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# A comprehensive model covering prospective teachers' technology use: the relationships among self, teaching and learning conceptions and attitudes

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## ABSTRACT

This study was conducted to propose and examine a comprehensive model embracing prospective teachers' beliefs about self, teaching and learning conceptions, and attitudes towards using instructional technologies. Prospective or inservice teachers' beliefs (from central to peripheral) and attitudes may empower the support of teacher training related to using instructional technologies. Participants were 1208 Turkish prospective teachers from five different universities who participated voluntarily and were selected using convenience sampling. Structural equation modelling analysis showed that prospective teachers' beliefs about the autonomous self and autonomous-related self positively related to both their constructivist beliefs about teaching and learning and attitudes towards using instructional technologies, whereas the same beliefs negatively related to traditional conceptions of teaching and learning. Moreover, participants' constructivist beliefs about teaching and learning positively predicted their attitudes towards using instructional technologies. Furthermore, their beliefs about related self positively and unexpectedly predicted their constructivist conceptions and attitudes. Implications are presented considering these results.

## ARTICLE HISTORY

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## KEYWORDS

Teaching belief system; self; teaching-learning conception; attitudes towards using instructional technologies; prospective teachers

Researchers from different subject areas and contexts have verified that effective use of instructional technologies positively contributes to students' conceptual understanding (Byrom & Bingham, 2001; Mitchem, Wells, & Wells, 2003; Mumtaz, 2000; Schmid et al., 2014; West, 2012). Policy makers have directed a considerable amount of investments towards developing technological opportunities for learning environments (DeSantis, 2012; Keengwe, Schnellert, & Mills, 2012; West, 2012). However, prospective and inservice teachers still face strong barriers when using instructional technologies in their teaching practices (Ertmer, 1999; Goktas, Gedik, & Baydas, 2013; Zhao & Cziko, 2001).

Ertmer (1999, 2005) described two types of barriers: first-order and second-order barriers. First-order barriers, often described as extrinsic factors, include lack of access to computers and software, insufficient time to plan instruction, and inadequate technical and administrative support. Second-order barriers, on the other hand, are intrinsic factors such as beliefs about teaching, beliefs about computers, established classroom practices and unwillingness to change. Considering the investments for hardware and software opportunities in schools together with training support for prospective and inservice teachers, second-order barriers have gained a central position for today's

prospective teachers (PTs) (Abbitt, 2011; An & Reigeluth, 2011; Kim, Kim, Lee, Spector, & DeMeester, 2013). One of the reasons for the failure of technology-related educational reforms is that these second-order barriers are underestimated (Papanastasiou & Angeli, 2008). Therefore, certain researchers (e.g. Smarkola, 2008; Teo, 2009) state that identification and support of PTs' belief systems may have a key role in order to prepare them for successful use of technology.

Looking at the research on prospective and inservice teachers' beliefs and behaviours towards using instructional technologies, some variables such as computer self-efficacy beliefs and attitudes (Abbitt, 2011; Sang, Valcke, van Braak, & Tondeur, 2010), teachers' proficiency and readiness to use instructional technologies (Inan & Lowther, 2010) have been examined. However, the literature still needs empirical evidence displaying a hierarchy between PTs' beliefs and effects of these beliefs on their attitudes towards using instructional technologies. In this regard, this study was conducted to propose and examine a comprehensive model embracing PTs' beliefs about self, teaching and learning conceptions, and attitudes towards using instructional technologies.

### **Beliefs and belief systems**

Beliefs are defined as a 'person's subjective probability judgments concerning some discriminable aspects of his world; they deal with the person's understanding of himself and his environment' (Fishbein & Ajzen, 1975, p. 131). This definition indicates that a PT's beliefs involve his/her subjective judgements and filtered experiences and knowledge; therefore, they guide his/her teaching practices (Fives & Buehl, 2012; Pajares, 1992). Rokeach (1968) stated that people have numerous beliefs, so they should have a hierarchical order (similar to the structure of an atom). In this hierarchy, beliefs relate to each other on a central-peripheral continuum. According to Rokeach (1968), a belief system has a nucleus involving core (central) beliefs and peripheral beliefs surround these core beliefs. Central beliefs have more connections with other beliefs in comparison to peripheral ones. In this way, central beliefs shape peripheral ones. In addition, making any change in central beliefs is more difficult than change in peripheral beliefs, because any change in a central belief forces the belief system to encounter radical shifts affecting many peripheral beliefs (Rokeach, 1968).

Rokeach (1968) suggested five types of beliefs. Among them, Type A and B beliefs are supported by people's own direct experiences and involve beliefs about the nature of self. The difference between Type A and B beliefs is that Type A beliefs are based on social consensus. Type C beliefs, also known as 'authority beliefs', determine who should be trusted as authority. In other words, these beliefs correspond to epistemological beliefs that involve beliefs about the source of knowledge. Type D beliefs are the ones derived from these epistemological beliefs, such as ideological beliefs. Finally, Type E beliefs cover beliefs relating to matters of taste. This type of beliefs has fewer or almost no connections with other types of beliefs. Rokeach (1968) stated that Type A and B beliefs are more central beliefs than Type C and D beliefs, because the latter do not involve almost any direct experience and the former directly relate to self. Furthermore, Type D beliefs are more peripheral than Type C beliefs, because they are derived from Type C beliefs. Finally, Type E beliefs are the most peripheral beliefs in people's belief systems, because these beliefs have fewer connections with other beliefs.

Some recent educational research studies have used or referred to the belief system defined by Rokeach (1968). For example, Chien, Wu, and Hsu (2014) aimed to explore teachers' beliefs about technology-based assessments and investigate the possible interplay between their beliefs and their usage of technology-based assessments in classrooms. It is also possible to find educational research regarding belief systems in the Turkish context. For example, Kilinc et al. (2013) investigated Turkish preservice science teachers' teaching efficacy beliefs about genetically modified foods using a belief system approach. They suggested that epistemologies based on traditional teaching and the values attached to science teaching were the core beliefs that affect the relationship between predictor variables and teaching efficacy.

Demirbağ, Kingır, and Çepni (2015) investigated the relationship between prospective teachers' belief systems and writing to learn, among students from the department of elementary science education at a public university in Turkey. This study concluded that the development of prospective teachers' belief systems could increase the quality of writing to learn.

## **Self**

Self, as a culturally accepted human model, involves people's beliefs and perceptions about themselves (Heelas & Lock, 1981; Kağıtçıbaşı, 2007). Cross-cultural psychologists state that self is affected by cultural values such as collectivism–individualism (Kağıtçıbaşı, 2007; Kitayama, Duffy, & Uchida, 2007). There are two types of collectivism–individualism: normative (Hofstede, 1980; Triandis, 1995) and relational (Kağıtçıbaşı, 2007). The former stresses ideology and how people think individual–group relations should be organised. The latter relates to independency or interdependency of self. According to the view of relational collectivism–individualism, if a society cares about independency more than interdependency in human relations, the autonomous (independent) self is observed more than the related (interdependent) self in that society.

At the beginning, Western psychologists defined two types of self which have been labelled autonomous self and related self (Kağıtçıbaşı, 2007). Autonomous self has been accepted as the Western type of self and praised because individuals having an autonomous self can make their decisions individually and feel independent from other members of society. In other words, autonomous self is common among people who are self-sufficient and separated from others in terms of societal relations. On the other hand, people (mostly from Eastern societies) having a related self feel themselves to be dependent on others such as family members and relatives. These people make their decisions considering many other members of their society. In addition to this dualistic view of self, Kağıtçıbaşı (1996, 2007) defined a third type of self, which is labelled autonomous–related self. Individuals holding strong beliefs about this type of self present characteristics of autonomous and related self together. Therefore, these individuals not only feel themselves to be self-sufficient in making their own decisions, but also can have close relations with others in their society (Kağıtçıbaşı, 2007; Kağıtçıbaşı & Cemalcılar, 2014). However, these close relations cannot prevent them from making their decisions individually.

Why the cross-cultural psychologists lay special emphasis on the concept of 'self' can be explained in two ways. The first is that self creates an opportunity for researchers to adapt or consider cultural differentiations in their studies. The second is that people's beliefs about self explain their behaviours such as achievement motivation and self-enhancement. People, for example, holding autonomous self beliefs have more personal achievement motivation in comparison to people holding related self beliefs (Kağıtçıbaşı, 2007).

## **Conceptions of teaching and learning**

Teachers' conceptions of teaching and learning comprise personal beliefs about what learning and teaching are and what these processes involve (Chan & Elliott, 2004). Researchers have attempted to find out students' or prospective and/or inservice teachers' conceptions of learning by qualitative designs (mostly phenomenographic studies) and have labelled them memorising, understanding, increase of knowledge and making science (Bahcivan, 2014a; Marton, Dall'Alba, & Beaty, 1993; Saljö, 1979; Tsai, 2004). Furthermore, certain researchers (e.g. Koballa, Graber, Coleman, & Kemp, 2000; Tsai, 2002) have focused on prospective and/or inservice teachers' conceptions of teaching and declared similar categories such as transferring knowledge and interacting.

Scholars (e.g. Koballa et al., 2000; Tsai, 2002) state that teachers generally hold consistent conceptions of teaching and learning. Therefore, although researchers seem to produce different labels, all these conceptions of teaching and learning categories can be labelled constructivist versus traditional to avoid unnecessary complications (Chan & Elliott, 2004). A PT holding a

traditional conception of teaching and learning is expected to transmit his/her knowledge to learners directly because s/he admits that learning is a passive process. Therefore, such a PT does not give adequate importance to learners' needs, feelings and readiness. On the other hand, a PT holding a constructivist conception is expected to facilitate students' learning through reasoning and justification. S/he knows that learners are active in all processes, so s/he takes into consideration students' learning needs, existing knowledge and feelings (Chan & Elliott, 2004). Certain researchers have already shown that compared with the PTs having traditional conceptions, PTs having constructivist conceptions may more easily accept instructional technologies as useful tools for learning environments (Bai & Ertmer, 2008; Mumtaz, 2000; Sang et al., 2010).

Research studies have found that these conceptions relate to prospective and/or inservice teachers' epistemological beliefs (Bahcivan, 2014b; Chan & Elliott, 2004; Hofer & Pintrich, 1997), teaching efficacy beliefs (Bahcivan & Kapucu, 2014; Eren, 2009) and teaching behaviours (Koballa, Glynn, Upson, & Coleman, 2005). Therefore, the beliefs involved in these conceptions are accepted as critical parts of PTs' teaching belief systems (Bahcivan, 2014b).

### **Attitudes**

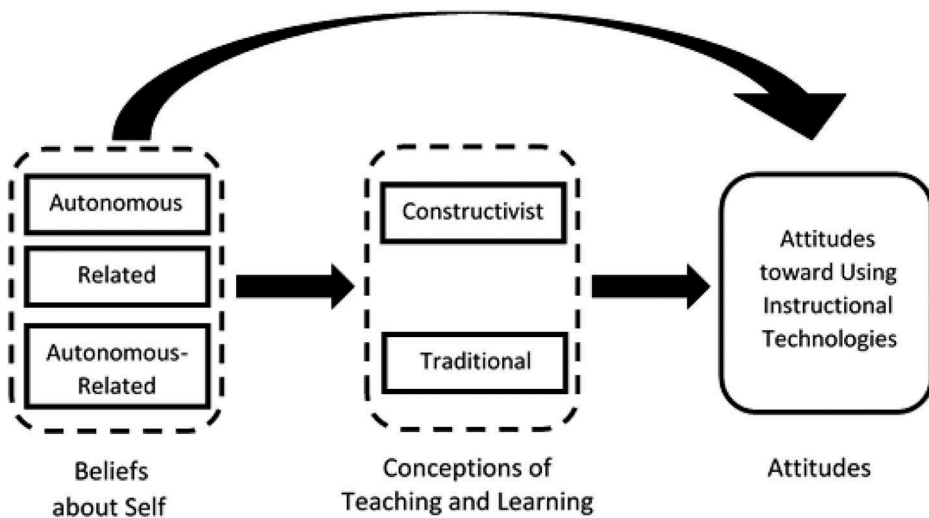
Rokeach (1968) defined an attitude as 'a relatively enduring organisation of beliefs around an object or situation predisposing one to respond in some preferential manner' (p. 112). This definition highlights three aspects: an attitude (1) is formed by a related set of beliefs; (2) is a durable structure (not temporary); and (3) (possibly) generates consistent behaviours (Rokeach, 1968). Fishbein and Ajzen (1975) also proposed that attitudes are specific forms of beliefs. Ajzen (1991) hypothesised some structural relations among beliefs, attitudes and behaviours by his pioneering theory, the theory of planned behaviour. This theory hypothesises that attitudes are affected by certain beliefs and affect people's behavioural intentions, which then determine the form of behaviours.

Researchers have already shown that PTs' attitudes have an effect on their behavioural intentions and classroom practices related to using instructional technologies. For example, Holden and Rada (2011) found that technology self-efficacy affected technology acceptance. In addition, according to Teo (2011), teachers' perceived usefulness, attitudes towards use and facilitating conditions have direct influences on their behavioural intentions to use technology. Agyei and Voogt (2011), Buabeng-Andoh (2012) and Celik and Yesilyurt (2013) provided evidence that PTs' attitudes towards using instructional technologies affect their intentions to use these technologies in future practice.

There is a robust literature on PT attitudes towards technology integration (i.e. Deng, Chai, Tsai, & Lee, 2014; Ertmer, Ottenbreit-Leftwich, & Tondeur, 2014; Lee & Lee, 2014). On the other hand, PTs' beliefs, teaching and learning conceptions, and attitudes towards use of technology have not yet been studied together in a relational perspective.

### **Proposed model**

Before clarifying the proposed model, we need to define instructional technology. In this study instructional technology was used to cover all types of digital technologies that a PT can use during his/her teaching/learning environment. Considering the aforementioned research studies in teacher education and psychology, the structural model in Figure 1 was prepared to be examined. The model is drawn from the literature and based on two distinct ideas/theories. The first is that beliefs relate to each other on a central-peripheral continuum (Rokeach, 1968). Therefore, it can be expected that beliefs about self relate to beliefs about (conceptions of) teaching and learning because the former is viewed as a Type A or Type B belief (beliefs about self), as hypothesised and verified by the studies by Rokeach (1968). Additionally, conceptions of teaching and learning may be admitted as a Type D belief (derived belief, such as any ideological belief), for two reasons. First,



**Figure 1.** Proposed model of the study.

these conceptions are partly shaped by epistemological beliefs (Chan & Elliott, 2004; Hofer & Pintrich, 1997). Second, epistemological beliefs involve individuals' beliefs about the source of knowledge and can be identified with Type C beliefs, which involve authority beliefs as presented above. Therefore, we labelled PTs' conceptions of teaching and learning as a Type D belief, which is more peripheral in relation to Type C beliefs. The second idea/theory guiding the construction of this model is that beliefs are specific forms of attitudes so they directly affect attitudes (Ajzen, 1991; Fishbein & Ajzen, 1975; Rokeach, 1968). Furthermore, the aforementioned researchers hypothesised and supported that there are strong relations between beliefs and attitudes.

The model has three main hypotheses. First, individuals holding beliefs of the autonomous or autonomous-related self are expected to attach more importance to autonomy in comparison with people holding beliefs of the related self. Therefore, they can be expected to construct their knowledge independently from authorities. At this point, considering the close relationship between beliefs about learning and teaching (e.g. Tsai, 2002), it is hypothesised that PTs holding beliefs of the autonomous and autonomous-related self may have constructivist conceptions of teaching and learning. PTs having a related self, on the other hand, are expected to hold traditional teaching and learning beliefs.

The second hypothesis is that PTs holding beliefs of the autonomous or autonomous-related self have positive attitudes towards using instructional technologies, whereas beliefs about related self negatively relate to the same attitudes. There are two main reasons behind this hypothesis: (1) beliefs relate to and shape attitudes (Ajzen, 1991; Fishbein & Ajzen, 1975; Rokeach, 1968) and (2) autonomous or autonomous-related PTs may view technology as an opportunity to teach and learn consistent with constructivist approaches, whereas the opposite is valid for PTs holding beliefs of the related self.

The third hypothesis is that PTs holding constructivist conceptions of teaching and learning have positive attitudes towards using instructional technologies, whereas beliefs about the related self negatively relate to the same attitudes. This hypothesis also can be supported by two claims. The first is that PTs' beliefs are expected to relate to their attitudes (Ajzen, 1991; Fishbein & Ajzen, 1975; Rokeach, 1968). The second is that constructivists look for ways to create opportunities for learners to construct their own learning. Empirical studies (e.g. Bai & Ertmer, 2008) have shown that PTs holding constructivist beliefs of learning and teaching have also a positive view of instructional technologies.

The proposed model of the study, thus the theoretical framework of this research, has two delimitations. The first is about the theory of planned behaviour, which hypothesises that attitudes are affected by certain beliefs and affect people's behavioural intentions, which then determine the form of people's behaviours. This study was not conducted based on this theory. The second delimitation is about Rokeach's (1968) beliefs system, which involves five types of beliefs. However, all of these types of beliefs were not taken into consideration in this study for several reasons. First, measuring all these types of beliefs would require us to ask too many questions in a limited time and such an intention might decrease the internal validity of the study because of participant fatigue. Second, 'self' itself can be said to be very rarely studied in the literature in the context of PTs' teaching belief systems. Therefore, studying this concept in the context of considering PTs' attitudes towards using instructional technologies could be more valuable for future research. Third, teaching and learning conceptions were found to be clearly related to PTs' teaching behaviours as well as their attitudes, as presented in the aforementioned literature. For this reason, this variable was taken into account to be examined for prediction of attitudes towards using instructional technologies. Lastly, Type C beliefs, also known as authority beliefs, determine who should be trusted as authority. Beliefs regarding the source of knowledge are subjects of epistemology.

### ***Significance of the study***

Examining the proposed model in [Figure 1](#) contributes to the literature in four ways. First, the results of this study are valuable in terms of its empirical support for theoretical relations. Why beliefs about self can be accepted as being among the central beliefs of a PT's belief system is explained (based on the literature) in previous sections; however, such a hypothesis still lacks empirical evidence. In light of this possible evidence, (technology) teacher educators may have a more comprehensive model displaying structural relations among PTs' beliefs. Second, the Turkish Ministry of National Education has allocated a considerable budget for the FATİH Project (i.e. Movement of Enhancing Opportunities and Improving Technology), which encompasses distribution of LCD interactive (touch) boards to all regular classrooms in public schools, with Internet connection, distribution of personal tablets for each student and training for all inservice teachers (Ministry of National Education, 2015). Any possible hierarchical order among PTs' or inservice teachers' beliefs may empower the support of this training. For example, educational forums or sessions on 'self' can be added to prospective/in-service teacher training or education programmes, considering the results of this study. Such forums or other educational initiatives are also vital for many countries since instructional technology-focused investments have increased all around the world (DeSantis, 2012; Keengwe, Schnellert, & Mills, 2012; West, 2012). Third, this study will be realised in the context of Turkey, which represents a unique mixture of cultural values from both the West and East. In this regard, empirical evidence from such a context may have the potential to be observed in many other parts of the world. Lastly, there is a gap in the literature about the relationships among PTs' beliefs about self, teaching and learning conceptions, and attitudes towards use of technology in their classrooms. The literature still lacks the relationship between conceptions of teaching and learning and the attitudes towards using instructional technologies, although these conceptions are also beliefs. These variables are vital in terms of technology integration, and this research may produce results to bridge this gap.

### ***Purpose and research questions***

The purpose of this study is to investigate structural relations among Turkish PTs' beliefs about self, conceptions of teaching and learning, and attitudes towards using instructional technologies.

In this section research questions (RQs) and hypotheses (RHs) are given respectively.

The following research questions and hypotheses were examined:

RQ-1: What are the relations between Turkish PTs' beliefs about self and conceptions of teaching and learning?

RH-1: PTs holding beliefs of the autonomous and autonomous-related self may have constructivist conceptions of teaching and learning; PTs having a related self, on the other hand, are expected to hold traditional teaching and learning beliefs.

RQ-2: What are the relations between Turkish PTs' beliefs about self and attitudes towards using instructional technologies?

RH-2: PTs holding beliefs of the autonomous or autonomous-related self have positive attitudes towards using instructional technologies, whereas beliefs about related self negatively relate to the same attitudes.

RQ-3: What are the relations between Turkish PTs' conceptions of teaching and learning and attitudes towards using instructional technologies?

RH-3: PTs holding constructivist conceptions of teaching and learning have positive attitudes towards using instructional technologies, whereas beliefs about traditional conceptions of teaching and learning negatively relate to the same attitudes.

## Methodology

### Sample

The researchers attempted to reach a maximum number of participants by convenience sampling (Creswell, 2008). The sample of the study included 1208 PTs (373 male, 832 female, 3 PTs did not indicate their gender) from five different state universities in the central region of Turkey. These universities have had a faculty of education for at least 25 years and contain on average 3500 undergraduate students in these faculties. Participants' ages were observed in the range of 22–33 years ( $M = 24.2$ ). Since possible effects of subject areas are beyond the scope this study, the sample included PTs from eight different undergraduate programmes of the Faculty of Education: Primary Education (242 PTs), Science Education (242 PTs), Mathematics Education (76 PTs), Turkish Language Education (33 PTs), Computer Education and Instructional Technology (290 PTs), Preschool Teacher Education (117 PTs), Social Sciences Education (154 PTs) and Psychological Counselling and Guidance (54 PTs). Participants were selected among junior (722 [3rd year]) and senior (486 [4th year]) students. Third- and fourth-year teacher candidates hold possibly more connected and developed teaching belief systems in comparison to prior-year teacher candidates because the number of pedagogical courses that they take is higher than for prior-year teacher candidates. In certain pedagogical courses, students in the last two years have some opportunities such as making school observations and implementing teaching practices in real classrooms. Therefore, such a sample makes it possible to observe the relationships investigated in this study.

### Instruments

The data were collected through three different instruments: the Autonomy and Relatedness Scale (Kağıtçıbaşı, Baydar, & Cemalcılar, 2006), the Teaching and Learning Conceptions Questionnaire (Chan & Elliott, 2004) and Attitudes Towards Using Instructional Technology Scale (Kilinc et al., 2016).



### ***Autonomy and Relatedness Scale***

The Autonomy and Relatedness Scale (ARS) was firstly developed by Kağıtçıbaşı et al. (2006) to measure Turkish university students' beliefs about self. ARS has three different dimensions and each includes nine items: autonomous self (e.g. I feel myself independent from my relatives), related self (e.g. My relatives have priority in my life) and autonomous-related self (e.g. Both having close relationships and being autonomous are important to me). Items have a 5-point Likert response scale (from 1 = *strongly disagree* to 5 = *strongly agree*). Fourteen items were recoded so that higher scores in each dimension corresponded to a participant holding beliefs about that type of self. Kağıtçıbaşı and her colleagues (2006) reported reliability scores as  $\alpha = .74, .78, .84$  respectively for autonomous self, related self and autonomous-related self scales.

### ***Teaching and Learning Conceptions Questionnaire***

The Teaching and Learning Conceptions Questionnaire (TLCQ) was firstly developed by Chan and Elliott (2004) to measure prospective and inservice teachers' beliefs about teaching and learning. The TLCQ has 30 items distributed among two dimensions: constructivist (e.g. Learning means students have ample opportunities to explore, discuss and express their ideas) and traditional (e.g. Learning means remembering what the teacher has taught). Dimensions are, respectively, represented by 12 and 18 items which have a 5-point Likert response scale (from 1 = *strongly disagree* to 5 = *strongly agree*). Higher scores in each dimension correspond to a PT holding strong beliefs related to that conception. The TLCQ was adapted into Turkish by Eren (2009) with a sample of Turkish PTs. He reported a good model fit ( $\chi^2/df = 2.42$ ; CFI = .94; RMSEA = .061) and high reliability scores for constructivist ( $\alpha = .92$ ) and traditional ( $\alpha = .89$ ) conception dimensions.

### ***Attitudes Towards Using Instructional Technologies Questionnaire***

Although there are many other validated instruments measuring PTs' attitudes, this instrument was especially chosen because it was developed by a sample involving Turkish PTs. This instrument was developed by Kilinc et al. (2016) to measure Turkish PTs' attitudes towards using instructional technologies. In developing the Attitudes Towards Using Instructional Technologies Questionnaire (AUITQ), semi-structured interviews and the related literature were taken into consideration. Results of the exploratory factor analysis ( $n = 1667$  PTs) showed that AUITQ had three factors, which were Perceived Usefulness (e.g. Educational technologies help students visualise abstract topics), Perceived Ease of Use (e.g. If I want, I can easily use educational technologies) and Compatibility (e.g. Educational technologies are compatible with the teaching methods I will use). During the analyses 5 items among 20 items were removed from the AUITQ so the dimensions had reliability scores of .89, .82 and .87. Higher scores in AUITQ means that PTs have positive attitudes towards using instructional technologies in educational contexts.

According to Fraenkel and Wallen (2008), validity and reliability of the instruments should be taken into consideration when researchers use them in their research. Although this study is not an instrument development and validation study, validation results of the instruments used in the study are given in the Results section because this study uses structural equation modelling and validation is a more critical factor to be considered in structural equation modelling studies (Kline, 2011).

### ***Data collection***

Before the data collection, ARS, TLCQ and AUITQ were combined into a single instrument which was preceded by a demographic part. In other words, all of these instruments were answered by the students in one session. In the demographic part, participants were asked to mark or write certain statements such as gender, school, department etc. The following parts presented items of the aforementioned scales or questionnaires. PTs were informed about the purposes of the study and participated in the study voluntarily. The instrument was distributed to PTs during their regular

courses by the researchers. Participants were allowed enough time to respond, which took 20 minutes on average.

### **Data analysis**

Analysis involved two steps: descriptive and inferential. Descriptive analysis involved means, standard deviations and reliabilities (calculated by SPSS 21) and confirmatory factor analysis, which was performed through AMOS 21 (Analysis of Moment Structures). A first-order confirmatory factor analysis ( $n = 1208$ ) was conducted to present construct-related evidence for validity of ARS and TLCQ results. Related to AUITQ, all the 20 items were validated by a first-order confirmatory model, because the sub-dimensions were not vital for the purposes of this study. Inferential statistics comprised the structural equation modelling analysis, which was also conducted through AMOS 21 to examine the structural relations proposed in [Figure 1](#). Conducting confirmatory factor analysis and structural equation modelling analysis factor loadings and certain fit indices ( $\chi^2/df$ , CFI, TLI and RMSEA) were examined through AMOS. Regarding the factor loadings, Kline (2011) stated that values at least equal to 0.7 are called high standardised factor loadings. Similarly, Shevlin and Miles (1998) expected to observe at least a factor loading value of around 0.30 (called low standardised factor loading) in confirmatory factor analyses in order to retain an item. On the other hand, Tabachnick and Fidell (2013) suggested increasing sample size to retain items presenting lower factor-loading values. Therefore, considering the high number of participants in this study, we decided to retain items presenting at least 0.20 of factor-loading value. Furthermore, as mentioned above,  $\chi^2/df$ , CFI, TLI and RMSEA were utilised to examine analysis models. Despite its sensitiveness to large sample size,  $\chi^2/df$  was examined owing to its extended preference among researchers (Byrne, 2010). However, considering its disadvantage with high sample size we examined certain additional fit indices. Related to CFI and TLI, researchers (e.g. Kline, 2011) suggest values larger than 0.95 as the cut-off point for good fit. Kline (2011) also stated that RMSEA values smaller than 0.06 correspond to good fit.

## **Results**

### **Validation of ARS**

A first-order confirmatory factor analysis ( $n = 1208$ ) was performed for validation of scores. During the first attempt two items for the autonomous self dimension and four items for the related self dimension had factor loading (regression weight) values lower than 0.20. These items were removed from the dataset and the analysis was performed again. Model fit was also examined by certain indices which were  $\chi^2/df$ , CFI, TLI and RMSEA. Fit indices had values of 4.94, 0.91, 0.87 and 0.05, respectively, corresponding to fair fit of the model. [Table 1](#) displays factor loadings (FL), means ( $M$ ) and standard deviations ( $SD$ ) of each item and Cronbach's alpha ( $\alpha$ ) reliability scores of each dimension.

Reliabilities were found as 0.75, 0.61 and 0.68 respectively for autonomous, related and autonomous-related self scales. [Table 1](#) shows that highest mean scores were observed for autonomous-related self items whereas the lowest mean scores were observed for autonomous self items. These scores show that Turkish PTs do not always consult relatives or other close friends to make decisions. They, on the contrary, want to make their decisions independently and earn respect from others, even if they have close relationships with them. In addition to this, participants' item results had the lowest  $SD$  scores for the related self dimension.

### **Validation of TLCQ**

A first-order confirmatory model ( $n = 1208$ ) was examined for validation purposes. Initial attempts resulted in two items regarding traditional conceptions having factor loadings lower than 0.20. These items were excluded and then the analysis was executed again. The remaining items had

**Table 1.** Descriptive results of ARS.

Code*	FL	<i>M</i>	<i>SD</i>	$\alpha$	
A1	0.21	3.07	1.10	0.75	
A4	0.61	3.24	1.14		
A5	0.44	2.42	0.98		
A6	0.37	2.24	0.93		
A7	0.76	3.05	1.08		
A8	0.72	2.91	1.05		
A9	0.70	3.23	1.10		
R10	0.47	3.89	0.88		0.61
R13	0.29	3.48	1.02		
R14	0.50	3.84	0.91		
R16	0.62	3.72	1.01		
R17	0.71	3.99	0.86		
AR19	0.63	4.11	0.88	0.68	
AR20	0.63	4.29	0.87		
AR21	0.28	3.04	1.17		
AR22	0.33	3.76	0.98		
AR23	0.31	3.40	1.19		
AR24	0.30	3.15	1.16		
AR25	0.41	3.79	0.96		
AR26	0.40	3.38	1.18		
AR27	0.62	4.16	0.90		

\*Letters represent factors (A for autonomous, R for related and AR for autonomous–related self), numbers represent item rankings. Bold coded items were recoded.

factor loadings of at least or greater than 0.37.  $\chi^2/df$ , CFI, TLI and RMSEA values were examined for model fit and found respectively as 3.19, 0.94, 0.93 and 0.04, corresponding to fair fit. [Table 2](#) presents all the descriptive results.

[Table 2](#) shows that the constructivist conception and the traditional conception had alpha reliabilities as 0.87 and 0.90, corresponding to high internal reliabilities for each dimension. The descriptive results show that Turkish PTs had higher mean scores for constructivist items than for traditional items. Additionally, *SD* values for constructivist items are lower than those for traditional items, therefore it can be said that participants' item scores are closer to the mean scores for constructivist items compared with traditional items. Finally, considering the highest mean scores, it can be deduced that Turkish PTs believe that students should be encouraged to find their own answers and their feelings should be carefully considered. Additionally, considering the lowest mean scores, PTs believe that good teaching should not involve a teacher's continuous control of students only by using his/her voice.

### Validation of AUISQ

The results of AUISQ were validated by a first-order confirmatory factor analysis ( $n = 1208$ ). Based on initial values, just one item was excluded from the dataset because of a factor loading value smaller than 0.20. The final results showed that any item in AUISQ had a factor loading value of at least 0.49. Moreover,  $\chi^2/df$ , CFI, TLI and RMSEA were observed as 3.90, 0.97, 0.96 and 0.04, corresponding to a good model fit. [Table 3](#) presents the overall descriptive results.

Cronbach's alpha reliability was found to be 0.93, corresponding to high internal reliability. Furthermore, it is clear that all items' mean scores are greater than the midpoint (2.5). Therefore, it can be said that Turkish PTs seem to have positive attitudes towards using instructional technologies. Considering the highest mean scores, PTs believe that instructional technologies are functional for two reasons: (1) they convert learning environments into entertaining places and (2) they help students to visualise abstract terms and concepts.

**Table 2.** Descriptive results of TLCQ.

Code*	FL	M	SD	$\alpha$	
C1	0.62	4.59	0.78	0.87	
C2	0.63	4.50	0.76		
C5	0.56	4.23	0.86		
C6	0.55	4.29	0.87		
C10	0.68	4.41	0.78		
C13	0.70	4.41	0.84		
C14	0.70	4.39	0.79		
C18	0.49	4.01	0.87		
C19	0.56	4.04	0.84		
C24	0.46	4.01	0.88		
C25	0.65	4.38	0.83		
C28	0.49	4.10	0.92		
T3	0.59	2.33	1.16		0.90
T4	0.57	2.76	1.12		
T7	0.41	3.31	1.08		
T8	0.67	2.29	1.22		
T11	0.37	3.61	1.09		
T12	0.71	2.38	1.28		
T15	0.43	3.47	1.09		
T16	0.62	2.81	1.21		
T17	0.71	2.39	1.23		
T20	0.61	2.96	1.18		
T21	0.70	2.33	1.18		
T22	0.67	2.73	1.24		
T23	0.56	2.85	1.27		
T26	0.42	3.38	1.07		
T27	0.71	2.46	1.25		
T29	0.64	3.03	1.24		

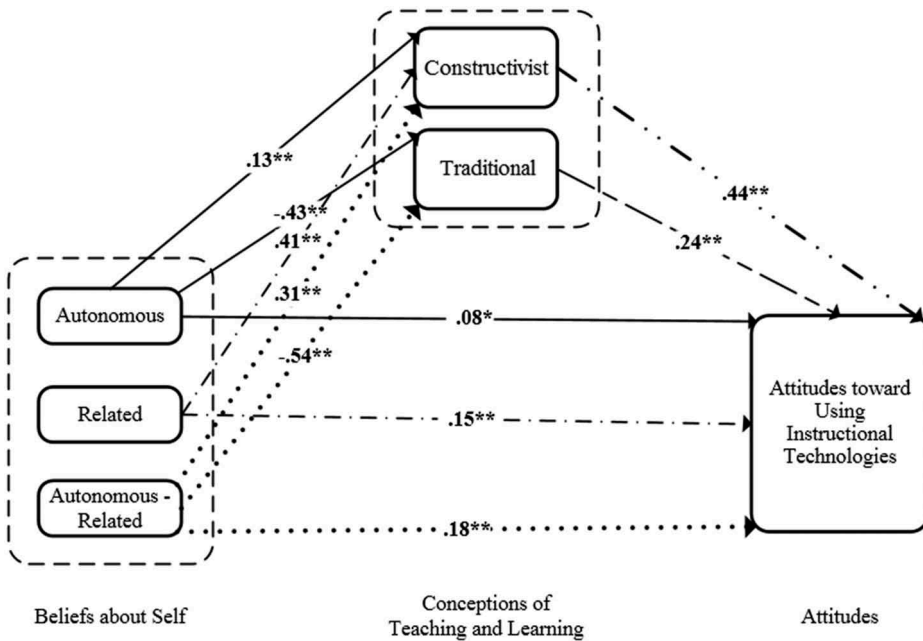
\*Letters represent factors (C = constructivist and T = traditional), numbers represent item rankings.

**Table 3.** Descriptive results of AUISQ.

Code	FL	M	SD	$\alpha$
T1	0.72	4.09	0.94	0.93
T2	0.76	4.15	0.82	
T3	0.78	4.17	0.82	
T4	0.69	4.08	0.89	
T5	0.49	3.82	1.03	
T6	0.69	4.07	0.88	
T7	0.68	4.29	0.75	
T8	0.63	4.19	0.79	
T9	0.67	4.07	0.88	
T10	0.57	3.95	0.90	
T11	0.54	4.02	0.90	
T12	0.51	3.99	0.88	
T13	0.55	4.03	0.86	
T14	0.50	4.15	0.91	
T15	0.50	4.11	0.89	
T16	0.63	3.99	0.88	
T17	0.60	4.01	0.86	
T18	0.59	3.98	0.84	
T19	0.55	4.00	0.87	

### ***Relationships among self, conceptions and attitudes***

The proposed relationships (see Figure 1) among participant Turkish PTs' beliefs about self, conceptions of teaching and learning, and attitudes towards using instructional technologies were investigated by structural equation modelling analysis. This analysis was actually conducted to respond to the three research questions querying the theoretical relationships among conceptions of learning and teaching, beliefs about self and attitudes towards using instructional



**Figure 2.** Standardised regression weights observed in the proposed model.

Note. \* $p < 0.05$ , \*\* $p < 0.001$ .

technologies with a sample of Turkish PTs. The model had a fair fit ( $\chi^2/df = 2.54$ , CFI = 0.90, TLI = 0.89 and RMSEA = 0.04). The structural model explained the variances of constructivist conceptions, traditional conceptions and attitudes as 28%, 47% and 32% respectively. Standardised regression weights observed in the model are presented in Figure 2.

In Figure 2, arrows are used to represent significant relations between the variables. The structural relations presented in Figure 2 partly met the researchers' expectations. First of all, beliefs about autonomous self and autonomous-related self positively relate to both constructivist beliefs about teaching and learning (first research question) and attitudes towards using instructional technologies (second research question). Additionally, the same beliefs negatively related to traditional conceptions of teaching and learning (first research question). Moreover, PTs' constructivist beliefs about teaching and learning positively predicted their attitudes towards using instructional technologies (third research question). There were three significant relations which run contrary to the expectations proposed at the beginning. The first two are that PTs' beliefs about related self positively predicted their constructivist conceptions and attitudes. And, the third is that traditional conceptions had been proposed as negatively relating to attitudes; however, they related positively.

## Discussions

This study supported two different theoretical claims taking into account the literature presented at the beginning of the study. The first is that PTs' beliefs lie on a spectrum from central to peripheral, so they generate teaching belief systems (Rokeach, 1968). The second is that PTs' beliefs are related to their attitudes (Ajzen, 1991; Fishbein & Ajzen, 1975; Rokeach, 1968).

According to the results of the study, the relationships between basic variables (beliefs about self, conceptions of teaching and learning, and attitudes towards using instructional technologies) of the research are presented in Figure 3. On the other hand, some relations between these

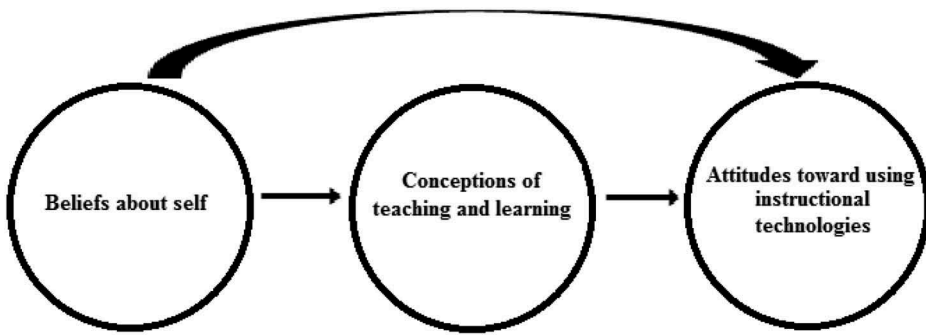


Figure 3. The finalised model.

variables were not found to be compatible with the research hypotheses. For this reason, these results are discussed in the context of the research hypotheses and related literature in this section.

The results of this study support the hypothesis that states that when Turkish PTs in the sample have autonomous self beliefs, they then also hold constructivist beliefs about learning and teaching. Considering that autonomous PTs feel that they are self-sufficient in daily activities and attempt to make their decisions independently (Kağıtçıbaşı, 1996, 2007), they were expected to appreciate constructivist beliefs, which promote the creation of learning environments in which students attempt to construct their own leaning (Chan & Elliott, 2004). Therefore, we had hypothesised that constructivist beliefs and beliefs about the autonomous self have common points regarding the independence of an individual, and the results support this hypothetical claim. When it comes to PTs' beliefs about autonomous-related self they were expected (hypothesised) to produce the same results as autonomous self beliefs because people having an autonomous-related self present characteristics belonging to both dependency and interdependency (Kağıtçıbaşı, 2007). On the other hand, we hypothesised that any PTs having autonomous or autonomous-related self beliefs were expected to hold negative beliefs about traditional teaching and learning. The main idea of traditional teaching and learning beliefs runs opposite to autonomy, because in the traditional view students are accepted as passive learners so they are dependent on teachers (Chan & Elliott, 2004). Therefore, regarding the effects of autonomous and autonomous-related self beliefs on teaching and learning beliefs, this study produced the expected results. In addition to these, PTs' autonomous and autonomous-related self beliefs had been expected to predict their attitudes towards using instructional technologies positively because these PTs had been expected to benefit from instructional technologies in any learning environment. Regarding this point of view, the results met our hypotheses behind the proposed model of this study.

Furthermore, PTs' constructivist beliefs about teaching and learning had also been hypothesised to positively predict attitudes towards using instructional technologies. Empirical evidence existing in the literature emphasises that prospective and/or inservice teachers holding constructivist beliefs attempt to find ways to create opportunities for learners to construct their own learning and that these teachers benefit from such technologies for personalising and enriching learning environments in terms of these opportunities (Bai & Ertmer, 2008; Mumtaz, 2000; Sang et al., 2010). Therefore, the results of this study are coherent with existing empirical evidence.

According to results of the study, participants' beliefs about the related self positively predict their constructivist conceptions and attitudes towards using instructional technologies, which is opposite to the research hypotheses. The previous results provided expected evidence about the central-peripheral relatedness among beliefs hypothesised based on the contributions of Rokeach (1968). At this point, it can be said that the opposite relationship was observed between these beliefs because there may be more than one central belief (about self) shaping any peripheral beliefs. Furthermore, the literature lacks specific results related to the relationship of self, so for this reason it would not be

possible for the researchers to discuss these findings with related existing research findings. However the above-mentioned contradictory findings of this research can be taken into consideration by future research and the relationships can be tested in different contexts.

Lastly, results showed that participants' traditional beliefs about teaching and learning positively relate to their attitudes towards using instructional technologies. This result can be clarified in two ways. The first is that Koballa et al. (2000) emphasised that PTs can have more than one conception of teaching and learning which may create some incoherencies among their conceptions. In this study, PTs had obviously higher mean scores for constructivist items than for traditional ones. Therefore, the positive relation between their traditional conceptions and attitudes can be explained by their high mean scores in constructivist items. The second is that certain researchers (e.g. Kane, Sandretto, & Heath, 2002) mention that interrogating the PTs' beliefs without observation of their practices may not produce reliable results. PTs' beliefs can yield unexpected behaviours or attitudes because of different reasons; for example, participants in this study may believe in utilising instructional technologies independently from their conceptions because of their current education in faculties.

## Conclusions

Conclusions are given based on the results of this study.

Firstly, we can conclude that Turkish PTs' beliefs about the autonomous and autonomous-related self positively and directly predict their constructivist beliefs about teaching and learning. In addition, these two beliefs negatively relate to traditional beliefs about teaching and learning. These conclusions are compatible with the hypotheses of the research.

Secondly, we can conclude that Turkish PTs' beliefs about the autonomous and autonomous-related self positively and directly predict their attitudes towards using instructional technologies. This conclusion is compatible with the hypotheses of the research. On the other hand, beliefs about the related self positively predicted their constructivist conceptions and also attitudes towards using instructional technologies. This conclusion is contrary to the research hypotheses. This contradiction is discussed in the Discussions section.

Thirdly, we can conclude that Turkish PTs' constructivist beliefs about teaching and learning positively and directly predict their attitudes towards using instructional technologies. This conclusion is compatible with the hypotheses of the research. On the other hand, participants' traditional beliefs about teaching and learning also positively relate to their attitudes towards using instructional technologies, which is contrary to the research hypotheses. This contradiction is also discussed in the Discussions section.

Implications based on these conclusions can be made for future research and teacher training practice.

## Limitations and implications

There were five limitations. The data of the study were collected through paper-and-pencil instruments; therefore, the results are based on self-report data, which is the basic limitation for our interpretations. Another limitation is the limited number of variables covered by the belief-attitude model proposed in the study. The belief side of the model was constructed on the theoretical contributions of Rokeach (1968), who defined five different types of beliefs. However, this study covered just two different types of beliefs to avoid participant fatigue and because of certain theoretical considerations mentioned above. Therefore, it is possible to change the relations observed if all types of beliefs are included in future studies.

The next limitation relates to convenience sampling, involving PTs from five different universities. The sample of the study included 1208 PTs from five different universities in the central region of Turkey. For this reason it is possible that these unexpected results are due in part to

Turkey's unique culture. In this regard, the results of this study can only be generalisable to its own sample. The fourth limitation is about the confirmatory factor analysis and structural equation modelling results. The low factor loadings may decrease the fit indices during the structural equation modelling. We obtained a fair fit instead of a good fit during the structural equation modelling. In future studies, researchers can attempt to obtain a good fit with a high sample size for more valid measurement results.

The last limitation is related to the reliability scores of self scales, which can be considered as moderate to low. Based on this observation we can state that the results of self scales may include random errors. This reliability problem can be eliminated through including a higher number of PTs by random sampling procedures.

There are two possible implications of the study: one is for research and the other is for teacher training practice. For future studies, we suggest supporting quantitative findings with qualitative data such as interviews, lesson plans and classroom observations. In this study, we could not note any satisfying reasons why PTs' beliefs of the related self positively predicted their constructivist beliefs about teaching and learning and their attitudes towards using instructional technologies. Qualitative data may help us to clarify this point.

Finally, considering that Turkish PTs' beliefs about the autonomous or autonomous-related self positively related to their constructivist beliefs and attitudes towards using instructional technologies, we suggest extending the content of teacher education programmes to develop PTs' beliefs about self. By setting up collaboration with social psychologists, teacher educators may be able to construct new courses to support the autonomous-related self beliefs of Turkish prospective teachers.

## Disclosure statement

No potential conflict of interest was reported by the authors.

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