Impact of different levels of academic achievement on epistemological beliefs

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ABSTRACT

Purpose: This research investigated variations in epistemological belief (EB) based on levels of academic achievement (excellent, very good and good).

Design/Methodology/Approach: The study sample comprised 319 university students from the University of Jordan and Al-Ahliyya Amman University across various majors with different levels of academic achievement based on their grade point average (GPA). Epistemological beliefs (EB) were evaluated using the epistemological belief scale.

Findings: The findings from the one-way analysis of variance indicated statistically significant differences in epistemological belief across academic levels favoring the excellent level over the very good and good levels in each dimension such as speed of learning, the structure of knowledge and ability to learn. However, no statistically significant variances were observed between students at the very good and good levels across any of the dimensions of epistemological belief.

Conclusion: The study concludes that students excelling academically tend to exhibit more advanced EB compared to their very good and good counterparts.

Practical Implications: These findings suggest that teachers may need to adapt their instructional strategies to the diverse epistemological beliefs of students with different academic achievement levels. This could involve providing more challenging learning experiences for excellent students while offering additional support and scaffolding for other students.

Contribution to the Literature: This study contributes to the existing body of research on epistemological beliefs by providing new insights into the relationship between EB and academic achievement levels. These findings have implications for understanding how students' beliefs about knowledge and learning influence their academic performance.

Keywords: *Academic achievement, Educational psychology, Epistemological beliefs scale, Epistemological beliefs, Grade point average, Personal epistemology, University students.*

1. INTRODUCTION

Epistemological beliefs (EB) are widely considered important cognitive constructs in education. It refers to an individual's perspective and assumptions about knowledge and how it is acquired (Hofer & Pintrich, 1997). They represent individuals' subjective perceptions and ideas about the structure of knowledge, the source of knowledge, the certainty of knowledge, control over its acquisition and the speed of its acquisition (Schommer, 1994). According to Magno (2011), a student's EB can influence how they employ learning strategies and how well they perform academically. Positive EB is associated with exceptional academic achievement and the highest educational results (Bernardo, 2009). They are particularly associated with deep learning approaches (Prasadini, Hamid, Khatibi, & Azam, 2018).

Researchers in educational psychology have increased their interest in EB in recent decades due to the emergence of several evidence that support the important role that these beliefs can play in learning, motivation, and academic performance in general. EB is commonly seen as a lens through which people interpret knowledge, develop standards and decide on an appropriate course of action (Hofer & Pintrich, 2002). The importance of students' EB in academic tasks especially when they want to continue these tasks is affected by their beliefs about

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intelligence, knowledge and learning. Students who believe in fixed abilities and simple knowledge tend to avoid difficulties and use ineffective strategies unlike students who have deep, sophisticated and mature EB. They are more inclined to seek help, to obtain knowledge and to believe in their need to seek knowledge which pushes them to face difficulties, adapt to them and use appropriate strategies that affect academic performance directly and indirectly (Pintrich, 2002; Schommer, Crouse, & Rhodes, 1992).

A considerable body of literature suggests a positive relationship between EB and academic performance. For example, researchers such as Schommer (1990), Schommer (1993), Hofer (2000) and Lodewyk (2007) have supported this relationship. However, other studies such as those conducted by Cano and Cardelle-Elawar (2004), Peng and Fitzgerald (2006), Stathopoulou and Vosniadou (2007), Harteis, Gruber, and Hertramph (2010) and Jena and Chakraborty (2018) did not find a clear or positive correlation. The majority of these studies primarily examined the relationship between academic achievement and EB in a general manner neglecting to consider the potential impact of different academic levels on comprehending the link between achievement and EB. Consequently, this study seeks to overcome the lack of specificity in earlier studies regarding how various levels of academic achievement (such as excellent, very good and good) might influence the degrees of EB. The following study question was put forward this ambiguity: How do different levels of academic achievement (such as excellent, very good and good) potentially impact the degrees of EB among university students?

Understanding how different level of academic achievement influence individuals' beliefs about knowledge acquisition is crucial for educational institutions and teachers. Knowing the differences in the degree of EB at each of the different levels of achievement can provide more insight into how beliefs and performance are related. Where do the differences lie in EB in which dimensions specifically and thus determining which groups can benefit most from programs for developing EB?

2. REVIEW OF THE LITERATURE

2.1. Epistemological Beliefs (EB) Theories

Interest in EB began with the work of Perry (1970). He started researching EB by asking students in interviews about knowledge—what it is, how to get it and how to verify it. According to the study's findings, people initially think that knowledge is fixed and certain but as they get older, they discover that knowledge is not fixed and must be challenged through experimentation and inference. Subsequently, they address the idea that an individual's EB represents their understanding of the basics of knowledge and their approach to learning (Schommer, 1998). Perry (1970) studied EB from a developmental perspective as a process of epistemological growth which means that people's beliefs about knowledge evolve and progress through a pattern of developmental stages in a specific order and sequence (much like Piaget's stages of mental development).

Later, Schommer (1990) introduced a new perspective on epistemological beliefs (EB) conceptualizing personal knowledge as a set of beliefs about knowledge and learning. She posited that these beliefs may not be integrated or sequential but rather exist independently to some extent. Schommer (1994) further developed this theory proposing the existence of five distinct dimensions of EB. Each dimension has two poles ranging from naive to complex or sophisticated beliefs. The five dimensions are (a) The source of knowledge (beliefs about whether knowledge is derived from authorities, objective processes or subjective experiences). (b)The stability of knowledge (beliefs about whether knowledge is constant or subject to change). (c) The structure of knowledge (beliefs about whether knowledge is composed of discrete pieces or intricately connected ideas). (d) The speed of learning (beliefs about how quickly or gradually learning occurs) (e) The ability to learn (beliefs about whether the capacity to learn is fixed at birth or can be changed) . Schommer (1990) developed the Schommer epistemological questionnaire to measure EB across various aspects. Subsequent research has provided evidence supporting the multidimensional nature of EB with studies such as Hofer (2000) and Jehng, Johnson and Anderson (1993) contributing to this understanding.

2.2. The Relationship between Academic Performances and EB

A large body of related literature indicated that EB and academic performance were positively related. Studies have found that students who have more developed EB are more likely to engage in learning and educational tasks compared to students with simple beliefs (Heiskanen & Lonka, 2012; Ondap & Hornejas, 2022; Rezaei & Bahadorikhosroshahi, 2019) and they have positive attitudes towards studying (Önen, 2011). They use deeper

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learning strategies such as critical thinking, analyzing information and creating connections between information (Phan, 2008; Tanriverdi, 2012) and a deeper level of comprehension and understanding compared to students who believe that knowledge is simple. They tend to employ surface-level processing characterized by rote memorization (Schommer, 1990). Those with mature beliefs also have higher internal motivation to learn (Oschatz, 2015; Paulsen & Feldman, 1999) in addition to better academic performance and achievement (Lodewyk, 2007; Schreiber & Shinn, 2003). Several studies have looked at the link between EB and academic achievement. EB has a direct and indirect impact on achievement and academic performance in general. According to Lodewyk (2007), there are differences in EB depending on gender, orientation towards school, level of academic achievement and the belief that knowledge is simple which predict academic performance in general. Cano (2005) found that EB changed throughout secondary school and directly and indirectly affected academic performance through the learning approaches used. Hutagalung, Wong, and Rushdan (2017) also found that EB has a direct impact on achievement in science through learning methods and achievement goal orientations. Sadeghi, Asadzadeh, and Ahadi (2018) also indicated that EB may play a role in explaining a large part of academic achievement in addition to procrastination and the quality of school life.

2.3. Factors Mediate the Relationship between Academic Achievement and EB

According to the aforementioned discussion, there is a consistent body of research supporting the advantages of developed epistemic views in relation to learning and academic achievement. This effect is believed to be influenced by various mediating factors including self-regulation either directly or indirectly (Schommer, 1998 , Barbara K Hofer & Pintrich, 1997). It has been found that EB is closely related to self-regulation (Demirbağ, 2021; Demirbag & Bahcivan, 2021; Soltani & Askarizadeh, 2021). Each of them affects the other. This relationship is considered extremely important for academic success as students who view learning as a controllable process will work to set goals, monitor their progress and modify their study methods which can enhance academic performance (Zimmerman, 2002). In a study by Bråten and Strømsø (2005) on university students, it was found that students with more developed beliefs are more involved in self-regulated learning behaviors because they realize that learning is a complex and gradual process that requires effort and perseverance. In this context, MUIS (2007) presented a model of four assumptions in which he attempted to explain the relationship between EB and learning: (1) EB is part of the epistemological and emotional factors that influence how individuals approach a learning task. (2) EB contributes to shaping the standards and expectations that students establish for their educational objectives. (3) These standards serve as input into metacognition and the standards are used as a basis for judging learning outcomes. (4) The relationship between EB and self-regulation is reciprocal and each of them affects the other.

2.4. Research Problem

Nevertheless, certain studies have failed to identify a significant relationship between EB and learning outcomes or academic performance in contrast to the research that has empirically linked sophisticated (EB) with academic performance. Jena and Chakraborty (2018) and Harteis et al. (2010) found a weak or negligible effect of EB on learning and academic achievement (Cano & Cardelle-Elawar, 2004; Peng & Fitzgerald, 2006). For example, in a study by Stathopoulou and Vosniadou (2007) on the role of EB in understanding physics within a class of high school students, the results indicated that developed EB related to physics are necessary but not sufficient alone to understand physics. One of the reasons for such a discrepancy may be how the relationship between them was studied. Despite the many studies conducted on the relationship between EB and achievement, we found that these studies dealt with achievement in its relationship with beliefs as a whole and did not examine multiple levels of achievement (good, very good and excellent) about beliefs. As a result, the studies provide limited information about the differences in beliefs across different levels of achievement and do not provide any insights into the differences between these levels which require further investigation. The current study seeks to examine how the degrees of epistemological beliefs differ according to the level of academic achievement (excellent, very good and good).

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3. METHODOLOGY

3.1. Research Design

The current study's research design used a one-way ANOVA analysis. This design allowed for the comparison of means across multiple groups to ascertain the presence of statistically significant differences in the dependent variable by employing one-way ANOVA analysis. This study aimed to provide statistical evidence supporting the impact of different levels of academic achievement (excellent, very good and good) on EB.

3.2. Population and Sample

University students constituted the targeted population for the study studying at different universities in Jordan, 319 students in all were polled for this study from the University of Jordan and Al-Ahliyya Amman University. Students had an average age of 22.6 years. Out of the total students, 34% were male and 66% were female. The distribution of academic levels among the students was as follows: 22% were in their first year, 26% in their second year, 31% in their third year and 21% in their fourth year. In terms of academic performance, 23% reported good performance, 51% reported very good performance and 36% reported excellent performance as shown in Table 1.

Table 1. Participants by gender, academic level and academic achievement level distribution.

Variables		**Number**	**Percentage**
Gender	Male	109	34%
	Female	210	66%
Academic level	First	71	22%
	Second	83	26%
	Third	98	31%
	Fourth	67	21%
Academic achievement	Good	71	23%
	Very good	164	51%
	Excellent	110	36%

3.3. Instruments

3.3.1. Epistemological Belief Scale

The students' epistemological beliefs (EB) were evaluated using the epistemological belief scale, a 28-item questionnaire developed by Al-Natsheh (2023). This scale assesses five distinct dimensions of EB: structure of knowledge, stability of knowledge, source of knowledge, speed of learning and ability to learn. Participants were asked to rate each item on a 5-point Likert scale ranging from 1 (strong disagreement) to 5 (strong agreement). The total score on the scale ranges from 28 to 140 with higher scores indicating a more sophisticated level of the participant's beliefs about the respective dimension of knowledge. Conversely, lower scores indicate simpler beliefs.

3.3.2. Validity and Reliability of the Scale

The scale has been found to have good construct validity to determine the construct validity of the scale. The relationships between the five dimensions of EB and the total score were calculated which was found to be in the range of 0.55 – 0.74. The scale has satisfactory reliability. The internal consistency of the scale was assessed using Cronbach's alpha. A value of 0.83 was obtained which indicated a high level of internal consistency.

4. RESULT

A one-way analysis of variance (ANOVA) was performed to evaluate the existence of potential differences between the dimensions of EB and the three groups for overall academic achievement (excellent, very good and good). Table 2 presents the means and standard deviations for each dimension of EB across the three levels of academic achievement.

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Table 2. Comparison of scores from the epistemological belief scale according to academic achievement level.

EB dimensions	Level of academic achievement						*F*
	Good (N=79)		Very good (N=164)		Excellent (N=110)		
	Mean	SD	Mean	SD	Mean	SD	
Structure of knowledge	15.6	2.56	16.1	2.44	17.4	2.67	12.9*
Stability of knowledge	16.6	2.97	17.0	2.97	17.6	3.04	2.55
Source of knowledge	15.7	1.93	15.2	2.04	15.4	2.31	1.02
Speed of learning	18.3	3.13	18.6	3.8	19.7	2.63	6.88*
Ability to learn	29.2	5.06	29.8	4.25	30.9	4.15	3.64*

Note: *Significant at 0.05 level.

The first dimension of EB (the structure of knowledge) showed significant differences between the three groups of academic achievement (F (2, 350) = 12.9, $p < 0.005$. Table 3 revealed that students with excellent academic achievement had significantly higher mean scores (M = 17.4, SD = 2.67) on the structure of knowledge dimension compared to students with very good academic achievement (M = 16.1, SD = 2.44) and with good academic achievement (M = 15.6, SD = 2.56). Nevertheless, no statistically significant distinction was detected between the students with very good and good academic achievement concerning this dimension.

Table 3. Multiple comparison results (LCD test) for the differences between the means in various academic means at different academic levels in EB.

EB dimensions	Level	Good	Very good	Excellent
Structure of knowledge	Good	-	0.567	0.001 *
	Very good	-	-	0.002*
	Excellent	-	-	-
Speed of learning	Good	-	0.731	0.000*
	Very good	-	-	0.001*
	Excellent	-	-	-
Ability to learn	Good	-	0.409	0.022*
	Very good	-	-	0.050*
	Excellent	-	-	-

Note: *Significant at 0.05 level.

According to the second dimension (stability of knowledge), there were no significant differences between the three groups of academic achievement (F (2, 350) = 2.55, $p > 0.05$). The mean scores for this dimension were relatively similar across all three groups with students with excellent academic achievement (M = 17.6, SD = 3.04) having slightly higher mean scores compared to students with good (M = 16.6, SD = 2.97) and very good (M = 17.0, SD =2.97) academic achievement.

According to the third dimension (source of knowledge), there were no significant differences across the three groups of academic achievement (F (2, 350) = 1.02, $p > 0.05$). The mean scores for this dimension were similar across all three groups with students with excellent academic achievement (M = 15.4, SD = 2.31) having slightly higher mean scores compared to students with good (M = 15.7, SD = 1.93) and very good (M = 15.2, SD = 2.04) academic achievement.

The fourth dimension (speed of learning) showed significant differences between the three groups of academic achievement (F (2, 350) = 6.88, $p < 0.05$). LCD test post hoc comparisons revealed that students with excellent academic achievement had significantly higher mean scores (M = 19.7, SD = 2.63) on the speed of learning dimension compared to students with very good academic achievement (M = 18.6, SD = 3.8) and with good academic achievement (M = 18.3, SD = 3.13). However, there was no significant difference between students with very good and good academic achievement on this dimension.

The fifth dimension (ability to learn) showed significant differences between the three groups of academic achievement (F (2, 350) = 3.64, $p < 0.05$). LCD test post hoc comparisons revealed that students with excellent academic achievement had significantly higher mean scores (M = 30.9, SD = 4.15) on the ability to learn dimension

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compared to students with very good academic achievement (M = 29.8, SD = 4.25) and with good academic achievement (M = 29.2, SD = 5.06). However, there was no significant difference between students with very good and good academic achievement on this dimension.

5. DISCUSSION

The study attempted to investigate differences in EB among university students according to the level of academic achievement (excellent, very good and good). The findings of the study show that students with excellent levels have more developed EB compared to students with very good and good levels. Data analysis showed that the differences in EB between the excellent level and both the very good and good levels came in the following dimensions: speed of learning, ability to learn and structure of knowledge and no differences appeared between them in the two dimensions of a source of knowledge and stability of knowledge. In other words, the results suggest that students with high academic achievement at the excellent level have more mature and sophisticated EB and a deeper understanding of the nature of knowledge and how to acquire it.

The first dimension of EB (the structure of knowledge) showed significant variation among the three academic achievement groups. This result is in line with what other research has found that academic success and EB are positively related (Cano, 2005; Hutagalung et al., 2017; Lodewyk, 2007; Sadeghi et al., 2018; Schommer, 1993). Similarly, Paulsen and Wells (1998) discovered that structure of knowledge is a predictor of grade point average (GPA). The results indicate that students with exceptional GPAs had more developed beliefs about the structure of knowledge compared with students with low GPA. Excellent students may use deeper learning techniques that encourage greater achievement if they believe that knowledge is an integrated and ordered structure rather than an independent set of facts (Schommer, 1993). Students become more skilled at retrieving and applying knowledge when they can recognize relationships between concepts. For high-achieving students, understanding knowledge as more interconnected than discrete can lead to stronger performance.

Interestingly, the source of knowledge and stability of knowledge did not differ between groups. This suggests that students at different achievement levels may hold similar beliefs about the sources of knowledge and the stability of knowledge. These results were relatively not agreed with a number of previous studies. For instance, Hofer (2000) discovered a strong relationship between students' performance in psychology and science courses and their scores on stability of knowledge and the structure of knowledge. Additionally, the study revealed a meaningful relationship between these knowledge factors and both course grades and overall GPA. Pouratashi, Zhu, and Zamani (2018) found differences in the dimensions of the source of knowledge and the stability of knowledge. This may indicate that these dimensions of EB are less influenced by academic performance and more influenced by other factors such as cultural or personal beliefs.

The dimension of the speed of learning showed significant differences, the excellent students achieved higher mean values on the speed of learning dimension than the very good and good students. This outcome is consistent with the results of other research that has shown that students with higher GPAs have stronger EB about their speed of learning and ability to learn (Schommer, 1990; Schommer, 1993). Similarly, Schommer-Aikins, Duell, and Hutter (2005) found that mathematical problem-solving ability was significantly predicted by a person's confidence in the speed of learning and ability to learn. Students who perform excellently might think that knowledge comes about more slowly through practice and effort than it does quickly in class. The requirements of higher education which call for extensive study are well-suited to an incremental approach to learning. On the other hand, students who anticipate quick comprehension might find it difficult to understand difficult or complex content.

Similarly, significant differences were observed in the ability to learn dimensions. Students with excellent academic achievement demonstrated significantly higher mean scores on this dimension compared to those with very good and good academic achievement. This finding implies that students who achieve at the highest academic levels possess beliefs about their potential to learn challenging content versus being fixed in their capacities. The belief in one's ability to learn is closely related to the construct of self-efficacy which has been shown to positively influence academic achievement (Bandura, 1982). When students are confident in their learning abilities, they are more likely to engage deeply with the material, persist in the face of challenges and use effective learning strategies (Pajares, 1996).

It can also be said that the possession of high achievers (excellence) to have more sophisticated EB may be due to several features associated with these students as they tend to integrate into more effective learning strategies

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and into self-regulated learning in which the student works to set goals, monitor their progress and adjust their progress. These students may have a deeper understanding of how knowledge is acquired and the importance of critical thinking and evidence-based thinking. As a result, they may develop more mature EB consistent with these effective learning practices (Pintrich, 2002; Pintrich & De Groot, 1990). Students with high academic achievement also often show a higher level of intrinsic motivation which is related to self-efficacy. Individuals with high academic performance may have greater confidence in their ability to acquire knowledge and solve problems which in turn will lead to more maturity (EB) (Schunk, Meece, & Pintrich, 2014).

The study's findings showed that there were no significant differences in the five dimensions of EB between the "very good" and "good" academic achievement levels. This suggests that advancing from a good to a very good level of academic achievement may not lead to substantial improvements in students' EB. This discovery challenges research suggesting that developed EB correlates with academic achievements (Cano, 2005; Hutagalung et al., 2017; Lodewyk, 2007; Sadeghi et al., 2018) .One potential reason for the lack of distinction could be that both good and bad students exhibited strong EB as demonstrated by their average scores which were likely influenced by various factors like academic level, age and extent of the university experience, Thus, their beliefs seem to converge on a similar level. This discovery could contribute to research on how academic performance intersects with belief systems by pinpointing the areas and dimensions where performance impacts EB. This calls for more research to explore the differences in this interesting finding.

It is critical to understand that the link between EB and academic achievement is reciprocal and mediated by many factors. There may be a relationship between high academic achievement and mature beliefs but other factors such as the educational environment and individual experiences may play an influence on these beliefs. Similarly, EB is not the only factor that may influence academic success. Academic success may also be affected by other elements such as self-regulation and motivation.

6. CONCLUSION

The importance of EB in academic contexts is revealed by the differences that appear in the dimensions of epistemological structure, learning speed and learning ability across different levels of academic achievement. These beliefs may represent important psychological concepts that play a part in how students learn. Academic performance can therefore be improved through educational interventions that promote students' EB. Teachers can better support students in their pursuit of academic excellence and lifelong learning if they understand the role of these beliefs.

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INSTITUTIONAL REVIEW BOARD STATEMENT

The Ethical Committee of the Al-Ahliyya Amman University, Amman, Jordan has granted approval for this study on 25 October 2023 (Ref. No. FES-18G-272).

TRANSPARENCY

The authors confirm that the manuscript is an honest, accurate, and transparent account of the study; that no vital features of the study have been omitted; and that any discrepancies from the study as planned have been explained. This study followed all ethical practices during writing.

COMPETING INTERESTS

The authors declare that they have no competing interests.

AUTHORS' CONTRIBUTIONS

All authors contributed equally to the conception and design of the study. All authors have read and agreed to the published version of the manuscript.

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