not explain large percentage of variance in students' academic achievement.

The results of the current study suggest that there are other important variables that may influence students' academic achievement. When the two models were examined together in the same regression model (see Model 3 in Table 1), the two models only explained 11% of variance in students' academic achievement. Future research may examine other important variables within the Omani school context such as students' self-efficacy beliefs (Aldhafri, 2016) and social goals (King, McInerney, & Watkins, 2012, 2013; King & Watkins, 2012) as self-related variables or classroom climate and students' perceptions of parenting styles as context-related variables.

Acknowledgements

This research was thankfully supported by a grant (RC/EDU/PSYC/12/01) from The Research Council in Oman. This funding source had no involvement in the conduct of the research and preparation of the article.

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