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The Relationship between Epistemic Beliefs and Academic Performance: Are Better Students always More Mature?

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Abstract

This study investigates the relationship between epistemic beliefs and academic performance among a group of high school students in United Arab Emirates (UAE). Despite some contradictions, the general trend in the literature is that more mature students usually outperform students with naïve epistemic beliefs. We hypothesized that this relationship is reciprocal and learning strategies and task demands play a key role in building the schemas of epistemic beliefs. Accordingly, the requirements of traditional teaching and assessment methods might lead students to adopt less advanced epistemic beliefs that might be consistent with traditional learning strategies and task demands. To test this hypothesis, we compared the epistemic beliefs of high, average, and low level students (n = 165) in the traditional, developing educational system in UAE. Students were classified according to their performance on two formats of assessment; the regular exams and the continuous evaluation, using Arabic, standardized version of Epistemic beliefs Inventory prepared by Schraw et al, (2002). For the two assessment formats, the results were inconsistent with the traditional findings in the literature as advanced and medium students got higher scores (immature beliefs) than low level students on most epistemic beliefs, with the exception of the beliefs in Innate Ability (IA), where weak students got higher epistemic beliefs than advanced or medium level students. The results were discussed as an indication that academically better students were more able to adapt to the system requirement by adopting naïve epistemic beliefs. Also, the results were discussed within the Arab/Emirati cultural context.

Keywords: epistemic beliefs, academic achievement, learning strategies, Epistemic Beliefs Inventory (EBI)

1. Introduction

1.1 The Problem

"Epistemic beliefs" is an increasingly important construct in educational psychology and education. The term "epistemology" is used for centuries to refer to one of the basic fields of philosophy, that is related to the nature of knowledge, knowledge acquisition, and limits of knowledge. However, the term "epistemic beliefs" is used in educational and educational psychology literature since late 1960s to describe individuals' underlying beliefs about the nature of knowledge in terms of its certainty, structure, organization, sources, and how manageable it could be. Accordingly, this line of research is interested in investigating folk theories of knowledge in relation to learning and education.

Although there is substantial literature that shows that epistemic beliefs are multi-dimensional phenomena that affect different aspects of students' learning and education (see below), less efforts have been made to study such relationship in non-Western cultures, especially in the Arab World. The current study is an attempt to investigate the relationship between epistemic beliefs and academic performance of high school students in an Arab society of United Arab Emirates (U.A.E).

1.2 What Are "Epistemic Beliefs"?

Early researchers on epistemic beliefs (e.g., Perry, 1968) were interested in their development as a unified, single phenomenon from naïve to mature beliefs. These researchers thought that the development of personal epistemology occurs in a stage-like manner, where various aspects of it develop synchronously. In 1990s, Schommer (1990; 1994) conceptualized personal epistemology as a multidimensional system of relatively

independent beliefs about knowledge and learning. This hypothesized system (see Table 1, based on Schommer, 1994) includes beliefs about (a) stability of knowledge (CK), ranging from unchanging knowledge to tentative knowledge, (b) structure of knowledge (SK), ranging from isolated bits and pieces of information to integrated concepts, (c) source of knowledge (OA), ranging from omniscient authority to reason and empirical evidence, (d) speed of learning (QA), ranging from quick or not-at-all to gradual learning, and (e) ability to learn (IA), ranging from fixed at birth ability to improvable one.

Table 1. Basic dimensions of epistemic beliefs

	Naïve	Mature
Structure	simple	complex
Certainty	certain	tentative
Source	authority	reason
Control	innate	acquired
Speed	quick	gradual

Later, Schommer (Schommer-Aikin, 2004) expanded her multidimensional system further into a belief system that includes affect component. Like any emotionally-based belief system, epistemic beliefs, in this new conceptualization, can have limited adherence to logic, have powerful influence over thinking, and are difficult to change. An important aspect of this belief system proposed by Schommer is its presumed asynchronous development. Unlike early models of epistemic beliefs, which describe a holistic transition from one stage to another, epistemic beliefs in the multidimensional system may or may not be aligned synchronically. Accordingly, a person can have a mature belief that knowledge is complex and yet, at the same time, he might believe that knowledge is unchanging. The notion of asynchronous development can be helpful in understanding the variability and intra-individual differences in epistemic beliefs. Another aspect of Schommer's multidimensional belief system is the quantitative assessment of epistemic beliefs. While early research was based on interviews, open-ended questions, and qualitative analyses of the data, Schommer introduced a quantitative approach to evaluate and assess epistemic beliefs. She devised the Epistemological Questionnaire (Schommer, 1990) to measure the five dimensions of personal epistemology described above (see Table 1). This questionnaire consists of 63 items. Each item is a statement that describes a belief about knowledge and learning. Participants respond to these statements on a 5-point Likert scale from 1 (strongly disagree) to 5 (strongly agree).Later, other researchers (e.g., Jehng, Johnson, & Anderson, 1993; Schraw, Bendixen, & Dunkle, 2002; Wood & Kardash, 2002) devised similar instruments that were based on the same logic (for a review of the instruments used to evaluate epistemic beliefs, see DeBacker, Crowson, Beesley, Thoma, & Hestevold, 2008; Duell & Schommer-Aikins, 2001). Finally, Schommer-Aikin argues, personal epistemology cannot be thought of in vacuum. Rather, it should be considered a system that is embedded within other systems (e.g., culture, classroom, family, peers, teachers…etc). This last consideration makes understanding epistemic beliefs incomplete unless we understand the general cultural context in which they function.

1.3 Epistemic Beliefs and Learning

There is substantial evidence that supports the claim that students' belief systems play significant role in their learning and motivation in the classroom. In comparison to students with naïve epistemic beliefs, students with more advanced, mature epistemic beliefs were found to have deeper level of comprehension (Ryan, 1984; Schommer, 1990), better academic performance (Chen & Pajares, 2010; Kember, 2001; Lodewyk, 2007; Many, Howard, & Hoge, 2002; Peng & Fitzgerald, 2006; Schommer, Crouse, & Rhodes, 1992; Schommer-Aikins, Duell, & Hutter, 2005; Schommer-Aikins & Easter, 2006; Stathopoulou & Vosniadou, 2007; Stroeger, 2006), higher ability to solve ill-structured problems, but not well-structured ones (Lodewyk, 2007; Schraw, Dunkle, & Bendixen, 1995), more elaborated moral reasoning (Bendixen, Schraw, & Dunkle, 1998), higher ability to integrate competing claims and reach the right conclusions (Kardash & Scholes, 1996; Rukavina & Daneman, 1996), and higher ability to consider evidence and evaluate alternative points of view, and they are more critical of inconsistencies and misconceptions (Nussbaum, Sinatra, & Poliquin, 2008). Moreover, gifted students were found to have more mature epistemic beliefs than non-gifted ones by the end of high school (Schommer & Dunnell, 1994; 1997). Also, epistemologically mature students were found to focus on constructivist aspects of learning (Tsai, 2000), have more realistic expectations about studying, better attitudes toward school (Schommer

& Walker, 1997), and more intrinsic motivation to learn (Paulson & Feldman, 1999; 2005). Other researchers have shown that epistemic beliefs affect self confidence in solving math problems (Steiner, 2007), and influence their self regulated learning goals and learning strategies (Muis & Franco, 2009). (For a general review of the role of epistemic beliefs in learning and teaching, see Maggioni & Parkinson, 2008).

Early attempts to explain the relationship between epistemic beliefs and learning or academic achievement was based on Schommer's (1998) and Hofer and Pintrich's (1997) reasoning that epistemic beliefs can specify goals for the learning situation, and these goals in turn affect the choice of learning and metacognitive strategies to be used in learning and problem solving. These learning and metacognitive strategies and goals, it is argued, subsequently influence academic performance and achievement. Thus, a student who believes that knowledge is about accumulating a large set of separate facts will probably develop a learning goal of acquiring as large as possible set of separate, isolated facts and information. This student is more likely to prefer rote memorization strategy, and will do will on memory-based exams but not on exams that assess higher thinking skills. On the other hand, a student who believes that knowledge is about a web of interrelated, connected structures of information is more likely to prefer more advanced memory strategies such as organization or elaboration. This student might not do well on traditional, memory- based exams but on those exams that address higher levels of thinking. Accordingly, this self-regulated learning strategy is considered a medium through which epistemic beliefs can influence academic performance. In a more recent work, Muis (2007) suggested four propositions to explain the relationship between epistemic beliefs and learning, where (1) epistemic beliefs of learners affect their self motivation (achievement goals, outcome expectations, and intrinsic interest), (2) epistemic beliefs determine the standards individuals set for learning, and these standards in turn are used to determine the learning strategies to be used in learning, (3) these standards serve as input to metacognition, where standards are used as a basis against which learning products are compared via metacognitive monitoring, and (4) the relationship between epistemic beliefs and self-regulated learning is reciprocal, where epistemic beliefs feed information into self-regulated learning, and self regulated learning, in turn, feeds information into epistemic beliefs schemas. Muis and Franco (2009) presented what they called validation of Muis's model. That is, their data seem to support the hypothesis that epistemic beliefs influence students' achievement goals, which subsequently influence students' learning strategies and their academic achievement.

Another variable that was suggested to mediate between epistemic beliefs and academic achievement is learners' ideas or conceptions of learning, or what have become known as "approaches to learning" (Cano, 2005). According to this theoretical framework (Biggs, 1987; Marton and Saljo, 1997), students develop either a superficial level of understanding (surface approach to learning, where students are extrinsically motivated to care about details to be reproduced later, using repetitive strategies), deep approach to learning (where students are intrinsically motivated to focus on the main ideas, using meaning-based strategies), or achievement approach (motivated by the need to achieve deep understanding, and use higher organizational strategies). Data from Cano (2005) and Cano and Cardelle-Elawar (2004) support the hypothesis that approaches to learning can predict academic performance and act as mediating variables between epistemic beliefs and academic performance. Moreover, Chen and Pajares (2010) found that both epistemic beliefs and goal orientation act as mediating factors between implicit theories of intellectual ability (e.g., Dweck and Leggett's (1988) distinction between fixed vs. incremental ability), on one hand, and the academic performance in science, on the other hand.

Accordingly, it seems that there is a general trend of evidence supporting the positive effect of mature epistemic beliefs on different aspects of learning (including academic performance). Also, it seems that this effect can be direct or mediated by self-regulated learning activities (e.g., achievement goals, strategy selection, or metacognitive monitoring), goal orientation, or approaches to learning. Moreover, these mediating variables were found to have independent significant effects on learning (see Cano, 2005, and Muis, 2007). However, despite this general trend of the results, literature has mixed results, significant exceptions, and anomalies that make reaching a final conclusion about the relationship between epistemic beliefs and academic performance a difficult task. On one hand, some studies found that epistemic beliefs had no effect on learning (Harteis, Gruber, & Hertramph, 2010), while others found that this effect is limited (significant but low) and can explain only about less than 10% of the variance in academic performance or problem solving activities (Cano & Cardelle-Elawar, 2004; Peng & Fitzgerald, 2006). This limited effect made some researchers (Stathopoulou & Vosniadou, 2007) believe that sophisticated epistemic beliefs are necessary but not sufficient conditions for academic performance. On the other hand, some studies have mixed results or even results that are against the generally predicted relationship between epistemic beliefs and learning. For example, while Peng and Fitzgerald (2006) found a positive, significant but low effect of mature epistemic beliefs on learning, they also found a significant, positive relationship between belief in quick, all-or-none learning (an immature epistemic belief) and

the quality of performance on the individual plan activity. Also, Kember (2001) found that Hong Kong students with naïve epistemic beliefs (didactive/reproductive) found it difficult to adjust to higher education if teaching was not expository and if assignment went beyond the reproduction of the taught materials. Kember also found that students with mature epistemic beliefs (facilitative/transformative) were more comfortable with constructivist learning but uncomfortable with old fashion expository teaching and reproductive assignments. Moreover, other studies (e.g., Gow, Balla, Kember, Stokes, 1989; Kember, 2000) showed that advanced students in Hong Kong might adopt surface approach to learning, especially in their final year under the pressure of institutional demands such as dense curriculum and severe time limit. On the other hand, Tsai, Ho, Liang, and Lin (2011) found that mature epistemic beliefs led to higher-level conceptions of learning science while naïve epistemic beliefs led to lower level of conceptions of learning science. However, Taiwanese students who viewed scientific knowledge as uncertain (advanced epistemic belief) tended to have lower self-efficacy attitude toward learning science, while students who viewed scientific knowledge as certain tended to have higher self-efficacy attitude toward learning science. Tsai and his colleagues attribute this unexpected result to the school and educational values in Taiwanese culture that are influenced by Chinese Confucian doctrine which requires students to show respect to teachers and assign high value to firm, standardized examinations. Accordingly, regarding scientific knowledge as certain would enhance advanced students' preference to seek standard knowledge and firm answer to get higher scores (and higher self-efficacy) in comparison to those who believe that scientific knowledge are uncertain. Consistent with this line of research with mixed results, Ricco, Pierce, and Medinilla (2010) found that epistemic beliefs that scientific knowledge develops and needs justification were positively related to mastery goal and high self- efficacy. However, they also found that uncritical acceptance of authority, and believing that knowledge is certain were positively related to the high level mastery motivational variables, but negatively related to science grades. To interpret these results Ricco and his colleagues argued that trusting authority can be supportive of learning in sample derived from a lower SES minority Hispanic community in California. However, this tendency to trust authority might not be awarded by teachers who follow the high standards of teaching and learning that emphasizes critical thinking in California schools.

Accordingly, it can be seen that the relationship between epistemic beliefs and academic performance is a complicated one that can not be represented as a linear one-way relationship. Rather, this relationship is reciprocal where learning strategies, task demands, and motivational factors might change epistemic beliefs schemas. Actually, this effect of the learning process on changing epistemic beliefs is mentioned in Muis's (2007) integrated model of epistemic beliefs and self-regulated learning as a feedback mechanism, through which epistemic beliefs change over time in training programs (e.g., Higgins, 1997; Verschaffel, De Corte, Lasure, Van Vaerenbergh, Bogaerts, & Ratinckx, 1999). Accordingly, we argue that epistemic beliefs are adaptive mechanisms that are sensitive to task requirements and necessary learning strategies, and can change, according to these conditions, to be better able to accomplish the learning task. Thus, situational factors such as culture, time pressure, assessment tasks, studying load, institutional demands, and teachers' expectations might change epistemic beliefs or push toward different preferences of them. And students can adopt epistemic beliefs that fit with the situational factors and task demands. Moreover, academically higher students can allocate resources and respond to task demands more wisely than their academically below average counterparts. Accordingly, a good student, who usually adopts advanced epistemic beliefs, might adopt immature Simple Knowledge epistemic belief if the teaching is traditional or the exams are about memory-based retrieval of fragmented information. To sum up, better students might be more able to adapt their learning strategies and epistemic beliefs to the task requirements and demands than academically lower students. This logic finds support in the literature reviewed above (Gow et al, 1989; Kember, 2000; Ricco et al, 2011; Tsai et al, 2010), where cultural factors, studying load, family and teachers' expectation led learners to adopt naïve beliefs or lower achievement goal.

Of course, this change in the conceptualization of the relationship between epistemic beliefs and learning requires similar change in the conceptualization of epistemic beliefs to be a dynamic, flexible process that change on a maturity/naivety continuum according to the task requirements, instead of being a fixed attribute. Moreover, accepting this logic might indicate that we can define the maturity/naivety of epistemic beliefs depending on the situational factors mentioned above, where the learner uses metacognitive monitoring to wisely allocate cognitive resources in a way that is appropriate for different tasks. For example, if the test requires only rote memorization we would expect the learner to adopt epistemic belief in simple, isolated facts. On the other hand, if the course is fatal to the student's career, we can predict him/her to adopt more mature beliefs in general. In general, more able learners are assumed to be more able to distribute time and effort wisely, given his personal needs, level of development, and the general requirements of the task.

1.4 The Current Study

Given the previous logic explained above, the relationship between epistemic beliefs and academic performance is a reciprocal one. In this relationship, epistemic beliefs lead to a certain level of academic performance. On the other hand, situational factors or task demands such as time pressure, teacher expectation, classroom culture, and assessment techniques might lead the student to adopt certain epistemic beliefs. We argue that task demands are adaptive mechanisms that determine how sophisticated the approach of handling the task should be and how much time and effort should be dedicated to it.

As the first step to test this conceptualization of the relationship between epistemic beliefs and academic performance, it might be reasonable to investigate this relationship among a group of high school students in United Arab Emirates (U.A.E.). UAE is a small country on the western coast of Arabian Gulf, with huge financial resources from oil that enable the government to provide its citizens one of highest income levels in the world. Although a lot of money and effort is invested into educational reform in UAE, the educational system there still depends on traditional, memory-based teaching strategies and assessment methods. Accordingly, such system can provide a good opportunity to study the effect of traditional teaching and assessment demands on learning goals and epistemic beliefs. In other words, the current research tries to see whether these low level demands can lead, even advanced students, to adopt immature epistemic beliefs? This characterization of the educational system in UAE (as a traditional one) can be evident in the literature about four basic aspects of the system: teaching, curriculum, assessment, and culture. As for **teaching**, there is strong indication that educational system in UAE and other Arab countries is teacher-centered, where teaching depends on traditional methods of lecturing and lacks generative techniques. In such system, students are passive recipients of the information given by the teachers (Babteen, 2006; Saleh, 2009). In regard to **curriculum**, educational studies about curriculum in the Gulf region indicate that information is presented in a fragmented style and lacks integrative perspective that enables the student to build relationships between pieces of information (Hendi, 2007). Moreover, it was found that curriculum in this region does not enhance critical thinking (Al-Nagdi, 2005), school achievement is not related to creativity in most subjects, except math (Abo-Galala, 2004). On the other hand, Researchers (e.g., Al-Shemri, 2005; Karam, 2000) who reviewed exams and **assessment** techniques in Emirati curricula found that assessment questions and tasks focus more on lower levels of Bloom's taxonomy, and ignore the ones that focus on analysis and evaluation. Finally, there is a general **cultural** tendency among Arab students, especially in the Gulf region, to accept authority as a main source of information. For example, it was found that Saudi students considers authority the main source of information (Al-Salhi, 2001) and Omani students were found to be more accepting of authority, as the source of information, than their American counterparts (Karabenick & Moosa, 2005). These results are consistent with data obtained from Arab Israelis (Tabak & Weinstock, 2008; Weinstock, 2010) who were found to be more respectful to authority and more likely to adopt an absolutist position than their Jewish counterparts.

With these aspects of the educational system in UAE in mind, it might be reasonable to hypothesize that this system requires students to approach learning on a surface level, develop superficial strategies, and have performance, rather than mastery, motivation. And these requirements make students more likely to adopt less mature epistemic beliefs. Moreover, academically higher students are more likely to adapt to these requirements and to show more sensitivity to them in comparison to average or academically lowerl students. Accordingly, it might be reasonable to expect that better students in such educational system will be more likely to adopt naive epistemic beliefs than low level students.

To verify these predictions, we divided students into three groups (high, medium, and weak levels), according to their academic performance in two different assessment formats: Exams and continuous evaluation across year or term (individual or group projects, activities, journals…etc.). Different epistemic beliefs of students belonging to different achievement levels were calculated and compared to study the relationship between them and academic performance in the light of task requirements and demands of the previously described educational system in UAE.

To sum up, we hope that the current research can shed light, from a cross cultural perspective, on the dynamics, manifestations, and variations of the relationship between epistemic beliefs and academic performance. More specifically, we aim to show how different task demands and situational factors might interact with the students' level and affect epistemic beliefs.

2. Method

2.1 Participants

165 students from public high schools in UAE participated in this study (50 males, and 115 females). Age range

was between 15 to 22 years, with average age 16.52 and standard deviation 1.30. Most of them (150) were living Abu Dhabi city, while the rest of them (15) were living in suburb areas. 118 of the participants were Emirati students, while 47 were descendents of expatriates living in UAE. In terms of the major, 58 participants were undetermined about major, while 57 participants were in Science section, and 50 participants were in Humanities section. While the sample seems too diverse (e.g., with significant imbalance between males and females, large age span, and mixture of students coming Emirati and non-Emirati cultural backgrounds), it reflects the demographical characteristics of the U.A.E. society, and its educational system.

Participants were divided into three groups: high, medium, and weak according to their performance on continuous, year work and final exams, as evaluated by their teachers. Accordingly, High level or advanced students were those in the upper quartile of the grades, and low level or weak students were those in lower quartile, while the rest of students were considered average level students. Number of students, percentages, and cutoff scores for each level in the both assessment methods are shown in Table 2.

Table 2. Number of students, percentages, and cutoff scores of students in the two levels of academic performance

	Continuous evaluation (Year work)			Exams		
Quartile	Number of students	Percentages	Cutoff scores	Number of students	Percentages	Cutoff scores
Low	43	26.1	55.51	39	23.6	77.04
Medium	78	47.3	71.46	81	49.1	85.42
High	44	26.7	83.14	45	27.3	92.80

2.2 Instrument

Students' epistemological beliefs were assessed by a standardized, Arabic version of the Epistemic Beliefs Inventory (EBI). EBI was originally developed by Schraw, Bendixen, and Dunkle (2002) as a self-report instrument that consists of 28 items. Participants evaluate each statement (item) using a 5-point Likert scale, where 1 corresponds to "strongly disagree" and 5 corresponds to "strongly agree". Participants circled the numbers that most closely matched their agreement with each statement. EBI measures the five dimensions of epistemological beliefs introduced by Schommer (1990) in her theory of epistemological belief system. These dimensions are quick leaning (QL), certainty of knowledge (CK), omniscient authority (OA), innate ability (IA), and simple knowledge (SK). The five beliefs are represented by 7, 5, 5, 6, and 5 items, respectively.

EBI is scored by adding up the scores on the items that represent every dimension separately to get a total score for each of them. In general, EBI items are written in the naïve direction (where higher scores indicate less mature beliefs). To avoid bias, four items were written in the sophisticated direction (where high scores indicate mature beliefs), and they are recorded in the opposite direction. Accordingly, an individual who completes EBI gets five scores, one for each of the dimensions of epistemological beliefs. High scores are taken to indicate more naïve beliefs.

Schraw et al. (2002) reported satisfactory psychometric data about the inventory. They showed high reliability of the inventory (test-retest reliability was 0.68 and Cronbach alpha was 0.83), and correlated the belief scores with reading comprehension test as a measure of EBI's predictive validity. The Arabic version of the EBI was prepared (Mohamed, 2008; In Press), where the statements were translated into modern standard Arabic, understood by almost every educated person in the Arab world. The Arabic version underwent a series of statistical analyses to investigate its psychometric properties, and determine its appropriateness to be used in the main study. A group of 43 Emirati students volunteered to participate in this standardization study. The average age of this group is 19.65 years. The inventory showed high level of reliability, as indicated by split-half correlation of .713, which reached.833 when corrected by Spearman-Brown formula. Cronbach alpha for the entire inventory was .863. Cronbach alpha coefficients for the five dimensions of EBI ranged from .624 to .837 (see Table 3). To determine its validity, the performance on the inventory was correlated with the performance on the Common Educational Proficiency Assessment (CEPA), which is a major test taken in grade 12 by all students who wish to go to colleges and universities in U.A.E. The logic behind correlating performance on EBI with the performance on CEPA exam to prove the validity of the EBI is the fairly established literature (as reviewed in the introduction) that indicates strong relationship between sophisticated epistemic beliefs and academic

performance. The total score on EBI correlated significantly with the students' CEPA scores (r = -.599) (note 1). The scores on the five dimensions of personal epistemology correlated highly with the CEPA scores. These correlations ranged from -.315 to -.659 (see Table 3). Item analysis showed that scores on most items negatively correlated with CEPA scores (between -.231 and -.694).

Table 3. Basic reliability and validity data of EBI

EBI Dimensions	Cronbach Alpha	Correlations with CEPA scores
Quick Learning (QL)	.837	-.659
Certainty of Knowledge (CK)	.711	-.541
Omniscient Authority (OA)	.687	-.315
Innate Ability (IA)	.663	-.578
Simple Knowledge (SK)	.624	-.623
Total	.863	-.599

Three items were removed because they showed low correlation with the total score and/or CEPA scores. These three items belong to the epistemic beliefs related to Quick Learning, Certainty of Knowledge, and Simple Knowledge dimensions. Accordingly, the Arabic version of EBI consisted of 25 items distributed over the five dimensions of epistemic beliefs so that there are 6 items in the Quick Learning dimension, 4 items in Certainty of knowledge dimension, 5 items in Omniscient Authority dimension, 6 items Innate ability dimension, and 4 items in Simple Knowledge dimension. In general, this data shows acceptable levels of reliability and validity for the Arabic version of EBI (for the details of the standardized Arabic version of EBI, see Mohamed, 2008; In Press).

To see whether the Arabic version of EBI includes the assumed five dimensions with the expected items in each dimension, the factorial structure of EBI was investigated. This was meant to be an additional procedure to provide evidence that the Arabic version of the EBI is a valid, trustworthy instrument to be used in the current research, In order to extract the factorial structure of the EBI, an exploratory factor analysis was conducted using principal component method and the initial structure was rotated using Quartimax rotation method. The input correlational matrix consisted of the current research participants' responses to the 25 items in the Arabic version of the EBI and the total sum of each of the presumed five dimensions of the inventory. It was found that eight factors with eigenvalue more than 1were extracted from the matrix, and accounted for 56.01% of the variance. As can be seen in Table 4 below, EBI items and dimensions were generally found to be highly saturated on five of these eight factors, which corresponded to the five dimensions in the EBI. In addition to the items with high saturation on each of these five factors, the other items were mostly either negatively or marginally saturated on these factors.

2.3 Procedures

Before collecting the data, guardians were contacted by mail and/or phone to give them a brief idea about the research and ask for their permission for children to participate. Those who approved their children's participation in the study were sent consent form to read and sign. On average, it took the participants 15 to 20 minutes to fill the inventory in the classrooms. After the participants finished filling the inventory, one of the authors briefed them about the research purposes and answered their questions for about five minutes.

Table 4. Factorial structure of the Arabic version of the EBI

	Components							
Items	1	2	3	4	5	6	7	8
Ql	062	**.889**	.112	.207	.159	-.102	-.002	-.061
Ck	.066	.007	-.010	.031	.160	-.106	**.909**	-.008
Oa	**.872**	-.061	.005	.320	-.082	.058	.008	.013
Ia	-.035	.066	.044	-.038	.391	**.840**	.046	.210
Sk	.074	.118	**.900**	-.033	.059	-.007	.096	.222
i1	.247	**.218**	.101	-.151	.358	-.140	.188	-.279
i3	.193	**.592**	-.332	-.246	.192	.021	-.091	-.179
i9	-.022	**.562**	.076	.157	-.066	.267	.006	.151
i15	-.073	**.586**	.080	-.051	-.404	.088	.122	.020
i20	-.215	**.344**	.231	.131	.378	-.165	.041	.070
i27	.050	**.339**	.211	.536	.074	-.036	-.065	.125
i2	.050	.135	-.149	-.052	.388	-.173	**.453**	.205
i18	-.096	.055	.000	.574	-.174	-.122	**.355**	-.046
i23	.009	.002	-.008	.047	-.041	.113	**.663**	-.010
i28	.067	-.138	.135	-.452	.153	.016	**.395**	.052
i4	**.409**	-.248	.028	.375	-.211	.016	.188	-.201
i7	**.712**	.003	.023	.005	.149	-.063	-.080	.002
i16	**.523**	.093	-.193	.202	.031	-.062	.033	.426
i19	**.223**	-.193	.144	.559	.030	.194	-.140	-.271
i25	**.579**	.095	.014	-.214	-.131	.078	.145	-.100
i5	.190	.180	-.196	.434	.190	**.236**	.102	.051
i8	.065	.150	-.178	.106	.085	**.691**	.072	-.097
i12	-.027	.031	.212	-.029	-.099	**.703**	-.122	.015
i13	-.177	-.098	.079	-.212	.197	**.273**	.025	.549
i24	.011	-.023	-.021	.040	.265	**.593**	.115	.037
i26	-.121	-.037	.183	-.412	.346	**.430**	-.015	.029
i10	-.069	.122	**.487**	.153	.084	-.031	-.070	.161
i11	.036	.064	**.202**	-.018	.027	-.124	.018	.747
i14	-.090	-.052	**.411**	.106	.245	-.144	-.116	-.320
i17	.054	-.061	**.703**	-.199	-.106	.215	.009	-.146

3. Results

Table 5 below includes means, standard deviations, minimum and maximum values, skewness and kurtosis values, and their standard errors of the five dimensions of epistemic beliefs comprising the EBI (n = 165). As can be seen in the table, it seems that distribution of the data follows the normal distribution curve as none of the skewness or kurtosis values reached or exceeded 2 of its SE.

Table 5. Means and standard deviations of major Epistemic beliefs in Epistemic Beliefs Inventory

	M	SD	Min	Max	Skewness	SE	Kurtosis	SE
Quick Learning (QL)	62.20	09.76	40.00	85.71	.093	.189	-.541	.376
Certainty of Knowledge (CK)	58.50	11.92	32.00	96.00	.166	.189	-.286	.376
Omniscient Authority (OA)	66.93	14.93	7.00	100.00	-.247	.189	.724	.376
Innate Ability (IA)	58.93	12.20	26.67	100.00	.246	.189	.521	.376
Simple Knowledge (SK)	57.21	12.16	28.00	92.00	.229	.189	.527	.376

In presenting the main results, we focus on comparing epistemic beliefs of students with different levels of academic achievement (high, medium, and low) in the two formats of assessment (exams and continuous evaluation). Accordingly, we conducted a 3 X 2 Manova of the data, where the five different dimensions of the EBI were the dependent variables, and the three levels of achievement in each of the assessment formats were the independent variables. Figures 1 and 2 below show graphical representations of the results of the exams and continuous evaluation, resAs can be seen in the figures, there is a general trend of results that indicates that high achievers (academically high and medium level students) are less epistemologically mature (except for IA) than academically low level students (notice that higher grade on one of EBI dimensions means less mature belief). In what follows, main aspects of the results will be presented according to the assessment format.

(1) Exams: Although the general pattern of results, the only significant difference between different levels of academic achievement on Exams was in Quick Learning (QA) dimension ($F(162,2) = 2.846$, $p < .061$), and Bonferroni Post hoc analysis shows academically high level students got significantly higher scores on this dimension than academically low level students (Mean difference = 5.6575, $p < .024$).

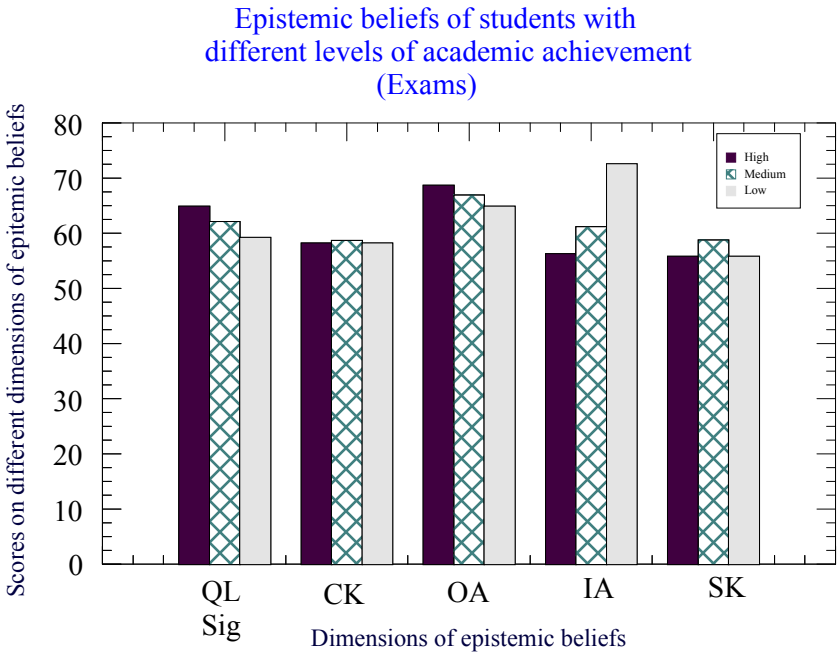

Figure 1. Epistemic beliefs of students with different levels of academic performance (exams)

(2) Continuous evaluation: The same pattern of results for exams was found for continuous evaluation, where advanced students tended to have more naïve epistemic beliefs than weak students.. However, the only significant difference between different levels of academic achievement on Continuous evaluation was in the Omniscient Authority dimension ($F(162, 2) = 3.748$, $p < .026$), and the Simple Knowledge dimension ($F(162,2) = 6.390$, $p < .002$) of epistemic beliefs. As for the former dimension of Omniscient Authority, Bonferroni Post hoc analysis shows that average level students scored significantly higher than low level students (Mean difference = 7.4448, $p < .027$). As for the latter dimension of Simple Knowledge, average level students scored

significantly higher than low level students (Mean difference =6.3548, $p < .015$).

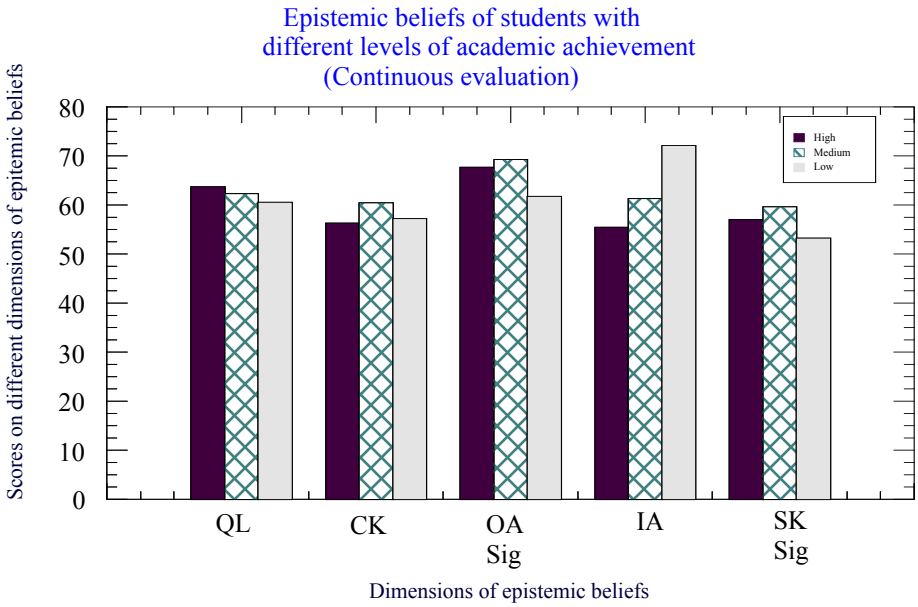

Figure 2. Epistemic beliefs of students with different levels of academic performance (continuous evaluation)

The only exception to the pattern mentioned above is the results of the Innate Ability (IA) dimension of epistemic beliefs, where the weak students scored higher on this dimension than average and high level students (which can be seen in the Figures 1 and 2). Although none of these differences (in the 2 assessment formats) reached statistical significance (probably because of the high standard deviation of this dimension), the correlation between IA scores and continuous evaluation grades was negatively significant ($r = -.155$, $p < .046$), which means that those with higher grades have more mature epistemic belief that hard work is needed in order to get high grades.

Another important aspect of the results that needs to be emphasized is that this pattern of results, in which academically more advanced students get higher scores on EBI dimensions, is almost the same for both formats of assessment (exams and continuous evaluation). This is evident through the lack of interaction between different levels of performance on Exams and Continuous evaluation for the five dimensions of EBI.

Moreover, a series of Manova analyses were conducted to see whether the pattern of results of both assessment formats might change depending gender (male vs. female), country of origin (Emirati vs. expats), or domain of study (science vs. Humanities). The lack of any significant interaction between the two assessment formats and any of these modifying factors showed that the same pattern of results, mentioned above, was true regardless of gender, country of origin, or the domain of study.

4. Discussion and Conclusions

This study investigated the relationship between epistemic beliefs and academic performance of high school students in United Arab Emirates. Reviewing literature (see the introduction) shows that despite some anomalies and contradictions (e.g., Cano & Cardelle-Elawar, 2004; Gow et al, 1989; Kembe, 2000; Ricco et al, 2010; Tsai et al, 2011), the general trend is that more epistemologically advanced students usually outperform students with naïve epistemic beliefs (e.g., Chen & Pajares, 2010; Kembe, 2001; Lodewyk, 2007; Many et al, 2002; Peng & Fitzgerald, 2006; Ryan, 1984; Schomme, 1990; Schommer et al, 1992, 2005, 2006; Stathopoulou & Vosniadou, 2007; Stroeger, 2006). This effect was attributed to the role of epistemic beliefs in setting up goals and standards, and strategy selection, which eventually affect academic performance (see Hofer & Pintrich, 1997; Schommer, 1998, and more recently, Muis, 2007). We compared the epistemic beliefs of students with different academic levels (high, average, and weak) as classified according to their performance on exam and continuous evaluation assessment.Unlike most, but not all, similar research it was found that more advanced students have more naïve beliefs than their weak counterparts, who tend to have more mature epistemic beliefs. This was the case for three epistemic beliefs (Quick Learning, Omniscient Authority, and Structure of Knowledge) but advanced students

were more mature only in the Innate Ability dimension.

The results of Quick Learning dimension indicate that better students consider learning an all-or-none process of acquiring knowledge, which should be fast without much room left for higher level processes such as analyzing, synthesizing, evaluation, or elaboration. Accordingly, in preparing for exams, it can be expected that students will focus on accumulating large sets of superficial information that can be retrieved easily in the exams, rather than on constructing their own structure of knowledge.

This result is consistent with previous findings (Al-Shemri, 2005) indicating that exam questions in gulf region schools are general and address only the lower levels of Bloom's taxonomy of abilities such a remembering, comprehension, and application. With such level of questions, it is not a surprise that in order to get high grade students need to adopt a belief in quick learning.

On the other hand, the Omniscient Authority (OA) dimension of EBI is about obeying authority. In the Arab world, the results of this dimension are consistent with the traditional role of teacher in the teacher-centered educational systems (like in UAE), and the importance of fulfilling the teacher's expectations. Moreover, it is consistent with the common finding that adherence to authority rules and traditions is a basic epistemic beliefs amongst Arab (Al-Salhi, 2001; Karabenick & Moosa, 2005; Kuhn & Weinstock, 2002; Weinstock, 2010), and Asian (Gow et al, 1989; Kember, 2000; Tsai et al, 2011) students.

As for the Simple Knowledge (SK) dimension of epistemic beliefs, it refers to dealing with knowledge as separate, isolated pieces of information rather than a network of interrelated concepts. If Simple Knowledge belief is adopted by high level students, this is consistent with previous research that indicates the need for an integrative education that integrates skills and information in Emirati schools, rather than focusing on isolated pieces of information (Hendi, 2007).

Having high scores on these two dimensions (OA and SK) among high level students in the continuous evaluation is consistent with previous findings about the dominant role of teacher in these activities, on one hand, and simple nature of tasks and project required from students as part of continuous evaluation in Emirati schools, where learning is basically teacher-centered, and teachers' expectations need to be taken seriously into consideration even in preparing individual projects (Abu Galala et al, 2004). That trend is also consistent with the lack of critical, independent thinking in classrooms and in the educational system (Al-Nagdi, 2005).

As for the Innate Ability pattern of results, where more advanced students get lower scores on this EBI dimension than academically low students, it provides more support to the idea that students self regulate their learning goals and, subsequently, their adopted epistemic beliefs. That is, in the first 3 dimensions discussed above, good students adopted naïve beliefs that were useful given the tasks' demands. However, these students understood that it was necessary to work hard in order to satisfy the requirements. The results, in general, also emphasize the asynchronous nature of epistemic beliefs (Schommer-Aikin, 2004), where the same person might have different levels of maturity for the different dimensions of epistemic beliefs, at the same time.

The study has three major implications to studying epistemic beliefs. First, in discussing the literature, we emphasized the reciprocal nature of the self-regulated learning strategies, where not only will epistemic beliefs affect academic performance, but also chosen strategies and situational factors such as nature of the task, task demands, time pressure, and the relative impact of the task can affect the adopted epistemic beliefs. Accordingly, we hypothesized that advanced students in certain circumstances (such as traditional, expository teaching, assessment that focus on low level skills, and fragmented curriculums) might adopt less sophisticated epistemic beliefs that fit better and enable these students to perform well in such system. The traditional, developing educational system in UAE provided us with good opportunity to test this hypothesis. The results support our conceptualization of the reciprocal relationship between learning goals determined by situational factors (task demands) and epistemic beliefs. That is, students were able to accommodate beliefs that make it more likely to improve their performance (choosing beliefs that fit with the system requirements) regardless of maturity/naivety issue; something that adds more dynamic dimension to epistemic beliefs. Second, this emphasis on the reciprocal relation between epistemic beliefs and academic needs can provide an explanation to the contradictions found in the literature regarding the relationship between epistemic beliefs and academic performance. That is, these contradictions can be explained in the light of the different demands and learning strategies induced by different learning situations or educational systems. Third, the study provides a cross cultural validation of the main concepts of epistemic beliefs especially in relation to academic performance. Considering epistemic beliefs in the light of characteristics and circumstances of different educational systems provides more natural experimentation of the relationship between epistemic beliefs and learning.

Of course, we are aware of the limitations of this study. For example, we still need to find out the role of

different factors in establishing this match between educational system requirements and situational circumstances, on one hand, and epistemic beliefs, on the other hand. These factors can include, among other factors, different kinds intelligence (e.g., academic, social, practical intelligence), flexibility, locus of control, …, etc. On the other hand, improving psychometric properties of epistemic belief measures, and issues of using them in non-Western cultures and the equivalency of content between original and standardized versions should occupy high position in the researchers' priority list. These limitations and others indicate that the area of epistemic beliefs will remain an active area of research for many years to come.

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Note

Note 1. The negative correlation indicates that students with low CEPA score usually have high (immature) EBI score.