EPISTEMOLOGICAL BELIEFS OF UNDERGRADUATE STUDENTS AS FUNCTION OF GENDER AND ACADEMIC LEVEL

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Abstract: Epistemological beliefs are those concerning the structure or the nature of knowledge and knowing, including definitions of knowledge, how knowledge is constructed, how knowledge is evaluated, and reflects the viewpoint of the individual about what and how knowledge can be acquired and the degree of certainty. The present study sought answers to the following questions: What are the overall epistemological beliefs of undergraduate students? Do epistemological beliefs of undergraduate students differ by gender? Do epistemological beliefs of undergraduate students differ by academic level? Epistemological beliefs scale comprising 62 items measuring five components of beliefs (i.e. Quick Learning, knowledge, Certain Knowledge, Omniscient authority, innate ability, and simple knowledge) was administered to a sample of 154 undergraduate students from the Faculty of Education at University of Malaya. Descriptive statistics, Two way MANOVA, multiple comparisons, and ANOVA analyses were used. Results indicated that: (1) participants had sophisticated beliefs on Innate ability, whereas they had a naïve belief on Certain knowledge, (2) males scored higher than females in innate ability, whereas both males and female are similar in Quick Learning, Certain Knowledge, Omniscient authority, and simple knowledge), (3) Quick Learning and Innate ability were found to decrease with increase in academic level.

Keywords: Certain Knowledge, Innate ability, Omniscient authority, Quick Learning, Simple knowledge.

INTRODUCTION

Epistemology is the investigation into the grounds and nature of knowledge itself. The study of epistemology focuses on our means for acquiring knowledge and how we can differentiate between truth and falsehood. Schommer [20] defined personal epistemology as "a belief system that is composed of several more or less independent dimensions" [20]. These beliefs are linked to cognitive processes [22]. Not surprisingly, a growing body of work provides evidence that personal epistemology is an important component of student learning. [10]. Epistemology is important because it is fundamental to how we think. Without some means of understanding how we acquire knowledge, how we rely upon our senses, and how we develop concepts in our minds, we have no

coherent path for our thinking. In conclusion, epistemological belief theories will help us to provide information about the students' beliefs and their thinking about knowledge, so educators and teachers will design classroom teaching and learning processes in terms of students' beliefs.

Most epistemological beliefs range from simple ideas to complex ideas. The simple ideas contain the beliefs that truth is certain and omniscient and transferable by the Authority. The complex ideas are those which refer to beliefs that the truth is relative and changeable and could be built actively by the person. Schommer [22] realized that sophisticated learners in thinking may believe that there is a large amount of developable knowledge and there is another knowledge that should be explored and a small amount of knowledge is fixed or constant. She also realized that simple-minded learners might believe that a great amount of knowledge is certain, some knowledge should be explored and a small amount of knowledge is subject to change.

Schommer [20] offers a more simplistic quantified view of students' beliefs about the nature of knowledge by contending that individuals possess multiple beliefs about the nature of knowledge and learning, and that these beliefs exist as a multidimensional system or more or less independent beliefs. According to Schommer, epistemological beliefs compressed five dimensions: Simple Knowledge: knowledge is simple rather than complex, Omniscient Authority: knowledge is handed down by authority rather than derived from reason, Certain Knowledge: knowledge is certain rather than tentative, Innate Ability: the ability to learn is innate rather than acquired and Quick Learning: learning is quick or not at all rather than gradual. Hofer and Pintrich [11], unlike Schommer, suggested that epistemological theories consist of four dimensions: Certainty of Knowledge, Simplicity of Knowledge, Source of Knowledge and Justification for Knowing.

Several studies investigated students' beliefs about nature of knowledge and knowing and focused on the factors influencing students' beliefs in the learning and teaching process. Among them are gender, grade level ([5, 6, 7, 8, 15, 21, 26]). For example, Lodewyk [15] indicated that girls had significantly more sophisticated beliefs in fixed and quick ability to learn and certain knowledge than boys. The boys had naive beliefs that one's ability is predetermined, that learning occurs quickly, and that knowledge is certain. In contrast, Trautwein and Lüdtke [28] indicated that no significant correlation existed between certainty beliefs and gender and age.

Cano [5] indicated that boys were significantly different in quick learning, fixed ability, and certain knowledge at the three school levels; boys' epistemological beliefs become less naive and more realistic as they advance through high school. On the other hand, the girls had significant differences in simple knowledge, fixed ability, and certain knowledge with respect to school level; girls' epistemological beliefs also become more realistic as they went through high school. Conley et al. [6] found no main effects of the gender. Schommer and Dunnell [19] found a significant difference between boys and girls with respect to fixed ability and quick learning, and boys were more likely to believe in these dimensions while Elder [7] indicated that epistemological beliefs do not differ by gender. Schommer [21] suggested that gender and grade level had an impact on the students' epistemological beliefs. Furthermore, he indicated that there was no significant interaction between gender and grade level.

In conclusion, the studies about adults' and young people's epistemological beliefs show that epistemological beliefs also vary with respect to gender and educational level. Furthermore, results from the previous studies were inconsistent and even contradictory.

THE PURPOSE OF THE STUDY

One of the factors possibly affecting student performance was discussed as students' epistemological beliefs by Schommer et al. [26] who stated that epistemological beliefs play an important role in the instruction process. Furthermore, Tsai [29] found a positive relation between epistemological beliefs and the instructional environment.

The importance of epistemological beliefs appears in its impact upon the beliefs that are related to learning and teaching in some cases and on the way the individual deals with learning and teaching in certain cases. This is important to the individuals who prepare teachers and desire to help students in developing accumulating thoughts about teaching and learning. In addition, the students' epistemological beliefs appear at the levels of knowledge participation in classroom academic assignments particularly when the students are keen to continue the assignments. Concerned studies show that academic performance of students is affected by their beliefs about the nature of knowledge .

Several studies investigated students' beliefs about the nature of knowledge and knowing and focused on the factors influencing students' beliefs in the learning and teaching process. Among them are gender, age, grade level. Briefly these studies revealed that epistemological beliefs change as a function of students' gender and grade level. In the light of these findings, the current study is conducted

to determine the students' epistemological beliefs with respect to gender, and grade level.

In this study, undergraduate students' epistemological beliefs are examined to provide a contribution to the learning process. This study provides opportunity to determine whether there is a gender related difference in student's epistemological beliefs or not. Furthermore, this study tries to explore the impact of academic level on students' epistemological beliefs. The results obtained from the current study may be used to enhance students' learning process, learning environment, the lecturer teaching methods, and the counselor counseling techniques. By knowing the students' epistemological beliefs lecturer have an idea and may plan instructional activities to develop students' epistemological beliefs. On the other hand, in Malaysia the studies about undergraduate students' epistemological beliefs are rare. To date, to the best of our knowledge, no studies have investigated the effect of academic level on epistemological beliefs of the students in Malaysia. In conclusion, this study can be considered as one of the initial attempts to provide information about the students' beliefs about the nature of knowledge and knowing to arrange the conditions of learning and instruction**.**

Also, the present study tried to investigate the validity of these assumptions within the undergraduates of the Faculty of Education at the University Malaya. It identifies the level of epistemological beliefs of the students, and examines the existence of difference in students' beliefs about the nature of knowledge with the difference in students' level of education and gender. Then, the purpose of the present study is to seek answers for the following questions: (a) what are the overall Epistemological beliefs of undergraduate students? (b) Do epistemological beliefs of undergraduate students differ by gender? (c) Do epistemological beliefs of undergraduate students differ by academic level?

METHODOLOGY

Samples

The population of the study comprised all undergraduate students in the Faculty of Education, University of Malaya. A total number of 154 undergraduate students from different academic level participated in the study.

Instrument

Schommer's [20] scale of Epistemological beliefs comprising 63 paragraphs distributed in five dimensions (namely: Quick Learning, Certain Knowledge, Omniscient authority, innate ability, and simple knowledge) was adopted to be congruent for the Malaysian environment. Accordingly, the current study developed a 62-item questionnaire to measure students' epistemological beliefs. The items were arranged for scoring using a 5-point Likert-type response scale, and the positive items were scored by the following key: 5= *strongly agree*, 4 = *agree*, 3 *undecided*, 2 = *disagree*, and 1 = *strongly disagree*. Also, the negative items were reverse coded in order that meaningful analyses at the sub-scale level could be conducted.

The Cronbach's alpha coefficients calculated for the quick learning, certain knowledge, omniscient authority, innate ability, and simple knowledge subscales were .79, .71, .69, .75 and .85, respectively, and it was calculated to be .86 for the entire scale. The scale correlation coefficients ranged between .36 and .46 on quick learning, between .37 and .57 certain knowledge, and between .35 and .60 on omniscient authority, between .37 to .57 on innate ability, and between .37 to .67 for simple knowledge. It is generally agreed that correlations in the range of .35 to .65 are useful and statistically significant beyond the 1% level, whereas correlations less than .25 are not useful and statistically non significant ([3, 4]). Thus, the results show that the alpha coefficients for all subscales were significantly high, suggesting that the internal reliability index of the five constructs and the entire scale is adequate.

In addition, Table 1 presents the results of inter correlations and shows that each subscale correlates significantly with other subscales and the entire scale. According to Harrison, Seeman, and Behm [9], this result provides at least further evidence for the consistency of the entire scale and for the convergent validity of each subscale. Therefore, it can be concluded that the three factors measure calculator attitudes in a coherent way. All subscales correlate significantly at the $p < .01$ level and the coefficients range from .276 to .738. This suggests that the five components were fairly independent to be used as independent variables. This allows us to examine the epistemological belief of students by each subscale.

Data analysis

In data analysis, average and MNOVA (dimensions) and ANOVA were used to examine the existence of differences in epistemological beliefs of undergraduates at the Faculty of Education with the differences in gender and educational level. In addition, posthoc analysis was used to identify whether there is development in students' beliefs or not according to their educational levels.

Table 1: Correlation Matrix of the Subscale

Subscale	Quick learning	Certain knowledge	Omniscient authority	Innate ability	Simple knowledge	Entire scale
Quick learning	1	.288**	.289**	.518**	.285**	.738**
Certain knowledge	.288**	1	.389**	.434**	.276**	.561**
Omniscient authority	.389**	.289**	1	.328**	.435**	.386**
Innate ability	.518**	.434**	.328**	1	.333**	.685**
Simple knowledge	.285**	.276**	.435**	.333**	1	.453**
Entire scale	.738**	.561**	.386**	.685**	.453**	1

**Correlation is significant at the .01 level (2-tailed).

Table 2: Descriptive Statistics for Each Subscale (n=154)

Subscale	Mean	Std. Deviation
Quick learning	2.70	4.05
Certain knowledge	3.43	3.15
Omniscient authority	3.01	3.54
Innate ability	2.50	4.93
Simple knowledge	3.09	3.26
Entire scale	2.95	10.97

Table 3: Results of Two way MANOVA Analysis for Differences Between the Means of the Students in the Four Educational Levels (years) in The Components of Epistemological beliefs.

Source	Component	Sum of squares	Df	Mean square	*F*- value	*p*-value
Gender	**Quick learning**	33.54	1	33.54	1.60	.21
	Certain knowledge	9.68	1	9.68	0.99	.32
	Omniscient authority	10.44	1	10.44	0.81	.37
	Innate ability	103.76	1	103.76	5.40	.02
	Simple knowledge	6.79	1	6.79	0.65	.42
Academic level	**Quick learning**	213.92	3	71.31	4.84	.00
	Certain knowledge	30.70	3	10.23	1.05	.37
	Omniscient authority	16.23	3	5.41	0.42	.74
	Innate ability	414.75	3	138.25	7.20	.00
	Simple knowledge	80.10	3	26.70	2.56	.06
Gender* level	**Quick learning**	26.22	3	8.74	0.59	.62
	Certain knowledge	21.06	3	7.02	0.72	.54
	Omniscient authority	20.79	3	6.93	0.54	.66
	Innate ability	38.13	3	12.71	0.66	.58
	Simple knowledge	47.67	3	15.89	1.53	.21

Table 4: Results of Multiple Comparisons (Scheffe Test) for the Differences between the Means of the attitudes in various educational levels in epistemological beliefs

		First	Second	Third	Forth
Quick learning	First	------	-2.96	-3.62**	-1.07
	Second	------	------	-0.65	- 1.90
	Third	------	------	------	-2.65*
	Forth	------	------	------	------
Innate ability	First	------	-6.39*	-6.04**	-2.89*
	Second	------	------	- 0.35	- 3.50
	Third	------	------	------	-3.15**
	Forth	------	------	------	------
Total	First	------	-5.79	-9.14**	-3.56
	Second	------	------	-3.35	-2.23
	Third	------	------	------	-4.58*
	Forth	------	------	------	------

*significant at α = .05, ** significant at α = .01

Table 5: Results of Two way ANOVA Analysis for Differences Between the Means of the Students in the Four Educational Levels (years) in Epistemological beliefs.

Source	Type III Sum of Squares	Df	Mean Square	*F*	*p*-value
Corrected Model	2393.393[a]	7	341.913	3.117	.004
Intercept	1474759.401	1	1474759.401	1.345E4	.000
Gender	307.063	1	307.063	2.800	.096
Level	973.767	3	324.589	2.960	.034
gender * level	39.008	3	13.003	.119	.949
Error	16012.822	146	109.677		
Total	5179739.000	154			

RESULTS

Overall profile of the students' epistemological beliefs were measured in terms of the quick learning, certain knowledge, omniscient authority, innate ability, and simple knowledge. All 154 participants responded to all items in the scale and no missing data was found in the survey.

According to Birisci, Metin, and Karakas [2], ranges of agreement with the attributions on the survey were determined by using the (n-1)/n formula and after calculation the interval width of the range between 1 through 5 was calculated as 0.8. As such, the interval width of 1-1.80 showed very low level (strongly disagree), the 1.81-2.60 interval showed low level (disagree), the 2.61-3.40 interval showed medium level (undecided), the 3.41-4.20 interval showed high level (agree) and the 4.21-5.00 interval showed very high level (strongly agree) of agreement with the statement on the survey.

Table 2 presents the participants' mean scores with the standard deviations of the five subscales. The participants scored the lowest on innate ability (mean = 2.50); as such, the participants have sophisticated beliefs about Innate ability. The means scores of participants beliefs about quick learning, omniscient authority, and simple knowledge subscales are (mean = 2.70, 3.01, and 3.09) respectively. The means scores indicated that the participants have a medium (undecided) belief about quick learning, omniscient authority, and simple knowledge. The participants scored highest on the certain knowledge subscale (mean=3.43); as such, the participants have naive beliefs about certain knowledge.

Preliminary assumption testing was conducted to check for multivariate normality and equality of variance. No violations were found on multivariate normality and equality of variance.

A two way, between groups multivariate analysis of variance was performed on the five dependent variables (quick learning, certain knowledge, omniscient authority, innate ability, and simple knowledge) for year level domain (first, second, third, and fourth). There were significant differences by level domain on the combined dependent variable epistemological beliefs: $F(15, 138) = 2.71$, Wilks' lambda = 0.76, $p < .01$. For gender, there is no significant difference by gender on the combined dependent variable epistemological beliefs: F (5, 148) = 1.44, Wilks' lambda = 0.05, $p > .05$. Also, no significant differences were found for the interaction between gender and level: F (15, 138) = 0.91, Wilks' lambda = 0.91, $p > .05$. Table 3 shows the results of two way MANOVA analysis to explore the differences between the means of the students' attitudes in the various educational levels (years) in epistemological beliefs.

Table 3 shows that the four groups (level domain) differ in Quick learning: F (3, 150) = 4.84, $p < .01$; and Innate ability $F(3, 150)=7.20$, $p < .01$. Table 3 shows that no significant difference existed in: Certain knowledge F (3, 150) = 1.05, $p > .05$; Omniscient authority F (3, 150) = 0.42, $p > .05$; and Simple knowledge F (3, 150) = 2.56, $p > .05$.

Table 3 shows that males scored higher than females in Innate ability $F(1, 152) = 5.40$, $p < .05$, whereas no significant gender differences in Quick learning; $F(1, 152)= 1.60$, $p > .05$; Certain knowledge $F(1, 152) = 0.99$, $p > .05$; Omniscient authority $F(1, 152) = 0.81$, $p >.05$; and Simple knowledge F(1, 152) = 0.65, $p > .05$.

Table 3 shows no significant effects for the interaction between level and gender in Quick learning; $F(3, 150)= 0.59$, $p > .05$; Certain knowledge $F(3, 150)= 0.72$, $p > .05$; Omniscient authority $F(3, 150)= 0.54$, p>0.05; Innate ability $F(3, 150) = 0.66$; Simple knowledge $F(3, 150) = 1.53$, $p > .05$.

To explore the significance of the dual performance differences between the students attitudes in the various educational levels in art epistemological beliefs, multiple comparisons (i.e., Scheffe Test) were used. Table 4 shows the results of Scheffe Test to explore the significance of attitudes differences between the pair wise means of the students' attitudes in various educational levels in epistemological beliefs.

Table 4 shows: (a) Third year student scored significantly higher than first year student on quick learning subscale, as such, students at third year level had less sophisticated beliefs about quick learning than first year students. (b) Forth year student scored significantly higher than third year student on quick learning subscale, as such, students at forth year level had less sophisticated beliefs about quick learning than third year students. (c) Second year student scored significantly higher than first year student on Innate ability subscale, as such, students at second year level had less sophisticated beliefs about Innate ability than first year students. (d) Third year student scored significantly higher than first year student on Innate ability subscale, as such, students at third year level had less sophisticated beliefs about Innate ability than first year students. (e) Forth year student scored significantly higher than first year student on Innate ability subscale, as such, students at forth year level had less sophisticated beliefs about Innate ability than first year students. (f) Forth year student scored significantly higher than third year student on Innate ability subscale, as such, students at forth year

level had less sophisticated beliefs about Innate ability than third year students.

To explore the effect of the level and gender variables on the epistemological beliefs, two way analysis of variance was used. Table 5 shows the results of two way ANOVA analysis for differences between the means of the students in the forth educational levels (years) in Epistemological beliefs

Table 5 shows that there is no significant gender difference in epistemological beliefs $F(1, 152)= 2.80$, $p > .05$, whereas there is significant differences of the level domain in epistemological beliefs $F(3, 151)= 2.96$, $p< .05$.

DISCUSSION

Data analysis revealed that the participants of the current study generally had fairly sophisticated beliefs about innate ability, implying that students believe that they can learn how to learn and their ability developed and not fixed. Students who hold this belief will make much effort to learn. On the other hand, the participants of the current study generally had fairly naive beliefs about the certain of knowledge, implying that student's belief that knowledge is absolute and certain. Students believe that things are black or white, true or false, right or wrong; it is commonly found that these beliefs are held by students in the first year. At this level, students want the lecturer to give them an answer. In addition, they may not be open to exploring or, in some cases, even being exposed to alternative explanations of the world [23]. The highest mean of the certain knowledge can be considered logical when the student's environment is taken into account. Some issues to the students are changing. The moderate mean of simple knowledge can be attributed to the weakness in directing the students by educational institutions which do not improve the student's ability to deal with difficult issues.

Furthermore, the present study indicates moderate beliefs about Quick learning, Omniscient authority, and Simple knowledge.

The moderate mean for quick learning can be attributed to absence of fixed criteria for learning method among the students. The respondents are sometimes concerned and concentrate on main ideas which, according the students, carry the most importance, while the same individuals see that some issues do not require concentration which they consider a pure waste of time. The moderate mean for Omniscient authority can be attributed to the education system and educational process which are not built up on solid bases. Some lecturers dictate the information to the students leaving them with no chance to prove or to express their own thoughts or to search and be a producer rather than just a listener. Others direct their students to search and read without limiting the students to a specific set of information.

The results of the present study are consistent with previous studies (e.g., [6, 14, and 17]). Kızılgüneş [14] stated that the students generally have tentative epistemological beliefs in the Innate ability. On the other hand, the results of the present study are inconsistent with previous studies (e.g., [6, 14, and 17]). For example, Özkal [17] found that the students have slightly more tentative views of epistemological beliefs and they tended to believe knowledge can change by time and it is not certain. In conclusion, researchers results differ from country to country.

To explore the impacts of the gender on students' epistemological beliefs, multivariate analyses of variance (MANOVA) was conducted. The results showed that there was a statistically significant gender related difference on the students' Innate ability, in favor of girls, whereas no significant differences in Quick learning, Certain knowledge, Omniscient authority, and Simple knowledge were found. The reason of the significant difference between girls' and boys' epistemological beliefs can be explained with Cano's [5] claim that girls had more realistic beliefs about knowledge compared to boys. Therefore, the girls need to strengthen their knowledge with evidence, experiments, and data. These findings seem to be consistent with some of the previous studies (e.g. [6, 7, 19, and 27]). For instance, Topçu and Yılmaz-Tüzün [27] identified that the girls had more sophisticated beliefs in Innate Ability. Conley et al. [6] found that boys and girls were not different with respect to Source of Knowledge, Certainty of Knowledge, and Development of Knowledge. They observed that boys and girls had similar beliefs about nature of knowledge and knowing. On the other hand, Elder [7] reported that there was no differences between girls and boys with respect to authority, certainty, developing, and reasoning.

Results of the present study are inconsistent with some of the previous studies (e.g., [1, 15, 16, 17, 18, 19, 21, and 27]). For example, Topçu and Yılmaz-Tüzün [27] identified that the girls attending to fourth and fifth grade had more sophisticated beliefs in Quick Learning, and the girls attending to sixth and eighth grade had less sophisticated beliefs in Omniscient Authority. Also, Schommer [21] stated that girls were less likely to believe in fixed ability and quick learning. Furthermore, Lodewky [15] stated that the girls had significantly more sophisticated beliefs in Fixed and Quick Ability to learn and certain knowledge than boys. Lodewyk argued that boys tended to believe that learning occurs quickly and knowledge is certain.

The present study failed to indicate a statistically significant difference between girls and boys with respect to Quick learning, Certainty of knowledge, Omniscient authority, and Simple knowledge which means that girls and boys tended to have very similar beliefs about these epistemological beliefs. This result is encouraging in terms of reducing the gender gap at least in Source of Knowledge, Development of Knowledge, and Certainty of Knowledge. Furthermore, it reflects that the Malaysian government offers the same opportunities to both genders in each sector of life.

Results of the present study also revealed a statistically significant effect of grade level on students' epistemological beliefs (Quick learning and Innate ability). On the other hand, no statistically significant difference was found between academic levels of students with respect to Certain knowledge, Omniscient authority, and Simple knowledge. The results of data analysis showed a statistically significant difference between first, second, third, and fourth levels of students with respect to Quick learning and innate ability. In other words, lower year level students had more sophisticated beliefs about Quick learning and Innate ability and they tended to believe that the ability to learn is acquired through experience, and learning happens gradually. This means that sophisticated beliefs about these dimensions decrease with increasing year level.

In conclusion, the students' epistemological beliefs change with respect to grade level. In general, first year level students had more sophisticated beliefs compared to second, third, and fourth year level students, and fourth year level students had less sophisticated beliefs compared to first, second, and third year level students. Paulsen and Wells [18] observed a negative relationship between students' advanced level and their beliefs on Innate ability and quick learning These findings were surprising, because the students who are in fourth year level are at an academically advanced level when compared to first, second, and third year level. Furthermore, Jehng et al. [12] suggested that students' epistemological beliefs develop when they are administered to more advanced education. This can be attributed to the fact that the majority of the educational and learning programs provide the students with ready-made knowledge and mainly concentrate on limiting the students into the study plans and the decided courses. On the other hand, the lecturers are very keen to have the supremacy over the students and not to accept the others' opinions. This is no doubt contradicting with the development of epistemological beliefs which call for innovation.

The results of the current study are inconsistent with the previous studies (e.g., [5, 12, 13, and 21]). For instance, Schommer [21] found a significant grade level effect on the students' epistemological beliefs and stated that there was epistemological development during high school, and that the students' beliefs in Quick Learning changed significantly from freshman to senior year. Also, Cano [5] reported that as grade level increases, epistemological beliefs change, becoming less naive and simplistic, and more realistic and complex. On the other hand, Kahn's [13] study concluded that graduate students who were at advanced academic level had less naive beliefs in Certain Knowledge than undergraduate students and they tended to believe that knowledge is tentative rather than absolute. Also, Jehng et al. [12] found that graduate students had more sophisticated beliefs than undergraduate students in terms of Certainty of Knowledge, Omniscient Authority. On the other hand, the results of the current study revealed that there was no interaction between grade level and gender with respect to the dimensions of epistemological beliefs. In contrast, Neber and Schommer [16] found an interaction between grade level and gender.

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