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The Effect of Different Educational Programs on the Development of Students' Epistemological Beliefs

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ABSTRACT Epistemological beliefs are beliefs about the nature of knowledge and knowing. The purpose of this paper is to examine the different educational programs (English teacher education, computer technology teacher education, and food technology) in terms of epistemological beliefs and to reveal the epistemological beliefs of fresh graduates studying these programs in Turkey and from different educational backgrounds. The interview questions used in this study focused on the source of knowledge, nature of knowledge, and elements in acquiring knowledge. The results revealed that prospective English teachers had relatively sophisticated ideas and the prospective food technologists had relatively naive ideas on each dimension of epistemological beliefs. Computer technology teachers had medium epistemological beliefs. This could be because English teacher education programs focus more on the students' epistemological beliefs, whereas food technologist programs focus more on the subject rather than on students' beliefs about knowledge on food subjects.

INTRODUCTION

Epistemological beliefs are beliefs about knowledge and knowing (Charles 2003). Students' epistemological beliefs are defined as personal and implicit belief systems or assumptions about the nature of knowledge and learning (Schommer 1990). Early studies considered epistemological beliefs unidimensional and focused on the students' learning (Ryan 1984). Later studies viewed epistemological beliefs as complex. Schommer (1990) suggested the multidimensionality of epistemological beliefs and identified the following dimensions: (1) *simple knowledge*, which includes beliefs ranging from knowledge is simple to complex; (2) *certain knowledge*, with beliefs ranging from knowledge is certain to tentative; (3) *fixed ability*, including beliefs ranging from learning is innate to acquired, and (4) *quick learning*, with beliefs ranging from learning is quick to not at all. Each dimension has a different effect on learning. Each dimension is independent, and the beliefs in each dimension do not need to develop at the same time. For example, a student could think that knowledge is acquired gradually and that knowledge is organized as isolated bits and pieces (Schommer 1990).

Some studies have reported that as the students' grade level increases, their epistemological beliefs become more sophisticated. For example, Mackay (1971), Ryan and Aikenhead (1992), Driver et al. (1996), and Leach et al. (1997) reported that although students' ideas about formal science become sophisticated through adolescence, their epistemological beliefs remain naïve through high school (as cited in Sandoval 2005). Schommer (1993) carried out a cross-sectional study to investigate the development of high school students' epistemological beliefs. She used the questionnaire from her previous study (Schommer 1990) to measure their epistemological beliefs. The results revealed that high school students' beliefs in simple knowledge, certain knowledge, and quick learning decreased from freshman to senior year. Moreover, students who believed less in quick learning tended to get higher grades. In a longitudinal study, Schommer et al. (1997) investigated the development of high school students' epistemological beliefs from the first to fourth year. Students were selected from Schommer's 1993 study, and the same instrument used in that study was given to the students. The results demonstrated that high school students' beliefs in the fixed ability to learn simple knowledge, quick learning, and certain knowl-

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edge became more sophisticated in their fourth year. In addition, students who believed that knowledge is acquired quickly tended to get lower grades. The results of the two studies (Schommer 1993; Schommer et al. 1997) revealed that high school students' epistemological beliefs had changed by the time they became seniors. Fujiwara and Phillips (2006) found that students who are about to complete their undergraduate education have stronger beliefs in quick learning and stable knowledge than those who have just started their undergraduate education.

The students' subject major also has an effect on their epistemological beliefs. Schommer et al. (2003) investigated the epistemological beliefs of mathematics, social science, and business school students. Each university student answered the epistemological beliefs questionnaire related to her or his academic discipline. Similar epistemological beliefs were found for mathematics and social science students, as well as for mathematics and business students. However, when the students' academic experience was considered, there was some evidence of domain specificity. Thus, when the epistemological beliefs of these university students differed, their academic disciplines became important. Domain-specific epistemological beliefs are beliefs about knowledge with respect to a particular academic domain (Chai and Khine 2008). College students whose subject major is "hard" (that is, natural sciences and engineering) tend to view knowledge as more certain than students whose major is "soft" (that is, humanities and social sciences) (Blackie 2012; Jehng et al. 1993; Kessels 2013; Trautwein and Lüdtke 2007). These findings were also supported for teachers. For example, Chai and Khine (2008) and Paulsen and Wells (1998) found that teachers whose subject major is "hard" tend to view knowledge as more certain and consider ability as innate and fixed.

O'Siochru and Norton (2014) studied the relationship between UK undergraduates' epistemological beliefs and their course performance without considering their major. They found no relation between the two constructs. Students often hold inconsistent epistemological beliefs in different contexts (Sandoval and Morrison 2003). According to Hui and Phang (2015), epistemological beliefs of art stream students (that is, students taking less than two science courses) were more naive than those of science stream students (that is, those taking two or more science courses).

Topcu (2013) investigated the domain-specific epistemological beliefs of chemistry, physics, and biology pre-service teachers in Turkey. He found out that physics pre-service teachers had less sophisticated epistemological beliefs on the certainty and simplicity of knowledge than chemistry and biology pre-service teachers. Guven (2012) found that English as a foreign language (EFL) pre-service teachers in formal education exhibited more sophisticated epistemological beliefs than EFL teachers in distance education. Ding and Mollohan (2015) investigated the differences in epistemological beliefs between science and non-science majors and examined the development of these students' beliefs in a biology course. At the beginning of biology instruction, science majors had more sophisticated epistemological beliefs than non-science majors. However, at the end of biology instruction, non-science majors had more sophisticated epistemological beliefs than science majors. Thus, the courses taken by the students were important for the development of their epistemological beliefs.

The students' epistemological beliefs are assessed by self-report scales (Schommer 1990; Schraw et al. 2002; O'Siochru and Norton 2014), interviews (Kitchener and King 1981; Perry 1970), and open-ended questionnaires (Yang 2005). Questionnaires with Likert-scale responses are widely used and are easy to apply. However, more in-depth information could be obtained through interviews. Thus, in this study, semi-structured interviews were used to assess students' epistemological beliefs. In contrast to other studies (Blackie 2012; Kessels 2013; O'Siochru and Norton 2014), this study examined the students' epistemological beliefs in terms of the objectives and course contents of their educational departments. The results of this study could be helpful for education planners and teachers, who can create their lesson plans according to the development of students' epistemological beliefs.

Objectives of the Study

This study aims to examine different educational programs (English teacher education, computer technology teacher education, and food technology) in terms of epistemological beliefs. It also aims to reveal the epistemological beliefs

of students who have just graduated from these programs. In particular, the study aims to examine the students' views about the source of knowledge, nature of knowledge, and elements in acquiring knowledge.

METHODOLOGY

Research Design

This study used a qualitative research design, wherein "the quality of relationships, activities, situations or materials" was investigated (Fraenkel and Wallen 2000: 502). A case study was conducted to investigate the participants' views on epistemological beliefs. A case study enables the in-depth investigation of an event, an activity or one or more individuals (Stake 1995). Purposive convenience sampling was used to select the participants.

Participants

Four alumni who had just graduated from their programs participated in the study. Two of them are prospective English teachers, one is a prospective computer technology teacher, and another is a prospective food technologist. The mean age of the participants was 21.

Student A graduated from the two-year food technology program of a vocational school. She was admitted to this higher education program after taking the university entrance exam, which students have to pass to enter any department in the university. The students are ranked according to their exam scores. Vocational school is generally preferred by the relatively lower achievers. Students need to graduate from science and mathematics programs in secondary school before entering vocational school.

Students B and D graduated from a four-year foreign language (English) program, which is for relatively higher achievers. Students need to graduate from language programs in secondary school to be able to enter the foreign language education program.

Student C graduated from a four-year computer education and instructional technology program. This program is also for higher achievers. Students must have graduated from science and mathematics programs in secondary school to be able to enter this program. All the participants except Student D attended public universities. Compared with private universities, public universities require higher exam scores for admission.

Data Collection

This research was conducted in Turkey. The participants' epistemological beliefs in each subject matter were examined through interviews, while their educational programs were analyzed using document analysis. The interview questions of Chan and Elliott (2002) were used to determine the students' epistemological beliefs. The researcher interviewed the students individually and informed them that there were no right or wrong answers. The questions were about the *source of knowledge*, *nature of knowledge*, and *elements in acquiring knowledge*. Each interview was transcribed by the first researchers and then by the other researcher, who is an expert in epistemological beliefs.

In this paper, in line with Schommer's (1990) view, students' epistemological beliefs were determined using Chan and Elliott's (2002: 399-400) interview questions. The questions are as follows:

Source of Knowledge

- Do you believe in, without doubt, the knowledge taught by the teacher? Why?
- Do you agree that the content of textbooks is, in general, correct and highly believable? Why do you have such a belief?
- Do you think textbooks are written by authorities/experts?

Nature of Knowledge

- Do you believe that knowledge is definitely unchanged or changes with time? What causes you to have such a belief? Is there any evidence to support your belief?

Elements in Acquiring Knowledge

- Which of the following is the deciding factor in obtaining knowledge: inborn/innate ability, effort, understanding, or learning method and strategy?
- Which is the most important factor? Rank the factors in order of importance.

Document analysis was conducted to examine the educational programs in terms of epistemological beliefs. The educational programs examined in this paper include a two-year vocational school program, a four-year foreign language (English) program, and a four-year computer education program. All these programs were examined in terms of the dimensions of epistemological beliefs, namely the *source of knowledge*, *nature of knowledge*, and *elements in acquiring knowledge*. The aims and courses of each program were examined.

Procedure

The educational programs and the epistemological beliefs of students enrolled in these programs were compared. First, the three educational programs were examined. Then, four students (referred to as Students A, B, C and D) who had just graduated from university were interviewed for about 30 minutes each.

RESULTS

The participants' epistemological beliefs were examined by using interview questions. The questions were divided into three parts: *source of knowledge, nature of knowledge,* and *elements in acquiring knowledge*. The participants' responses for each part were analyzed and interpreted.

Source of Knowledge

This part of the interview investigated the participants' beliefs regarding whether knowledge is handed down by an omniscient authority or reasoned out through objective and subjective means. The interview questions are as follows: (1) "Do you believe, without doubt, the knowledge taught by the teacher? Why?" (2) "Do you agree that the content of textbooks is, in general, correct and highly believable?" and (3) "Why do you have such a belief? Do you think textbooks are written by authorities/ experts?"

Both English teachers stated the most sophisticated ideas related to this dimension. For example, Student B stated, "*When teachers include their views while teaching, that is, subjective interpretation, I do not believe knowledge taught by teacher[s].*" She added,

"I do not agree that the content of textbooks is in generally correct and highly believable, because when I was doing a presentation in class, some words were misspelled and we found out the correct spelling while discussing it with the professor. The professor was annoyed with us, since we believed the textbook blindly. In the end, the professor stated that the content of the textbook is wrong, and then I looked at the dictionary, since it is objective and I trust objective things. Then, we told the teacher, "You are right.""

Moreover, Student B did not think that textbooks are written by authorities or experts: *"There is no need to be [an] expert to write a textbook. Even college graduates could write textbooks."*

Meanwhile, Student D stated that she did not believe without doubt the knowledge taught by the teacher: *"When the content of the knowledge taught by the teacher has differences with my knowledge and my view, I need to research it."* Regarding textbooks, Student D said,

"Each textbook could have different contents on the same subject. Thus, it makes sense for someone with knowledge about the subject to do research on it. Textbook contents could be different, since throughout my education, I have encountered some instances where the contents of the textbooks are different."

At the same time, Student D stated, *"Textbooks are written by authorities and experts."*

Students A and C, who are EFL majors, did not view authority as a deciding factor. This could be because their backgrounds are "soft." Both of them related their responses to real life practices. Student C said that she did not believe without doubt the knowledge taught by the teacher, since knowledge should always be questioned. She did not agree that the content of textbooks is, in general, correct and highly believable, stating, *"I believe that knowledge after looking at references."* However, she believed that textbooks are written by authorities/ experts.

On the other hand, Student A completely believed in the knowledge taught by the teacher: *"Every [piece of] knowledge I learned was correct. For example, I heard the same things on TV related to 'food' taught by [the] professor."* She also agreed that textbook contents were generally correct and believable. She said, "*If textbooks were wrong, they were withdrawn.*

Also, professors approve these textbooks." She added, *"Textbooks are written by professors and if they are not approved by [the] Ministry of Education, they could not be published."* Students C and A held relatively naïve beliefs related to this dimension.

Nature of Knowledge

In this part of the interview, students' beliefs on whether knowledge is certain and unchanging or tentative and ever changing were investigated. The interview questions are as follows: (1) "Do you believe that knowledge is definitely unchanged or changes with time?" and (2) "What causes you to have such a belief? Is there any evidence to support your belief?"

Student B believed that knowledge changes with time and that knowledge is "like a brick," which is added to another brick each day until "buildings are constructed". She believed this because "claims are constantly being debunked, scientists discover something, and with time, the claims are debunked. Like flowing water, not stationary."

Student D also believed that knowledge changes with time, "since the formation of theory and law causes old knowledge to decay. Knowledge is only an accumulation and changes with time." Student D cited the example of the emergence of atomic theory and how, over time, atoms were discovered to be composed of orbitals and nuclei.

Student C likewise believed that knowledge changes with time, since she did not think of it as "dogmatic." She stated, *"Knowledge is not static; it is changing."* She cited the educational philosophy of progressivism as evidence for this belief.

In contrast, Student A believed, *"Knowledge is unchanged. For example, in medicine, if knowledge changes, everything will be confused."* She added that changes in knowledge would mean "the changing of books" and "understanding the wrong things." When asked to provide evidence for this, she responded, *"I did not encounter anything that changes… But knowledge is unchanged; knowledge is important. For example, wrong knowledge could cost a person's life in medicine."*

Elements in Acquiring Knowledge

This part of the interview examined whether the students' ability is inborn and fixed or can be changed through learning and effort. The interview questions are as follows: (1) "Which of the following are the deciding factors in obtaining knowledge: inborn/innate ability, effort, understanding, or learning method and strategy?" and (2) "Which factor is the most important? Rank them in order of importance."

According to Student B, *"Learning method, strategy, effort, and understanding are the deciding factors in obtaining knowledge, because these are connected to each other. Without effort, there is no understanding. Without understanding, there is no method. They are scaffolding for knowledge."* She stated that method and strategy are the most important deciding factors in obtaining knowledge, since both are needed to gain knowledge: *"For example, underlining important points in newspapers helps us remember knowledge. Also, [when using] acronyms, the first letters help us [memorize] knowledge."* She ranked the factors in the following order of importance: learning method and strategy, effort, understanding, and innate ability. She quoted Einstein's statement that *"one percent of intelligence is inborn and ninety-nine percent of intelligence comes from studying."*

Meanwhile, Student D stated that understanding is the most important deciding factor in obtaining knowledge. She ranked the factors in the following order of importance: understanding, learning method and strategy, effort, and innate ability.

Student C believed that effort is the most important deciding factor in obtaining knowledge. She ranked the factors as follows: effort, learning method and strategy, innate ability, and understanding.

Student A ranked the factors from most to least important as follows: learning method and strategy, understanding, effort, and innate ability. She stated, *"While understanding and learning knowledge, we could decide. We first have to learn something and then we understand it. They are related to each other."* She added, *"Everyone has some learning methods, for example, memorization or writing or revising the subject on the same day. I think this is the most important one."* She believed that everyone has innate abilities and simply has to use those abilities properly.

The English teachers had relatively sophisticated ideas. Student A had relatively naive ideas,

while Students B and D had relatively sophisticated ideas regarding each dimension.

Characteristics of the Educational Programs

The language teacher education program is an undergraduate program consisting of English language development, comparative and applied linguistics, computer-aided language teaching, and specialized courses as well as subjects related to the English language, literature, and culture. This program aims to help students achieve adequate mastery of the English language and provide them with knowledge and practical skills for teaching EFL. Students have to complete school training programs to graduate.

The main concern of the computer education and instructional technology program is the effective use of new information and communication technology in education. Students practice their studies in various ways such as designing an environment for the Internet and educational software, dealing with visual remote teaching techniques, and producing different kinds of material.

The aim of the food technologist program is to develop students as a sub-worker working between the director and workers in food companies.

The English education and computer education programs focused on students' epistemological beliefs, unlike the food technologist program. For example, the aim of the courses of English education and computer education program are related to epistemological beliefs, whereas there is no course for aiming epistemological beliefs in food technology program. Table 1 shows some examples of the objectives of the courses in each department.

There is no specific course for examining the epistemological beliefs in the food technologist program. Some courses that are mandatory in the English education program are also included in the computer education program. The courses of the English education program mostly focused on epistemological beliefs, unlike the mandatory courses of the other departments.

DISCUSSION

The purpose of this paper was to examine the different educational programs (English teacher education, computer technology teacher education, and food technology) in terms of epistemological beliefs and to reveal the epistemological beliefs of students who had just graduated from these programs.

This study was limited to four participants representing different subject majors. Although the findings of this qualitative study cannot be generalized, the study could provide some information regarding each subject major. Previous studies have shown differences between the epistemological beliefs of students enrolled in "soft" and "hard" fields of study. In this paper, foreign language teaching is considered "soft," computer education teaching is considered both "hard" and "soft" since it includes social science courses, and food technology is considered "hard."

In this study, the food technologist showed relatively naive epistemological beliefs in each dimension. This could be because the food technology program concentrates on the subject matter, and the students apply the subject knowledge to real circumstances. The program has no objective or course content related to epistemological beliefs. It focuses more on the subject

Table 1: Objectives of the courses in each department

Course objective	*Course name*	*Department*
To explain psychological, social, and philosophical base of education	Introduction to Educational Sciences	English Teacher Education and Computer Teacher Education
To explain the constructivist approach	Educational Psychology	English Teacher Education and Computer Teacher Education
Students develop independent learning strategies and abilities through different activities. Students learn how to conduct strategy education in their class.	Teaching Strategies	English Teacher Education Department
Students become aware of their beliefs related to language and learning.	Special Teaching Methods	English Teacher Education

rather than on the students' beliefs about knowledge on food and science subjects.

The computer teacher showed relatively less sophisticated beliefs than the foreign language teachers. This could be because English teacher programs focus more on students' epistemological beliefs, since their aim is to train teachers and English teaching is considered a "soft" field of study. Another possible reason is that the computer teacher education and food technologist programs concentrate on subject matters related to computers, and the students apply that knowledge to real life. However, when the computer education program was examined, some courses related to epistemological beliefs were also found. These courses are mandatory for all educational faculty members.

Fujiwara and Phillips (2006) investigated the differences in epistemological beliefs between first-year students and graduating students. They found a significant difference in the quick learning and simple knowledge dimensions. Students majoring in the arts had a significantly lower mean score than those majoring in science and business in terms of quick learning. In addition, the differences among graduating students were only significant among students majoring in the arts and business administration but not among science majors. Similarly, in the present paper, the food technologist had relatively naïve beliefs in comparison with those who majored in other subjects.

Schommer et al. (2003) revealed that students' epistemological beliefs were similar for mathematics and social sciences and for mathematics and business. When academic experience was considered, there was some evidence of domain specificity. The result of the present paper is also in line with that of Ding and Mollohan (2015), who found that at the end of biology instruction, science majors' epistemological beliefs had changed from sophisticated to naïve. Thus, it could be stated that the instruction taken could affect the students' epistemological beliefs both positively and negatively. Lueddeke (2003) revealed that professors who teach "hard" fields of study tend to use a teacher-centered approach in class. Thus, the teaching approach could affect the students' epistemological beliefs. Similarly, the relatively naïve epistemological beliefs of computer education and food technology students could be the result of the teaching methods used by professors.

CONCLUSION

According to the qualitative research findings, the prospective English teachers had more sophisticated ideas than the prospective computer teacher, while the prospective food technologist had relatively naive ideas on each epistemological belief dimension. Thus, it could be stated that students in hard fields of study have naïve epistemological beliefs, whereas those in soft fields of study have sophisticated epistemological beliefs.

RECOMMENDATIONS

This research could be conducted on other disciplines, whether hard or soft such as mathematics, primary science, and social science teacher education programs. The number of participants could be increased. Quantitative research, such as a survey could also be conducted using more participants.

LIMITATIONS

Since this is a qualitative study, the results cannot be generalized to all students in English teacher education, computer teacher education, and food technologist programs.

NOTE

A part of this paper was presented at the World Council of Comparative Education Societies XIV World Congress in Istanbul, Turkey, under the same title ("The effect of different educational programs on development of students' epistemological beliefs").

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