ORIGINAL ARTICLE

The relationship between medical students' epistemological beliefs and achievement on a clinical performance examination

Sun-A Oh[1], Eun-Kyung Chung[2], Eui-Ryoung Han[3], Young-Jong Woo[2] and Deiter Kevin[4]

[1]Department of TESOL, Gwangju University, [2]Department of Medical Education, Chonnam National University Medical School, [3]Office of Education and Research, Chonnam National University Hospital, and [4]Department of Physical Theraphy, Gwangju Health University, Gwangju, Korea

Purpose: This study was to explore the relationship between clinical performance examination (CPX) achievement and epistemological beliefs to investigate the potentials of epistemological beliefs in ill-structured medical problem solving tasks.
Methods: We administered the epistemological beliefs questionnaire (EBQ) to fourth-year medical students and correlated the results with their CPX scores. The EBQ comprised 61 items reflecting five belief systems: certainty of knowledge, source of knowledge, rigidity of learning, ability to learn, and speed of knowledge acquisition. The CPX included scores for history taking, physical examination, and patient-physician interaction.
Results: The higher epistemological beliefs group obtained significantly higher scores on the CPX with regard to history taking and patient-physician interaction. The epistemological beliefs scores on certainty of knowledge and source of knowledge were significantly positively correlated with patient-physician interaction. The epistemological beliefs scores for ability to learn were significantly positively correlated with those for history taking, physical examination, and patient-physician interaction.
Conclusion: Students with more sophisticated and advanced epistemological beliefs stances used more comprehensive and varied approaches in the patient-physician interaction. Therefore, educational efforts that encourage discussions pertaining to epistemological views should be considered to improve clinical reasoning and problem-solving competence in the clinic setting.

Key Words: Clinical competence, Epistemological beliefs, Medical history taking, Physical examination, Physician-patient relations

Introduction

Epistemological beliefs are fundamental assumptions about the nature of knowledge, the certainty of knowing, the criteria and justifications for knowing. There is a variety of views explaining epistemological beliefs such as developmental, multidimensional, and integrated theoretical models. The model of Perry [1], King & Kitchener [2], Baxter Magolda [3] described epistemological developments as a progression, Schommer [4] and Hofer [5] considered multidimensional frameworks of epistemological beliefs. Schommer [4,6] proposed epistemological beliefs consisting of five dimensions: stability of knowledge, structure of knowledge, source of knowledge, speed of knowledge acquisition and control of knowledge acquisition. Hofer [5] indicated four types of beliefs dimensions: knowledge of certainty, source of

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Corresponding Author: Eun-Kyung Chung (http://orcid.org/0000-0002-3595-0220)
Department of Medical Education, Chonnam National University Medical School, 160 Baekseo-ro, Dong-gu, Gwangju 61469, Korea
Tel: +82.62.220.4178 Fax: +82.62.236.3653 email: ekcmedu@chonnam.ac.kr

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knowledge, the simplicity and the justification of knowledge. On the other hand, epistemological belief is an individual presupposition about knowledge and learning which play an influential role on the cognitive process [7]. They presented integrated theoretical model between epistemological beliefs and self-regulated learning [7,8].

Previous educational studies have examined the effects of epistemological beliefs on such areas of learning as reading comprehension [6], text processing [9], conceptual change [10] and multiple decision making [11,12]. On the other hand, instructional contexts could change the students' epistemological beliefs [13,14].

Epstemological beliefs also affect problem-solving skills and strategies in poorly structured environments [6,15,16]. Students who had simpler understandings of the structure of knowledge and invariability of knowledge made simpler diagnoses than did those with more complicated understandings. They also ignored divergent and idiosyncratic patient situations in the decision-making process [17]. Learners with a belief that knowledge is a fixed entity have been shown to engage in more rapid and superficial learning than thoughtful and deep learning [18]. Schommer & Dunnell [19] showed the more students had a belief that the ability of learning is decided at birth, learning is quick, and knowledge is unchangeable, the more likely they had an attitude of writing simplistic answers to problems.

Roex & Degryse [20] described the possible role of epistemological beliefs in medicine as follows: First, the explosive growth in the amount and accessibility of medical information expects the strategies on how to acquire knowledge. Second, ill-structured problem solving often demands solvers to think about various views and apply multiple standards while assessing problems [21,22]. Third, medical practice is a problem-solving process with scientific knowledge. Doctors must understand the origin of the knowledge, integrate new knowledge into existing knowledge and apply the treatment into patient.

Since personal epistemological beliefs affect students' behaviors and learning achievements, medical students' clinical performance examination (CPX) achievements may differ by students' epistemological beliefs stances. We hypothesized that students with naive beliefs such as knowledge is unchangeable and the source of knowledge is from authorities would be less likely to implement effective CPX strategies. Students with sophisticated beliefs about the complexity of knowledge, multiple perspectives on learning, and progressive learning processes would be more likely to apply multifaceted approaches with their patients. Therefore, the purpose of this study was to explore the relationship between medical students' epistemological beliefs and their achievement on the CPX.

Subjcets and methods

1. Subjects

The fourth-year of 130 students at Chonnam National University Medical School participated in this study. Excluding the incomplete data, the data of 124 students were analyzed (response rate, 95.4%). The Institutional Review Board determined that the study was exempt from the human subjects' research regulations. Consent was obtained from all participants. Seventy-three of the participants (58.9%) in this study were male, and 77 (62.1%) were under the age of 25.

2. Data collection

The students' epistemological beliefs were assessed using the Korean version of the Jehng, Johnson, and

Table 1. Epistemological Beliefs Subscales and Their Reliability

Subscale	Cognitive disposition			Cronbach α
	Naïve (1 point)	-------	Sophisticated (5 point)	
Certainty of knowledge	Knowledge is absolute	-------	Knowledge is tentative	0.646
Source of knowledge	Knowledge is given by authority	-------	Knowledge is acquired by the learner	0.727
Rigidity of learning	Learning is a process to take objective knowledge	-------	Learning is a constructive process to acquire knowledge by the learner	0.491
Ability to learn	Learning ability is innate	-------	Learning ability can be improved over time and individual effort	0.710
Speed of knowledge acquisition	Learning happens quickly	-------	Learning happens gradually	0.622

Anderson's Epistemological Beliefs Questionnaire (EBQ) [15]. The EBQ comprised 61 items rated on a 5-point Likert scale to reflect five belief systems: certainty of knowledge, source of knowledge, rigidity of learning, ability to learn, and speed of knowledge acquisition (Table 1). Higher scores represent a less dualistic, more relativistic epistemological stance, and lower scores indicate a more dualistic and more objectivist epistemological stance. For example, when a student obtained a low score on the certainty of knowledge, this score reflected the student's belief that knowledge is an absolute and unchanging truth. Students with sophisticated epistemological beliefs regarding the certainty of knowledge believe that knowledge is constantly evolving and that any knowledge is not immutable. The reliability of the whole EBQ was α=0.853. The reliability of subscales of epistemological beliefs are described in the Table 1. The students were asked to complete the EBQ, followed by the completion of the CPX.

The CPX consists of six symptoms representing common clinical problems including insomnia, syncope, dyspnea, hematemesis, back pain, and bruising. The students were allowed 10 minutes to interact with the standardized patients (SPs) regarding each symptom and were given another 5 minutes to prepare for the next examination. The SPs rated the patient-physician interaction on a 4-point Likert scale, and the medical faculty assessed the history taking and physical examinations using a dichotomous scale for the performance items. The five medical schools constituting the Jeolla Consortium for Clinical Performance Examination developed the cases and checklists and trained the SPs.

3. Data analysis

The overall epistemological beliefs scores were stratified into two groups by the mean score, and each CPX raw score was converted to T-scores. Student t-tests were used to identify differences of the CPX category scores according to the epistemological levels. Pearson correlation analyses were used to investigate relationships among CPX category scores and epistemological beliefs subscales scores. All analyses were performed using SPSS software version 18.0 (SPSS Inc., Chicago, USA).

Results

Table 2 shows differences in CPX category scores with respect to overall epistemological beliefs levels. The higher epistemological beliefs group had significantly higher scores for history taking (t=2.285, p=0.024) and patient-physician interaction (t=2.004, p=0.047) than did the lower one. No significant differences between higher and lower epistemological beliefs groups were observed with respect to physical examinations.

Table 2. Difference of Clinical Performance Examination Category Scores by Overall Epistemological Beliefs Levels

CPX category	Overall EB levels		t	p-value
	Lower group (n=61)	Higher group (n=63)		
History taking	48.76±6.36	51.22±5.62	2.285	0.024
Physical examination	49.17±6.22	50.82±5.52	1.559	0.122
Patient-physician interaction	48.96±5.63	51.03±5.83	2.004	0.047

Data are presented as mean±standard deviation.
CPX: Clinical performance examination, EB: Epistemological beliefs.

Table 3. Correlations between Epistemological Beliefs Subscale Scores and Clinical Performance Examination Category Scores

CPX category	EB subscale				
	Certainty of knowledge	Source of knowledge	Rigidity of learning	Ability to learn	Speed of knowledge acquisition
History taking	0.154	0.174*	0.055	0.232*	0.019
Physical examination	0.173	0.136	0.109	0.224*	0.055
Patient-physician interaction	0.250*	0.231*	0.109	0.225*	0.018

CPX: Clinical performance examination, EB: Epistemological beliefs.
*$p<0.05$ by Pearson correlation analyses.

Statistically significant correlations were found among the epistemological beliefs scales and CPX category scores (Table 3). The score of epistemological beliefs for certainty of knowledge was significantly positively correlated with those for patient-physician interaction (r=0.250, p=0.005). Epistemological beliefs scores for source of knowledge were significantly positively correlated with those for history taking (r=0.174, p=0.050) and patient-physician interaction (r=0.231, p=0.010). Epistemological beliefs scores for ability to learn were significantly positively correlated with those for history taking (r=0.232, p=0.010), physical examination (r=0.224, p=0.012), and patient-physician interaction (r=0.225, p=0.012).

Discussion

The higher epistemological beliefs group had higher achievements for history taking and patient-physician interaction than did the lower one. These results could indicate that students with a sophisticated, less dualistic epistemological beliefs stance performed better on the CPX, especially with respect to history taking and the patient-physician interaction.

There were slightly weak-positive correlations between epistemological beliefs scores on certainty of knowledge and CPX scores measuring patient-physician interaction. The weak-positive correlations were also demonstrated between epistemological beliefs scores on source of knowledge and the CPX scores measuring history taking and patient-physician interaction. Ability to learn was positively correlated with history taking, physical examination, and patient-physician interaction.

Although the correlations with epistemological beliefs and CPX components were not very strong, these results were consistent with the findings of Schommer [6] and Cano [23], which showed that students who believed knowledge is not absolute or acquired in an unmediated fashion attained greater academic success. In poorly structured medical situations, students with simpler

understandings about the structure of knowledge provided simpler diagnoses than did those who demonstrated more complex thoughts in this regard [17,24,25].

Scores on source of knowledge were related to how students view the patient-physician interaction. Those who had a more developed understanding of the source of knowledge were more likely to question the opinions of authorities when their own understanding differed. These students also paid more sincere attention what their patients were saying, regarding this information as a good source of knowledge. Students should try to identify plausible interpretations of symptoms and signs and could be able to suggest alternative while gathering information from and sharing it with patients.

Additionally, ability to learn of the epistemological beliefs was correlated with physical examination as well as history taking and patient-physician interaction. As physical examination was the item to evaluate the level of technical skills, there might be good results on the behaviors of students who believed the skills and attitude could be enhanced by repetitive practice.

Kienhues et al. [11] investigated how laypersons deal with conflicting versus consistent medical information on the Web. Students with an access to conflicting medical information showed more advanced treatments than those who were provided with well-structured information. Exposure to different ways of thinking could facilitate the beliefs development and may encourage students to become more relativistic and appreciative of multiple perspectives. Our results revealed that more sophisticated and advanced epistemological beliefs were positively related with the clinical performance as the outcomes of learning in medicine. Therefore, educational efforts that encourage discussions pertaining to epistemological views should be considered to improve clinical reasoning and problem-solving competence in the clinical setting.

The limitations of this study should be considered when interpreting the results. First, the correlations between epistemological beliefs and CPX were not strong. Therefore, we should ask more careful interpretations and suggestions on these results. In a further study, various sources would be needed to understand the students' epistemological beliefs such as interviews and writings. Second, our study focused only on the relationship between medical students' epistemological beliefs and their CPX performance. Further research may need to be carried out to determine other factors contributing to CPX performance.

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