A VALIDATION STUDY OF THE EPISTEMOLOGICAL BELIEFS QUESTIONNAIRE

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Abstract

This study aims to validate a questionnaire measuring the epistemological beliefs of school teachers. In order to study epistemological beliefs, the items were adapted from the questionnaires which are connecting with epistemological beliefs. Based on instruments, Epistemological Beliefs Questionnaire (EBQ), a five-point Likert type self-report questionnaire, is proposed and is investigated to show its validity in a random sample of 436 school teachers. Exploratory factor analysis showed that a five-factor structure of the epistemological beliefs composed of (1) belief in knowledge by experts, (2) belief in certainty knowledge, (3) belief in reasoning knowledge (4) belief in developing knowledge, and (5) belief in effort knowledge. Confirmatory factor analysis further confirmed the validity and reliability of epistemological beliefs as a five-factor construct. This Epistemological Beliefs Questionnaire (EBQ) can serve as a tool to evaluate the epistemological beliefs of school teachers.

Keywords: Epistemological Beliefs, Belief in Knowledge by Experts, Belief in Certainty Knowledge, Belief in Reasoning Knowledge, Belief in Developing Knowledge, and Belief in Effort Knowledge

Introduction

In our professional lives, we confront the learning of a new skill and make determination about their particular value. Epistemological beliefs play an important role in most academic experiences. Hofer clarifies how personal epistemology relates to learning and education in general. If epistemology is developmental and development is the aim of education, the goal of education is to foster epistemological development (Hofer, 2001, p. 367).

Furthermore, because epistemological thinking is a critical component of lifelong learning both in and outside of a classroom, epistemological beliefs impact the manner in which individuals resolve competing knowledge claims, evaluate new information, and make fundamental decisions that affect their own lives and the lives of others (Hofer, 2001, p. 354).

Educational psychologists have theorized epistemology to be "a person's implicit beliefs and assumptions regarding the nature, acquisition, structure, sources and justification of knowledge" (Hofer & Pintrich, 1997). Individuals' beliefs about knowledge and knowing are called epistemological beliefs (Hofer & Pintrich, 1997). They function as a lens through which a person interprets materials and learning demands, and influence learning and instruction processes (Rebmann, Schloemer, Berding, Luttenberger, & Paechter, 2015).

Schommer (1994) pioneered an epistemological beliefs system of five more or less independent beliefs, which are: stability of knowledge, structure of knowledge, source of knowledge, control of knowledge acquisition and the speed of knowledge acquisition. In contrast to Schommer (1994), Hofer and Pintrich (1997) indicated that some of Schommer's (1994) dimensions are outside of the definition of epistemological belief. Therefore, Hofer and Pintrich (1997) conceptualized these beliefs as the certainty of knowledge (stability), simplicity (structure)

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of knowledge, source of knowing (authority), and justification for knowing (evaluation of knowledge claims).

In this study, based on these two theoretical background of Schommer (1994) and Hofer and Pintrich (1997), Epistemological Beliefs Questionnaire (EBQ) developed by Chan and Elliot (2004) to measure the beliefs of teachers regarding the nature of knowledge in teaching and learning context in Hong Kong and Epistemological Beliefs Questionnaire (EBQ) developed by Elder (2002) to measure the beliefs of teachers regarding the nature of knowledge in teaching and learning context in USA used for validation of epistemological beliefs of school teachers in Myanmar.

Purposes of the Study

The main purpose of the study is to validate the Epistemological Beliefs Questionnaire for the school teachers.

Definitions of Key Terms

Epistemological Beliefs: Epistemological beliefs refer to conceptions about how knowledge is constructed and evaluated and how knowing occurs (Hofer, 2001).

Belief in Knowledge by Experts: belief that knowledge is handed down by teachers and other experts.

Belief in Certainty Knowledge: belief that knowledge is certain and unchanging.

Belief in Reasoning Knowledge: belief that knowledge is derived from reasoning / thinking / testing.

Belief in Developing Knowledge: belief that knowledge is uncertainty / developing / changeable.

Belief in Effort Knowledge: belief that knowledge is a learning process that requires effort.

Related Literature Review

Epistemology is an area of philosophy concerned with the nature and justification of human knowledge. A growing area of interest for psychologists and educators is that of personal epistemological development and epistemological beliefs: how individuals come to know, the theories and beliefs they hold about knowing, and the manner in which such epistemological premises are a part of and an influence on the cognitive processes of thinking and reasoning.

Piaget (1950) used the term genetic epistemology to describe his theory of intellectual development, initiating the interest of developmental psychologists in this intersection of philosophy and psychology. These interests were an important step in the growing reaction to the dominance of behaviorism, which had removed knowing altogether from learning (Kohlberg, 1971). Bringing knowing back into the picture was central to emerging theories of moral judgment and development (Gilligan, 1982; Kegan, 1982; Kohlberg, 1969, 1971). Along parallel lines, Perry's (1970) attempts to understand how students interpreted pluralistic educational experiences had led to a theory of epistemological development in college students.

Thus, the research on epistemological beliefs is traced back to the works of Piaget (1971) and Perry (1970); the latter researched epistemological development of male students at Harvard University. Perry (1970) uses a checklist and identifies nine positions of epistemological development that are consequently categorized into four major perspectives: dualism, multiplism,

relativism and commitment within relativism. It is important to note that there are obvious limitations to Perry's work. It fails to consider women's perspectives. The perceived limitations give rise to research and thus other models are developed.

The study of Belenky, Clinchy, Goldberger, and Tarule (1986) is based on the interviews of 135 women in the USA. Their theory is that women's epistemological views are closely related to their perceptions of self and how they are related to the world in general (Hofer & Pintrich, 2004). The scheme of Belenky, Clinchy, Goldberger, and Tarule (1986) in USA places the different ways of knowing by women into five epistemological categories; silence, received knowing, procedural knowledge, separate and connected.

Perry (1970) has not taken into consideration context and multiple views and Belenky, Clinchy, Goldberger, Tarule, and JM (1986) include only women's perspective, Magolda (1992) comes with another model which aims to isolate the epistemological belief patterns of male and female respondents while keeping in mind the contextual nature of epistemology. Through her research, Magolda (2001) identifies an order of four levels of development which she refers to as "ways of knowing". The identified levels are: absolute, transitional, independent and contextual.

King and Kitchener (1994) emphasize on exploring the cognitive process involved in solving ill-structured problems by respondents. They believe that epistemological beliefs are tied to the ability to understand and construct solutions for ill-structured problems. They develop the Reflective Judgment Model after conducting cross-sectional and longitudinal research with students from late adolescent stages into adulthood. This model consists of seven distinct stages of epistemological development and is further categorized into three distinct levels: the pre-reflective stage, the quasi-reflective stage and the reflective stage.

Perry (1968) believes that epistemological beliefs develop gradually and claims that students develop those beliefs progressively in their study. Contrary to such a view, Schommer (1990) criticizes the one-dimensional and developmental nature of epistemological beliefs represented by Perry, claiming that they do not develop in stages, but an individual can possess several beliefs simultaneously.

Schommer (1990) suggests that personal epistemologies may be a system of beliefs and consequently develops the first multi-dimensional theory. The multi-dimensional theory includes the possibility that each of the dimensions of epistemological beliefs may develop separately from the rest, especially, when an individual's beliefs are in a transitional phase. Her theory identifies the five beliefs. They are stability of knowledge, source of knowledge, structure of knowledge, ability to learn and speed of learning.

Thus, the current study will examine the psychometric properties of Epistemological Beliefs Questionnaire with a special emphasis on its construct validity and reliability.

Method

The descriptive survey method is utilized in this study.

Participants of the Study

The participants of the study are selected by using the random sampling method. The sample is composed of 436 school teachers (129 males and 307 females) in the study.

Instruments

The items for the questionnaire were generated through a literature review. In order to study epistemological beliefs, the items were adapted from the questionnaire which are concerning with epistemological beliefs. The items comprised in the epistemological beliefs questionnaire are assembled from 30 items of epistemological beliefs questionnaire developed by Chan and Elliott (2004) and 33 items of epistemological beliefs questionnaire developed by Elder (2002). The items were rated on five-point Likert Scale (1=strongly disagree to 5=strongly agree). The approximate time duration to accomplish all the items is about 20 minutes.

Data Collection Procedure

The expert review was conducted for face validity and content validity from nine well-experienced experts in the field of Educational Psychology. Based on the advice and the suggestions of the experts, some items were revised and omitted to avoid overlapping and uncertainty of items. The instrumentation procedure was done from January to February in 2022. To validate the epistemological beliefs questionnaire, exploratory factor analysis and confirmatory factor analysis were performed.

Data Analysis and Research Findings

Exploratory Factor analysis

At first, exploratory factor analysis was used to discover dimensions of the questionnaire and the number of items. It was also used to assume that there is a smaller set of unobserved (latent) variables or constructs that underlie the variables that actually were observed or measured. Exploratory factor analysis was conducted with the sample of 436 school teachers (129 males and 307 females).

Kaiser-Meyer-Olkin (KMO) was applied to assess the appropriateness of using factor analysis on the data set and Bartlett's test was used to check the assumption of equal variances before proceeding an EFA analysis. If KMO coefficient was greater than 0.60 and the Bartlett's test was significant, it would be possible to run an EFA analysis according to Buyukozturk (2006) (as cited in Yuce & Onel, 2018). The results of KMO and Bartlett's test are shown in Table 1.

Table 1 KMO and Bartlett's Test of TOSRA

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		0.823
Bartlett's test of Sphericity	Approx. Chi-Square	9255.626
	df	2016
	Sig.	0.000

According to Table 1, the KMO value of items was 0. 823 so that it was greater than 0.60 and the Bartlett's test was found to be significant (Chi-square= 9255.625, df= 2016, $p<0.01$).This means that the variables were correlated highly enough to provide a reasonable basis for factor analysis. These tests of normality and sampling adequacy indicated that the correlation matrix was of acceptable quality. Thus, the data were suitable to run EFA.

The principal axis factor analysis with varimax rotation was conducted to assess the underlying structure for the items of Epistemological Beliefs Questionnaire. Five factors were requested and according to these factors, the items were designed to index five factors. The factors

are named as belief in knowledge by experts, belief in certainty knowledge, belief in reasoning knowledge, belief in developing knowledge and belief in effort knowledge. Table 2 displayed the items and factor loadings for the rotated factors.

Table 2 Factor Loading for Rotated Factors of Epistemological Beliefs Questionnaire

	Items	Factors					Communalities
		1	**2**	**3**	**4**	**5**	
1	I consult experts when I face problem in life.	0.893					.658
2	I am very aware that teachers/ lecturers know a lot more than I do and so I agree with what they say is important rather than rely on my own judgment.	0.882					.535
3	How much a student learns in a school depends mostly on the quality of teachers in that school.	0.810					.521
4	An expert is someone who has a special gift in somearea.	0.764					.536
5	I have no doubts in whatever the experts say.	0.763					.497
6	Some people are born good learners, others are just stuck with limited abilities.	0.729					.569
7	I do believe the facts in textbooks written by experts.	0.699					.411
8	Scientific knowledge is certain and does not change.		0.831				.662
9	If scientists try hard enough, they can find the truth to almost anything.		0.799				.470
10	The most important aspect of scientific work is precise measurement and careful work.		0.731				.579
11	I believe there should exist a teaching method applicable to all learning situations.		0.683				.523
12	All questions in science have on right answer.		0.619				.492

	Items	Factors					Communalities
		1	**2**	**3**	**4**	**5**	
13	Scientists will ultimately get to the truth if they keep searching for it.		0.587				.479
14	A good way to know if something is true is to do an experiment.			0.824			.533
15	A good way to get ideas in science is to wonder why things happen.			0.817			.510
16	What you have learned now will need to be adjusted due to time or other reasons.			0.790			.448
17	In science, there can be more than one way for scientists to test their ideas.			0.730			.437
18	Good answers are based on evidence from many different experiments.			0.712			.451
19	It is good to try experiments more than once to make sure of your findings.			0.652			.470
20	Knowledge is uncertain. It changes over time.				0.812		.539
21	The things we teach need to change along with the world.				0.783		.455
22	Knowledge that is considered correct today may change tomorrow.				0.731		.512
23	Forming your own ideas is more important than learning what textbooks say.				0.699		.462
24	Knowledge may be modified after a certain period of time.				0.634		.437
25	How much you get from your learning depends mostly on your effort.					0.711	.579
26	Everyone needs to learn how to learn.					0.652	.538

	Items	Factors					Communalities
		1	**2**	**3**	**4**	**5**	
27	If people can't understand something right away, they should keep on trying.					0.638	.512
28	Knowing how to learn is more important than the acquired facts.					0.583	.436
29	Learning something really well takes a long time or much effort.					0.578	.428
	Eigenvalues % of Variance	21.422	12.427	7.553	5.661	5.475	52.538
	Cumulative %	21.422	33.849	41.401	47.06	52.537	

By reviewing the rotating factor matrix, 34 items are not connected with any factors and some of them have low standard loadings so that they are removed. A five-factor construct consisting of 29 items explaining 52.538 % of total variance is obtained.

Table 3 Reliability Analysis of Epistemological Beliefs Questionnaire

Questionnaire/Factors	Number of Items	Cronbach's Alpha
Belief in Knowledge by Experts	7	0.824
Belief in Certainty Knowledge	6	0.801
Belief in Reasoning Knowledge	6	0.792
Belief in Developing Knowledge	5	0.764
Belief in Effort Knowledge	5	0.752
Epistemological Beliefs	29	0.841

According to Table 3, reliability coefficients of each factor for Epistemological Beliefs Questionnaire ranged from 0.752 to 0.824. These values of coefficients indicated that items Myanmar Version of Epistemological Beliefs Questionnaire was good to measure epistemological beliefs of school teachers according to Chan and Elliott (2004), reliability coefficients above 0.89 are generally considered as excellent, 0.80-0.89 were good and 0.7-0.79 were adequate. The reliability coefficient values were 0.752 and higher than 0.752.

Thus, Epistemological Beliefs Questionnaire was reliable to measure epistemological beliefs of school teachers in Basic Education in Myanmar.

Confirmatory Factor Analysis

Confirmatory factor analysis was used to establish five factors of the epistemological beliefs questionnaire of the school teachers. Confirmatory factor analysis is a multivariate statistical procedure that is used to test how well measured variable represent the number of factors. The data of fit of the models of the epistemological beliefs was checked in Table 4.

Table 4 Model of Fit Indices

Model	χ2	*p*-value	CMIN/DF	CFI	GFI	AGFI	RMSEA	TLI
Five factors 29-items Epistemological Beliefs Questionnaire	3723.941	0.000	3.154	0.891	0.804	0.729	0.632	0.685

The data is assumed to be fit to the model if the CFI, GFI, AGFI and TLI values are higher than 0.09 (Hooper, Coughlan, & Mullen, 2008) and RMSEA value range from 0.05 to 0.1 (Bentler, 1990) and CMIN/Df (Chi-square/Df) was not exceeded 3. Based on the Table 4, CFI, GFI, AGFI and TLI did not reach adequate value. So, the model was re-specified. Hopper, Cough and Mullen (2008) expressed that it is a good to remove the items with low R2 values (less than 0.4) from the analysis to remove the better model fit. In the present analysis, the R2 values of two items were less than 0.4. Therefore, these items were removed from this study.

Moreover, according to Gerbing and Anderson (1984), another way of improving model fit is through the correlation of error terms. Then, after correlated error terms, the analysis was run to get a perfect model fit. The final model for epistemological beliefs with 27 items was in Table 5.

Table 5 Model Fit Indices of the Final Model

Model	χ2	*p*-value	CMIN/DF	CFI	GFI	AGFI	RMSEA	TLI
Five Factors 27-items Epistemological Beliefs Questionnaire	552.532	0.000	3.362	0.943	0.917	0.908	0.053	0.923

Based on the data presented in Table 5, CFI, GFI, AGFI and TLI were greater than 0.9 and RSMEA ranged from 0.5 to 0.1 and chi-square was found significant at *p*<0.01. Therefore, the model fit indices of epistemological beliefs with 27 items were obtained.

Validity and Reliability

Convergent validity

Convergent validity is also an evidence to test construct validity. To establish convergent validity, factor loading of the indicator variables, composite reliability (CR) and average variance extracted (AVE) should be used. AVE and CR values were computed by the formula using Microsoft Excel. Table 6 shows that the results of AVE and CR of epistemological beliefs questionnaire.

Table 6 Composite reliability (CR) and average variance extracted (AVE) of Epistemological Beliefs Questionnaire

Factors	CR	AVE
Belief in Knowledge by Experts	0.922	0.591
Belief in Certainty Knowledge	0.888	0.572
Belief in Reasoning Knowledge	0.859	0.539
Belief in Developing Knowledge	0.853	0.509
Belief in Effort Knowledge	0.775	0.503

The AVE values for the model range from 0.503 to 0.591. The CR values range from 0.775 to 0.922. According to Hunang et al (2013), AVE should be above 0.5 and CR should be 0.6 and above. According to Table 6, AVE values were above 0.5 and CR values were above 0.6. Then, the convergent validity was achieved for this construct. Therefore, the epistemological beliefs questionnaire can be assumed that it was a valid instrument to measure epistemological beliefs of the school teachers.

Discriminant Validity

Discriminant validity was used to show that the factor is actually differing from one another empirically. Discriminant validity was evaluated with square root of AVE with correlations of latent construct. The results were shown in Table 7.

Table 7 Square root of AVE with Correlations of Latent Factors of Epistemological Beliefs Questionnaire

Factors	Belief in Knowledge by Experts	Belief in Certainty Knowledge	Belief in Reasoning Knowledge	Belief in Developing Knowledge	Belief in Effort Knowledge
Belief in Knowledge by Experts	**0.768**				
Belief in Certainty Knowledge	0.63	**0.756**			
Belief in Reasoning Knowledge	0.59	0.52	**0.734**		
Belief in Developing Knowledge	0.53	0.49	0.45	**0.713**	
Belief in Effort Knowledge	0.52	0.48	0.46	0.48	**0.709**

Note: The diagonal numbers in bold letters are the square root of AVE values.

According to Table 7, all the square root of AVE values was greater than 0.5 and these values were greater than all the inter-latent factor correlations for all factors in the relevant rows

and columns. According to Fornell and Larcker (2011), square root of AVE should be above 0.5. Then, according to Hair et al (2013), square root of AVE values was greater than the inter-latent factor correlations. Thus, the results of the discriminant validity of Epistemological Beliefs Questionnaire were compatible with Fornell and Larcker (2011). According to Table 7, discriminant validity can be accepted for the measurement model and the discriminant validity between the factors.

Reliablity

After the result of confirmatory factor analysis of EBQ, the final scale of EBQ consisted of five factors with items in this study. Table 8 showed that the number of items retained and described coefficient for each factor of EBQ.

Table 8 Reliability Coefficient for each factor of EBQ

Factors	Number of items	Cronbach' Alpha
Belief in Knowledge by Experts	6	0.828
Belief in Certainty Knowledge	5	0.801
Belief in Reasoning Knowledge	6	0.782
Belief in Developing Knowledge	5	0.769
Belief in Effort Knowledge	5	0.756
EBQ	27	0.891

Based on Table 8, reliability coefficient of each factor ranged from 0.756 to 0.828 and the reliability coefficient of EBQ was 0.891 Thus, EBQ was reliable to measure epistemological beliefs of the school teachers.

Discussion and Recommendations

The purpose of this study was to validate a questionnaire that measured school teachers' epistemological beliefs in Myanmar context. The research yielded a 27-item measure with five factors, and the results provided evidence for the validity and reliability. Teachers' epistemological beliefs influence their teaching methods and approaches, shape the classroom environment and the interactions between teachers and students, impact students' motivation and engagement, influence their instructional decisions and effectiveness.

By understanding and reflecting on these beliefs, teachers can align their teaching strategies with their beliefs about knowledge acquisition, leading to more effective and meaningful learning experiences for their students. It is believed that Epistemological Beliefs Questionnaire (EBQ) developed for the school teachers can be supportive for addressing strategies related to professional development, reflective practice, cultivating open-mindedness, collaborative learning communities, pedagogical strategies, inquiry-based approaches, ongoing support and mentoring.

By addressing teachers' epistemological beliefs through these strategies, educational institutions can foster a culture of continuous professional growth and create more effective and inclusive learning environments for students. It is certainly important that the teachers should have sophisticated beliefs in order to implement the effective teaching learning process in 21st century. These beliefs equip teachers with the necessary mindset and skills to create student-centered,

adaptable, and inclusive learning environments. They foster critical thinking, inquiry, and a commitment to lifelong learning, ultimately enhancing the educational experiences and outcomes for students.

Therefore, it can be said that the questionnaire is competent enough to measure the epistemological beliefs of school teachers. The questionnaire results can help identify teachers' epistemological orientations and inform instructional practices and interventions aimed at promoting more sophisticated epistemological beliefs and also provide guidance for administrators, curriculum developer and educational institutions.

Conclusion

The Epistemological Beliefs Questionnaire (EBQ) was identified and applied with items by using CFA. All the model fit indices (RMSEA= 0.053, CFI= 0.943, TLI= 0.923, p= 0.000) indicated a good fit between the measurement model tested and the data. The convergent validity of Epistemological Beliefs Questionnaire was indicated by high composite reliability values and acceptable AVE values. The discriminant validity of the model was also indicated by the AVE values. As for the internal consistency reliability, the values of Cronbach's alpha pointed out the satisfactory results for reliability of Epistemological Beliefs Questionnaire. In accordance with results, Epistemological Beliefs Questionnaire (EBQ) can be considered a valid and reliable tool for measuring school teachers' epistemological beliefs.

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