



Investigating structural relations among university students' self-efficacy beliefs, epistemological beliefs, and digital literacy skills

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Abstract

This research study aimed to investigate the relationships among self-efficacy beliefs, epistemological beliefs, and digital literacy skills of university students who took courses through compulsory distance education throughout the COVID-19 pandemic. In this context, a structural equation model was proposed by reviewing the research studies in the literature. The proposed structural model was analyzed and discussed based on the literature. One thousand, six hundred and forty-four (1644) students studying in a university in Turkey voluntarily participated in the study. "Online learning self-efficacy scale", "Online specific epistemological beliefs scale" and "Digital literacy scale" were used as the data collection tools in the research. According to the results of the study, participants' online self-efficacy beliefs were found to be effective on their online epistemological beliefs and digital literacy. Furthermore, it was observed that online epistemological beliefs were also effective in digital literacy skills. Suggestions were made according to the results of the study.

Keywords: Digital literacy skills; E-learning; higher education; online specific epistemological beliefs; self-efficacy beliefs.

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1. INTRODUCTION

In the past, educational institutions where people studied were significant determinants of their academic development. Learning was limited to the resources these educational institutions could provide. However, this limitation has now been overcome by the technological developments brought about by the digital age. Nowadays, it can be said that learners have more control over their learning through the internet (Yang et al., 2022). Henceforth, individuals of all ages can reach instructors, libraries, museums, and laboratories in different parts of the world through the Internet without time and place limitations (Tang et al., 2021). Therefore, technology has become one of the milestones of formal learning, especially during the current COVID-19 pandemic. Today, the internet is widely used as a source of knowledge by learners (Akkaya, 2021; Bråten et al., 2019; Kammer et al., 2021; Tsai, 2008; Nkansah & Oldac 2024). In this projection, many learning activities (lessons, homework, information research, etc.) are carried out on a voluntary/compulsory basis on the Internet. However, the internet is an environment open to all kinds of manipulation of knowledge (Ay, 2016).

Although accessible information sources have been increasing day by day, the resulting mass of information makes it equally difficult to access qualified information. The validity and reliability of the knowledge on the internet mostly need to be confirmed (Aydin, 2020; Gecgel et al., 2020). Therefore, in the 21st century, citizens should be equipped with some cognitive skills (eg. the conscious use of ICTs to evaluate the reliability of the sources of knowledge in online environments) that will strengthen their hand in the fight against information pollution (von Gillern et al., 2024; Ferguson et al., 2012; Strømsø & Bråten 2010; Walraven et al., 2009). Moreover, the variables "Digital literacy", "online learning self-efficacy beliefs" and "online specific epistemological beliefs", which are known from the relevant literature to serve this purpose, have become popular over time. However, when the research in the relevant literature is examined, it is seen that these variables are often studied independently of each other. The literature on online learning is still limited in terms of studies dealing with the structural relationships between these variables. In this sense, this study can make a realistic contribution to the literature.

In this study, digital literacy skills were discussed in the context of "Online Learning Self-Efficacy Beliefs" and "Online Specific Epistemological Beliefs", which are thought to be other central variables related to digital literacy. The central position of these beliefs will be clarified within the following sections. Therefore, the purpose of this study was to examine the relations among Turkish university students' self-efficacy beliefs, epistemological beliefs, and digital literacy skills.

1.1. Theoretical framework

1.1.1. Online learning self-efficacy beliefs

Self-efficacy beliefs refer to individuals' beliefs about themselves regarding their capacity to be successful and to organize the necessary steps to achieve their targeted performance (Bandura, 1977; Zimmerman, 1995). Therefore, strong or weak self-efficacy beliefs may directly affect the thoughts, emotions, and motivational states of individuals. Also, the judgments that people have gained about their potential will be decisive in terms of their performance in a particular situation (Bandura, 1977; Warren et al., 2021). In this context, it may become possible to intervene in many different variables by determining self-efficacy beliefs (Chang et al., 2014; Lim et al., 2021).

In the last few decades, especially with the popularization of searching for information on the internet, it seems that studies in which self-efficacy beliefs are discussed by associating with online environments have come to the forefront in the literature. For example, Alemayehu and Chen (2021) found that higher education students' learning self-efficacy beliefs had a direct influence on self-monitoring and learning engagement in online learning environments. Alqurashi (2019) has revealed online learning self-efficacy is

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the most powerful and significant predictor of perceived learning and student satisfaction. Reddy et al., (2021) point out that competency in computers and self-efficacy of computer utilization have a significant effect on technology acceptance.

Furthermore, in the relevant literature, it is possible to find many other studies on the effects of self-efficacy beliefs on individuals' attitudes and their performance in online environments (Chang et al., 2014; Ekici et al., 2012; Li, 2020; Liang & Tsai, 2008; Lim et al., 2021). However, especially when recent studies on self-efficacy beliefs for online environments are reviewed, it is observed that they are limited in number and that self-efficacy beliefs on online environments were discussed by associating with a limited number of variables in most of the studies. In this sense, it is necessary to increase the number of scientific studies that comprehensively discuss self-efficacy in online learning environments based on the data obtained from sample groups with high participation.

1.1.2. Online-specific epistemological beliefs

Epistemology is the branch of philosophy that deals with knowledge and beliefs about knowing (Hofer & Pintrich, 1997). Epistemology, which was discussed by Perry (1970), who adopted the Piagetian framework for the first time in the literature as a model, was handled within a developmental perspective by many researchers following his studies (Belenky et al., 1986; Kuhn, 1991; King & Kitchener, 1994; Magolda, 1992). In these studies which were mainly conducted with university students, it was determined that the participants considered knowledge as "something absolute and precise (either right or wrong), simple, easy to understand, has a structure consisting of unrelated parts and is created by an expert and transferred to students", however, when they reached the final year, they believed that "knowledge cannot be absolute and precise, in other words, it can be right or wrong depending on the situation, it has a complex structure consisting of many interrelated parts and is produced by individuals based on evidence through reason or experiments" (Perry, 1968). According to this developmental perspective, individuals' epistemological beliefs develop in parallel with the increase in age, social interaction, and education levels over time (Perry, 1970).

The compatibility of Perry's (1970) epistemological belief model (Intellectual and Ethical Development) and other successive developmental models with the constructivist perspective, which had a broad repercussion in the field of educational sciences, enabled the prevalence of developmental models in the relevant literature for a long time. On the other hand, epistemic development is discussed as a whole in one dimension in all these developmental models. Schommer (1990) defines epistemology as "a system of belief about knowledge and learning that include more or less independent dimensions". Unlike developmental models, Schommer (1990) stated that it would be more appropriate to examine epistemic development in a continuous distribution rather than through the transitions between certain hierarchical levels and labeled epistemological beliefs on a naive-sophisticated scale.

In the perspective of a multidimensional belief system, epistemological beliefs are discussed in four dimensions, including the "certainty of knowledge", "simplicity of knowledge", "source of knowledge", and "justification for knowing" (Hofer & Pintrich, 1997). Accordingly, in the dimension of the certainty of knowledge, individuals with naive epistemological beliefs think that knowledge consists of unchanging, certain rights and wrongs, however, in individuals with sophisticated epistemological beliefs, knowledge is seen in a structure that can be changed and updated. In the dimension of the simplicity of knowledge, individuals with naive epistemological beliefs believe that knowledge consists of simple and unrelated parts, however, individuals with sophisticated epistemological beliefs believe that knowledge is parts of a whole interconnected with complex relationships. In the dimension of the source of knowledge, individuals with naive epistemological beliefs believe that authorities are the owners of knowledge, and that accurate knowledge can only be produced by the experts of the field, however, individuals with

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sophisticated epistemological beliefs consider themselves as authorities in the evaluation process of knowledge. Finally, in the dimension of the justification for knowing, while individuals with naive epistemological beliefs do not need any justification for knowledge, individuals with sophisticated epistemological beliefs consider that knowledge should be confirmed in different ways (for example, through experiments) (Hofer & Pintrich, 1997; Brownlee et al., 2002).

In the relevant literature, of "certainty of knowledge" and "simplicity of knowledge" dimensions are considered as the beliefs about the nature of knowledge whereas of "source of knowledge" and "justification for knowing" dimensions cover the beliefs about the nature of knowing (Hofer & Pintrich, 1997). Nevertheless, according to the belief system perspective, epistemic development does not have to occur simultaneously across these dimensions. Accordingly, an individual with naive beliefs in one epistemic dimension may simultaneously have sophisticated beliefs in another epistemic dimension (Schommer, 1990). The possibility of this differentiation between the dimensions in terms of epistemic development was confirmed in many studies in the literature (Buehl, 2008; Hofer, 2000). Nevertheless, this multidimensional nature of epistemological beliefs has made the distinction of domain general-content specific epistemological beliefs, which corresponds to another perspective in the literature. While the definition of a generally accepted epistemological belief is made for all contexts without any distinction in the domain-general epistemology perspective, it is accepted that epistemological beliefs may be adaptive by the context in the domain specificity perspective. Accordingly, individuals' epistemological beliefs may vary according to the context (Buehl & Alexander, 2006; Buehl et al., 2002). In this study, the domain specificity approach was adopted to discuss epistemological beliefs by the nature of the context, especially in online learning environments.

Epistemological beliefs can guide online information search processes as well as the learning process (Bråten & Strømsø, 2006; Ira & Gecer, 2017; Tsai, 2004). In the online information search process, individuals' epistemological beliefs about knowledge and sources of knowledge on the internet play an active role in learners' access to the sources of knowledge, evaluating the suitability of the information accessed for the search, and deciding on the accuracy and scope of knowledge in these sources (Mason et al., 2010). Studies indicate that epistemological beliefs are a predictive variable in terms of online information search strategies (selecting and evaluating the appropriate strategy) (Drossel et al., 2020; Chiu et al., 2013; Dahl et al., 2005; Greene et al., 2010; Mason & Boldrin, 2008; Muis & Franco, 2009). Therefore, it is stated in many studies in the literature that epistemological beliefs about online learning environments should be investigated (Bråten, 2008; Bråten et al., 2005; Bråten et al., 2019).

1.1.3. Digital literacy

In the simplest terms, digital literacy is defined as "the ability to survive in the digital age" (Eshet, 2004). Accordingly, individuals with advanced digital literacy skills are individuals who can adapt to new and developing technologies and use them actively (Ng, 2012; Buchan et al., 2024). In this sense, the concept of digital literacy, which was used for the first time by Gilster (1997) in the literature, is shown among the basic competencies required by the 21st century by many researchers today (Eshet, 2004; Ng, 2012; Vavik & Salomon, 2015; Voogt & Roblin, 2012; Voogt et al., 2013), which has led to the widespread use of digital literacy with many different keywords used interchangeably in the literature (such as information technology literacy, computer literacy and media literacy) (Zhang et al., 2024; Bawden, 2008; Eshet, 2004; Martin, 2008; Ng, 2012).

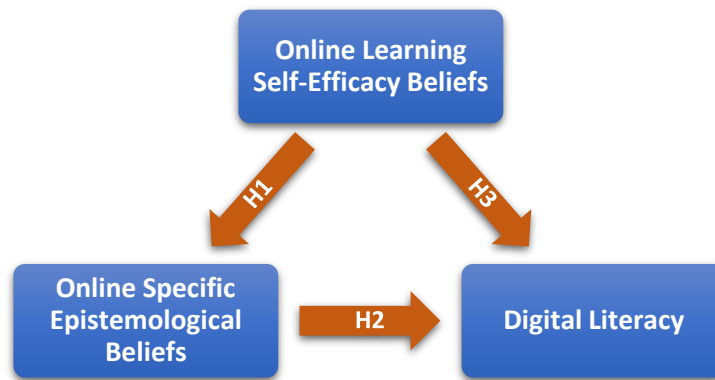
Ng's (2012) digital literacy model is one of the most frequently referenced models of digital literacy in the literature. This model argues that digital literacy includes three dimensions labeled as "technical", "cognitive" and "socio-emotional". While the technical dimension refers to "having the technical and operational skills to acquire information and use the information and communication technologies in daily

activities”, the cognitive dimension refers to “the ability to think critically while creating a cycle to search for, evaluate, and process digital information”, and the socio-emotional dimension refers to “the ability to use the internet responsibly to communicate, socialize and learn”. Hence, digital literacy is a blend of these three dimensions called technical, cognitive, and socio-emotional in a model of Ng (2012). Nevertheless, as was mentioned previously, it can be said that there is a possible relational network between these variables in terms of self-efficacy beliefs being a predictor variable in putting technical skills into practice and epistemological beliefs serving as a guide in cognitive processes such as accessing information, evaluating the sources of evidence, and processing information. Pre-service science teachers' digital literacy skills have been significantly predicted by their epistemological beliefs.

1.1.4. Proposed model and hypotheses

The relational model in Figure 1 was proposed to examine the research problem. In the proposed model, the relationships between university students' online learning self-efficacy beliefs, online-specific epistemological beliefs, and digital literacy levels were discussed based on Rokeach's (1968) belief system approach.

Figure 1
Proposed Model



Rokeach (1968) states that people have many different beliefs about various contexts, which may lead to possible confusion. Rokeach (1968), who stated that people organize their beliefs hierarchically in the form of central and peripheral beliefs to overcome this complexity, presented a relational model. He likened this model to the structure of the atom. According to the model, he stated that central beliefs had much more relational networks than peripheral beliefs due to their position, and therefore central beliefs were much more difficult to change. Accordingly, peripheral beliefs related to this belief also need to be rearranged to change a central belief (Rokeach, 1968).

Rokeach (1968) mentioned 5 different types of beliefs A, B, C, D, and E types while defining central and peripheral beliefs from the perspective of the belief system model. Among them, later beliefs in alphabetical order were derived from earlier beliefs. Therefore, type C beliefs are more central than type D beliefs, and type D beliefs are more central than type E beliefs (Rokeach, 1968).

Types A and B beliefs are beliefs related to self. These beliefs involve individuals' answers to the question "Who am I?". About the main difference between type A and type B beliefs, there is a social consensus in terms of type A beliefs, however, there is no social consensus in terms of type B beliefs. For example, while type A beliefs represent the society's beliefs about an individual, type B beliefs are the individual's beliefs that are directly related to himself/herself. Type C beliefs represent authority beliefs about knowledge and sources of knowledge. Therefore, epistemological beliefs are shown among type C

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beliefs. Type D beliefs are derived from Type C beliefs and include ideological judgments. Finally, type E beliefs include personal matters of taste and beliefs about aesthetics (Rokeach, 1968). In terms of the variables in the model proposed in this study, while self-efficacy beliefs are positioned at the innermost, epistemological beliefs are positioned in the middle, and the digital literacy variable is positioned at the utmost.

The innermost position of self-efficacy is based on Bandura's (1977) definition of the sources of self-efficacy. Bandura (1977) suggests four sources for self-efficacy beliefs: "enactive attainments", "vicarious experience", "social persuasion" and "physiological state". Among them, enactive attainments are individuals' efficacy perceptions arising from their success or failure firsthand on their own. Vicarious experience includes judgments of individuals' abilities, that they obtain by comparing themselves with others. The third source, social persuasion includes the support and encouragement provided by the social environment to the individual that he or she can successfully perform a task. Finally, the physiological state is related to how well the person feels physically and psychologically and its reflections on self-efficacy (Bandura, 1977). As it is seen, both the judgments of the person about himself and the judgments of his social environment about that person constitute a basis for self-efficacy beliefs. Therefore, it is possible to say that self-efficacy beliefs correspond to Type A and Type B beliefs in Rokeach's (1968) belief system definition.

Epistemological beliefs, another component in the model, are considered within the scope of Type C beliefs, which affect the beliefs about the source of knowledge and knowing, in the belief system perspective of Rokeach (1968). It is a frequently stated fact in the literature, that epistemological beliefs are at a central position in terms of beliefs and behaviors related to knowledge, knowing, and learning (Brownlee et al., 2002; Hofer & Pintrich, 1997). Therefore, epistemological beliefs were included in the model as an important variable in determining the strategies for online environments and evaluating the knowledge there.

Digital literacy, the last component in the model, has an interrelated term for epistemological beliefs and self-efficacy beliefs. In other words, people's digital literacy skills have been affected by their epistemological beliefs and self-efficacy beliefs. In the relevant literature, it is possible to find many studies that provide theoretical and empirical evidence that individuals with sophisticated epistemological beliefs are individuals who organize knowledge and communication technologies, benefit from multiple evidence sources and question the reliability of these sources of knowledge (Barzilai & Zohar 2012; Mason et al. 2018; Strømsø & Bråten 2010; Tsai, et al., 2011). To make such an evaluation of the sources of knowledge in online environments requires having advanced digital literacy skills. In this sense, it is possible to say that digital literacy and epistemological beliefs that encourage cognitive and metacognitive processes are intertwined variables.

Self-efficacy beliefs about online environments affect the strategies used to search for information on the internet according to the current research. Furthermore, having high self-efficacy for the Internet facilitates access to information in online environments (Tsai & Tsai, 2003; Zimmerman & Kulikowich, 2016). Individuals with high self-efficacy beliefs for online environments use the internet and computer more actively in the information search process (Durndell & Haag, 2002; Kaya & Durmus, 2010). On the other hand, learners with lower computer and internet self-efficacy beliefs may be less successful at online learning tasks and less likely involved in online mediums (Lyons et al., 2012; Pellas, 2014),

In the past, many researchers confirmed that self-efficacy beliefs about ICTs predicted the attitudes toward these tools and the skills related to the use of ICTs (Rex & Roth, 1998; Tekerek et al., 2012). Similarly, Ata (2011) found that there was a significant relationship between the use of Web 2.0 technology tools and information literacy self-efficacy perception. However, there were certain studies evidencing

that digital literacy is effective on people's self-efficacy beliefs (Mac Callum & Jeffrey 2014). In this sense, it is possible to say that individuals' self-efficacy beliefs about online environments may be effective on their digital literacy levels. However, this does not mean that digital literacy cannot exist without self-efficacy beliefs. All the variables of this research exist at the same time for any people; however, the interaction among these variables flows from self-efficacy beliefs to digital literacy skills based on theoretical and empirical research. In other words, during any digital action or behavior, we can observe self-efficacy beliefs, epistemological beliefs, and digital literacy skills at the same time. The proposed model presented in Figure 1 just defines the direction of reaction observed among these variables.

Based on all these evidences, the hypotheses tested in the study are as follows:

- H1: university students' online learning self-efficacy beliefs affect their epistemological beliefs about online environments.
- H2: university students' epistemological beliefs about online environments affect their digital literacy levels.
- H3: university students' online learning self-efficacy beliefs affect their digital literacy levels.

Considering these hypotheses as well as the purpose, the research problem of the study is:

What are the relationships among self-efficacy beliefs, epistemological beliefs, and digital literacy skills of university students who took courses through compulsory distance education during the COVID-19 pandemic?

1.2. Purpose of study

This study was conducted to investigate the relationships among university students' online learning self-efficacy beliefs, online-specific epistemological beliefs, and digital literacy skills. Therefore, an associational research design guided this cross-sectional survey study (Fraenkel & Wallen, 2006).

2. METHOD AND MATERIALS

2.1. Participants

One thousand, six hundred and forty-four (1644) undergraduate students from a Turkish state university (involving 25000 students in total) participated in the research voluntarily. Convenience sampling was applied to catch a higher number of participants. The distribution of participants by their age, gender, school type, and classes is represented in Table 1.

Table 1
Participants' frequency and percentage distributions

Variable	Trait	Number	Percentage
Gender	Female	971	59.06
	Male	673	40.94
Age	19 and under	139	8.45
	20	332	20.19
	21	382	23.24
	22	331	20.13
	23	204	12.41
	24	97	5.90
	25	44	2.68
Class	26 and below	115	7.00
	1 (Freshman)	595	36.19
	2 (Sophomore)	462	28.10
	3 (Junior)	255	15.51

	4 (Senior)	332	20.19
	Faculty	1262	76.76
School type	College	14	0.85
	Vocational School	368	22.38
Total		1644	100

2.2. Data collection instrument

The instrument covered 3 different scales which were 1) the online learning self-efficacy scale, 2) the online specific epistemological beliefs scale, and 3) the digital literacy scale.

The online learning self-efficacy scale: This scale, whose descriptive scores are represented in Table 2, was developed by Zimmerman and Kulikowich (2016) for the assessment of university students' online learning self-efficacy beliefs. The scale involved 22 items (5-point Likert type: 1 for completely disagree and 5 for completely agree) distributed to 3 factors; "online environment", "time management", and "technology use". The scales were adapted into Turkish by a sample of 2087 university students and reported one one-factor solution with a .98 Cronbach Alpha reliability score. Since the scale was utilized with a similar sample, a confirmatory factor analysis (n=1644) was conducted for validation (Tabachnick & Fidell, 2013). This analysis resulted acceptable fit indices [$\chi^2(155) = 750.761$, $\chi^2/df = 4.844$; $P < .001$, CFI = 0.979, TLI = 0.968, SRMR = 0.032, RMSEA = 0.048] with factor loadings between .54 and .82. In addition, Cronbach Alpha reliability was calculated as .96. Therefore, it could be claimed that the scale had the potential of yielding valid and reliable results.

Table 2

*Descriptive scores for online learning self-efficacy scale**

Item No	Item	M	SD	FL
1	"Navigate online course materials efficiently"	4.13	.91	.73
2	"Find the course syllabus online"	4.18	.87	.78
3	"Communicate effectively with my instructor via e-mail"	4.16	.95	.72
4	"Communicate effectively with technical support via e-mail, telephone, or live online chat"	4.13	.91	.78
5	"Submit assignments to an online dropbox"	4.22	.88	.77
6	"Overcome technical difficulties on my own"	3.86	.98	.65
7	"Navigate the online grade book"	4.27	.87	.80
8	"Manage time effectively"	3.89	1.00	.68
9	"Complete all assignments on time"	4.06	.96	.71
10	"Learn to use a new type of technology efficiently"	4.12	.84	.72
11	"Learn without being in the same room as the instructor"	3.65	1.16	.54
12	"Learn without being in the same room as other students"	3.83	1.09	.61
13	"Search the Internet to find the answer to a course-related question"	4.28	.82	.78
14	"Search the online course materials"	4.28	.80	.79
15	"Communicate using asynchronous technologies (discussion boards, e-mail, etc.)"	4.17	.86	.80
16	"Meet deadlines with very few reminders"	4.10	.93	.75
17	"Complete a group project entirely online"	4.05	.97	.75
18	"Use synchronous technology to communicate with others (such as Skype)"	4.30	.83	.82
19	"Focus on schoolwork when faced with distractions"	3.61	1.13	.55
20	"Develop and follow a plan for completing all required work on time"	4.00	.96	.71

21	"Use the library's online resources efficiently"	3.74	1.09	.61
22	"When a problem arises, promptly ask questions in the appropriate forum (e-mail, discussion board, etc.)"	4.16	.91	.77

*M for mean, SD for standard deviation, and FL for factor loading

Online specific epistemological beliefs scale: The scale was developed to measure university students' epistemological beliefs specified for online learning environments. Descriptive scores of the scale are represented in Table 3. Considering the exploratory factor analysis results covering data from 1058 undergraduate students. A two-factor solution was labeled as nature of knowing (7 items) and nature of knowledge (8 items) with .80 alpha reliability for both factors. Therefore, the scale had 15 five-point Likert items (1 for completely disagree and 5 for completely agree). Before, the analysis 8 items in nature of the knowledge dimension were recorded back so that higher scores on the scale pointed to sophisticated epistemological beliefs. In this study, we conducted a confirmatory factor analysis (n=1644) for validation and received acceptable fit indices such as $\chi^2(69) = 319.936$, $\chi^2/df = 4.637$; $P < .001$, CFI = 0.976, TLI = 0.963, SRMR = 0.031, RMSEA = 0.047 as well as factor loading values between .44 and .84. Also, Cronbach Alpha reliability scores were observed as .83 and .87 respectively for nature of knowing and nature of knowledge dimensions. Therefore, this scale was accepted as producing valid and reliable results.

Table 3

*Descriptive scores for online specific epistemological beliefs scale **

Factor	Item No	Item	M	SD	FL
Nature of Knowing	1	"Online media is only one of the sources that enable me to access knowledge."	4.00	.91	.56
	2	"Even when shared by domain experts I confirm the accuracy of information on online media using diverse resources."	3.92	.89	.66
	3	"I use my prior knowledge while deciding on the accuracy of knowledge from online media."	4.11	.73	.64
	4	"It is important that knowledge I find on online media is logical."	4.07	.87	.58
	5	"I study scientific works to decide on the accuracy of knowledge on online media."	4.00	.85	.73
	6	"I decide on the accuracy of knowledge on any online media by comparison with other online media."	3.88	.89	.57
	7	"I verify the knowledge on online media using various resources even if I believe its accuracy."	4.04	.81	.70
Nature of Knowledge	1	"I can always access correct answers using online media." (R)	2.51	1.03	.66
	2	"Knowledge on online media is mostly correct." (R)	2.63	1.01	.76
	3	"Knowledge of online media is correct." (R)	3.23	1.30	.84
	4	"Knowledge on online media presents absolute truths." (R)	3.21	1.31	.77
	5	"I am sure of the accuracy of knowledge on online media." (R)	2.38	1.02	.56
	6	"Most of the knowledge on online media are individual messages and content." (R)	2.45	.98	.44

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7	"Knowledge on online media can be the truth by itself." (R)	2.85	1.19	.68
8	"Knowledge on online media far from presenting a holistic and correct approach." (R)	2.76	1.03	.59

*M for mean, SD for standard deviation, FL for factor loading, and R for recorded

Digital literacy scale: This scale, whose descriptive scores are represented in Table 4, was developed by Ng (2012) for the measurement of undergraduate students' digital literacy skills. The scale originally involved 17 Likert (1 for completely disagree and 5 for completely agree) items distributed to 4 dimensions: attitudes, technical, cognitive, and social-emotional. Previously the scale was adapted into Turkish with a similar sample and reported a one-factor solution including 10 items. This adapted version was utilized in this study. Confirmatory factor analysis (n=1644), produced good fit indices [$\chi^2(28) = 121.356$, $\chi^2/df = 4.334$; $P < .001$, CFI = 0.988, TLI = 0.981, SRMR = 0.019, RMSEA = 0.045], was applied for validation purpose. Factor loading values were observed in the range of .48-.79. Moreover, Alpha reliability was calculated as .80. Therefore, it was accepted that this scale would produce valid and reliable findings.

Table 4
*Descriptive scores for digital literacy scale **

Item No	Item	M	SD	FL
1	"I know how to solve my technical problems."	1.99	.86	.75
2	"I can learn new technologies easily."	4.26	.75	.70
3	"I keep up with important new technologies."	3.94	.94	.72
4	"I know about a lot of different technologies."	3.70	1.00	.79
5	"I have the technical skills I need to use ICT for learning and to create artifacts (e.g. presentations, digital stories, wikis, blogs) that demonstrate my understanding of what I have learned."	3.80	.99	.71
6	"I have good ICT skills."	3.65	1.04	.72
7	"I am confident with my search and evaluation skills regarding obtaining information from the Web."	4.15	.80	.70
8	"I am familiar with issues related to web-based activities e.g. cyber safety, search issues, plagiarism."	3.78	1.05	.67
9	"ICT enables me to collaborate better with my peers on project work and other learning activities."	4.06	.87	.63
10	"I frequently obtain help with my university work from my friends over the Internet e.g. through Skype, Facebook, and Blogs."	3.83	1.11	.48

*M for mean, SD for standard deviation, and FL for factor loading

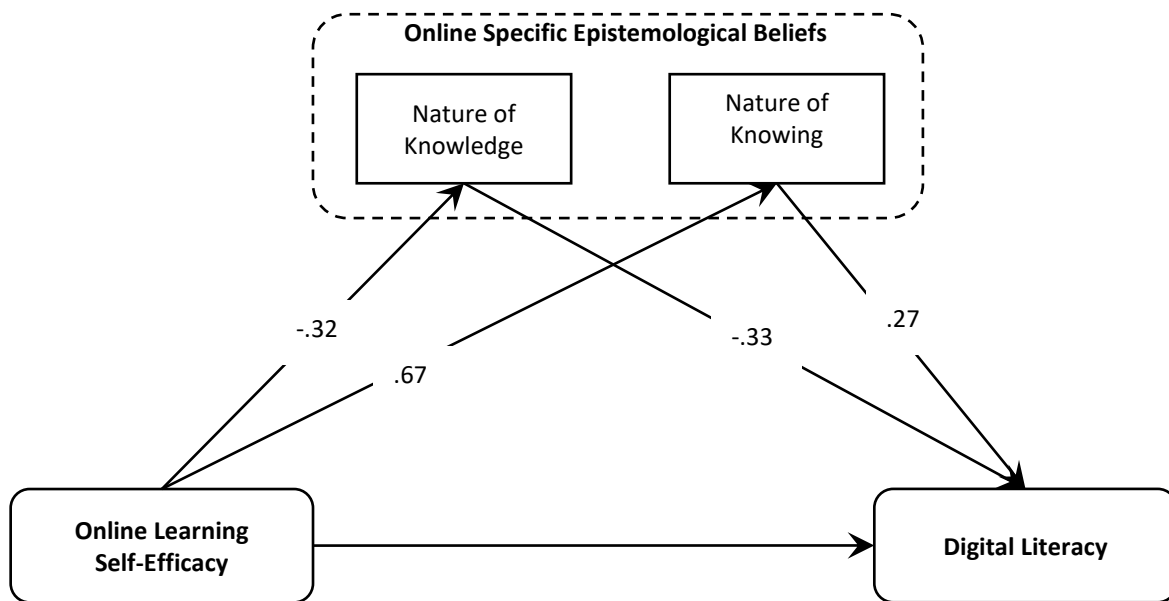
2.3. Analysis

All the scales were presented to participants by the learning management system (LMS) of the university. Voluntary participants were informed about the purposes of the research and requested to fill out the forms online. Then, data was transported to SPSS for analysis. Reliability analyses as well as descriptive statistics were conducted through SPSS. In addition, confirmatory factor analyses, and structural equation modeling analyses were applied through AMOS. Through structural equation modeling and confirmatory factor analyses, first-order models were adapted by the researchers (Tabachnick & Fidell, 2013). In other words, all the factors were directly related to other factors in the models.

3. RESULTS

Considering the purpose of the research the structural equation modeling analysis (n=1644) was applied to investigate relationships among Turkish university students' online learning self-efficacy beliefs, online-specific epistemological beliefs, and digital literacy skills. This analysis yielded a statistical model holding acceptable fit indices such as $\chi^2(956) = 4875.751$, $\chi^2/df = 5.100$; $P < .001$, CFI = 0.921, TLI = 0.911, SRMR = 0.073, RMSEA = 0.050. The model is represented in Figure 2.

Figure 2
Statistical model



According to Figure 2 participants' online learning self-efficacy beliefs predicted significantly their online-specific epistemological beliefs and digital literacy skills. Moreover, their online-specific epistemological beliefs were significantly related to their digital literacy skills. Online learning self-efficacy beliefs predicted the nature of knowledge beliefs negatively whereas the same beliefs predicted the nature of knowing beliefs positively. In other words, when university students felt more efficacious related to online learning, they held naive beliefs about the nature of knowledge; however, they held sophisticated beliefs about the nature of knowing. That is to say, a more self-efficacious university student most probably believed that knowledge is simple and certain (corresponding to naive beliefs for the nature of knowledge); however, the source of knowing was him/herself, and knew had to be justified (corresponding to sophisticated beliefs for nature of knowing).

Moreover, as can be seen in Figure 2, the nature of knowledge beliefs predicted digital literacy skills negatively whereas the nature of knowing beliefs predicted digital literacy skills positively. It means that undergraduate students' naive beliefs like the knowledge dimension (such as knowledge doesn't change, and knowledge doesn't have a network) as well as sophisticated beliefs like the knowing dimension (such as justification is necessary for knowing and authorities are not a source of knowing) get them to hold qualified digital literacy skills. Finally, results in Figure 2 showed that university students' online learning

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self-efficacy beliefs positively predicted their digital literacy skills. In other words, it seems that participants' efficacious beliefs triggered a positive qualification in their digital literacy skills.

4. DISCUSSION

Considering the scientific studies presented in the literature, the results of this study are mostly coherent with previous findings. For example, as a central belief related to self, self-efficacy beliefs were expected to be significantly related to other types of beliefs as stated by Rokeach (1968). In addition, Hofer and Pintrich (1997) claimed that epistemological beliefs were central to beliefs and variables of learning and teaching. Therefore, the results of this study showing significant relationships between epistemological beliefs and digital literacy skills were already coherent with the claims of Hofer and Pintrich (1997). Barnard et al., (2008) found close relations between university students' epistemological beliefs and self-regulated learning skills; in other words, university students' epistemological beliefs were effective in their learning processes.

As mentioned by previous research, enactive attainments of individuals are the most effective sources of their self-efficacy beliefs (Bandura, 1977). Our results have shown that university students' online learning self-efficacy beliefs are significant predictors of their epistemological beliefs and digital literacy skills. Considering these results as well as this discussion on the issue, utilizing online computers as educational tools may be accepted as a way of contributing to students' enactive attainments. Therefore, we can discuss the adaptation of online computers to educational mediums of university students as a way of effective pedagogical use of computers. These enactive attainments may positively contribute to both their epistemological beliefs and digital literacy skills.

As mentioned previously, studies show that there is a positive relationship between epistemological beliefs in different contexts and self-efficacy beliefs (Chen & Pajares, 2010; Hofer, 1994) and digital literacy skills (Barzilai & Zohar 2012; Mason et al., 2018; Strømsø & Bråten 2010; Tsai et al., 2011) can be found in the relevant literature. Similarly, it is known that digital literacy (or information literacy as another representation in the literature) skills are directly affected by self-efficacy beliefs (Kaya & Durmus, 2008; Tsai & Tsai, 2003; Zimmerman & Kulikowich, 2016).

Considering the results as well as the previous findings in the literature, it can be concluded that Turkish university students' online self-efficacy beliefs may contribute positively to their online-specific epistemological beliefs and digital literacy skills. In addition, it was found that participants' online specific epistemological beliefs may contribute positively to their digital literacy skills. Considering these statements, it is clear that positive contributions to university students' online learning self-efficacy beliefs are critically important for getting qualified digital literacy skills (Kaya & Durmus, 2008; Tsai & Tsai, 2003; Zimmerman & Kulikowich, 2016) and development of epistemological beliefs seems to be necessary for qualification of digital literacy skills (Chiu et al., 2013; Dahl et al., 2005; Muis & Franco, 2009).

5. CONCLUSIONS

There are two different limitations of the study. The first is that online specific epistemological beliefs scale is composed of two dimensions (nature of knowledge and nature of knowing) instead of four dimensions (source, certainty, simplicity, and justification). The last is that our sample involved participants just from one university in Turkey. Participants from other universities and/or countries may change the results.

The literature shows that the enactive attainments of individuals have the most powerful direct effect on their self-efficacy beliefs. Therefore, educational mediums for university students should be upgraded to provide them holding more direct experience in online learning. However, as far as we searched, the

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literature does not have any specific model focusing on the development of epistemological beliefs but presents limited evidence on the positive effect of argumentation on epistemological beliefs. Therefore, adaptation of argumentation as a way of teaching/learning can be suggested to university lecturers.

Ethical Approval: All procedures performed in studies involving human participants were by the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

Conflict of Interest: The authors declare no competing interests.

Consent Statement: Informed consent was obtained from all individual participants included in the study. All of the participants voluntarily participated in the study.

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