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AN INVESTIGATION OF PRE-SERVICE TEACHERS' BELIEFS REGARDING TECHNOLOGY INTEGRATION IN EDUCATION

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Abstract

Nowadays technology integration is seen essential in learning and teaching process due to the tremendous developments in technology. Teachers' pedagogical beliefs in relation to technology use may affect their implementation. Thus, it is considered important to determine pre-service teachers' beliefs regarding technology integration in class. This study aimed to find out pre-service teachers' beliefs regarding technology integration in education and whether there were statistically significant differences between pre-service teachers' beliefs and their age, gender, grade level and department. The data were collected by Technology Implementation Scale from 395 pre-service teachers studying in different departments at an education faculty of a state university in the fall semester of 2019-2020 academic year. The data were analyzed through descriptive statistics, independent samples t-test, one-way ANOVA, Tukey HSD and Games-Howell test. The research findings indicated that pre-service teachers had positive beliefs about technology expectancy; however, their beliefs about technology value were partly positive. It was also revealed that pre-service teachers' beliefs did not differ according to age, gender and grade variables whereas statistically significant differences were found according to department variable. It can be recommended that pre-service teachers should be trained about the value of the technology and presented with concrete samples of teaching with technology in various courses.

Keywords: Technology Integration, Implementation, Beliefs, Pre-Service Teachers.

1. INTRODUCTION

With the advent of new technologies, it has become impossible to consider education, instruction and technology independent from each other (Tosuntaş, Çubukçu and İnci, 2019). This situation made traditional teaching methods outdated, and technology integration has become an integral part of successful teaching (Negi, Negi and Pandey, 2011). Hence, it is seen important to train pre-service and in-service teachers for technology-enhanced instruction. In the past decade, a variety of programs and projects were initiated to prepare teachers to integrate technology into learning and teaching process (Hsu, 2013).

Technology has a great potential as a teaching tool (Lei, 2010). Lei and Yong (2007) found that technology use in class led to positive student learning outcomes when it was supported with appropriate pedagogical methods. Hence, it is essential to train pre-service teachers for technology integration in education. Their pedagogical knowledge is important for successfully integrating technology in teaching. Kolb (2017) state that there are six themes to take into consideration when integrating technology into learning- teaching process. These themes are explained below:

1. *Instructional strategies:* Technology integration for teachers is more than knowing to use a specific hardware or software. Teachers need to employ some pedagogical principles such as choosing

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an appropriate technological tool in relation to lesson objectives and students' needs, designing authentic contexts and giving opportunities for problem solving.

2. Engagement: For effective student engagement in technology enhanced classrooms, the tool should help students focus their attention on the learning goals rather than distract.
3. Access: Access to technological tools does not guarantee student engagement and achievement. Teachers should first believe in the benefits of using them for learning instead of creating fun in class.
4. Application of use: Technological tools should not provide students with 'drill and practice' approach. Instead, they should encourage meaningful learning so that they can create new knowledge.
5. Authenticity: Authentic learning supported with technology help students become self-directed learners. Thus, technological tools should be linked to real-life problems and situations.
6. Co-use: For successful technology integration, co-use is also important. While students are co-using a technological tool, they try to grasp the content learning and go into higher-order questioning and other cognitive processes together.

Though the positive sides of technology integration are shown, technology integration is a complex process. Teachers' pedagogical knowledge for successful technology integration may not be sufficient. As first suggested by Ertmer (1999), there are some internal and external factors that affect teachers' technology integration. Internal factors are beliefs, perceptions, and attitudes towards technology and its benefits, and external factors are lack or insufficiency of external resources such as access to technology tools, time and training for teachers.

Miller et al. (2003) suggest three related but independent components for teachers to have a deep change about technology integration in learning and teaching. The first one is material; teachers need hardware and software and in time technical assistance so that they can create content with technology. The second one is teachers' pedagogical beliefs about technology, their perceived efficacy beliefs about technology and their beliefs about the value of technology for student learning. The third component is approaches. Teachers' changing approaches and how they employ new approaches should be monitored. The three components need to be dealt with together for a sustainable change. In various studies, it was determined that lack of access to technology, technical support and in-service training affected teachers' technology integration (Liu, Ritzhaupt, Dawson and Barron, 2017; Ruggiero and Mong, 2015). Huzzie-Brown's (2018) study revealed that teachers' beliefs about technology integration into teaching was positive; however, they did not feel confident enough to use technology in practice. Teachers in that study indicated that they needed onsite support, peer mentoring and professional development to align content, technology and pedagogy. Besides, Hur, Shannon and Wolf (2016) found that teachers' technology integration was impacted by perceived benefits of technology and their perceived competency. In Tosuntaş, Çubukçu and İnci's (2019) study, it has been found that even if external barriers to technology integration are eliminated such as access to technology, teachers' lack of knowledge and skills and their attitudes and beliefs about technology are the reasons why technology integration cannot be achieved fully.

With fast developing technologies nowadays, internal barriers are more important than external barriers. Whether teachers will use technology or not to support teaching is mostly affected by how they perceive their teaching (Zehra and Bilwani, 2016). Many studies underline the importance of teacher beliefs in technology use (Ertmer, Ottenbreit-Leftwich, Sadik, Sendurur and Sendurur, 2012; Kim, Kim, Lee, Spector and DeMeester, 2013). Teachers need to have positive beliefs towards technology to implement it in learning and teaching. As defined by Pajares (1992), "Beliefs are the best indicators of the decisions individuals make throughout their lives" (p. 307). Pajares indicate strong relationships among teachers' beliefs and their planning, instructional decisions, and classroom practices. He believes that beliefs are stronger than knowledge and more influential in determining how people organize and define tasks and problems. Teachers' pedagogical beliefs in relation to technology use affect their implementation. Therefore, it is necessary to determine pre-service teachers' beliefs about technology integration so that it may be possible to determine their needs for technology integration.

In addition, motivational factors that lead teachers to try new technologies and work towards succeeding them are important. Expectancy-value theory of motivation has emerged as one of the motivational frameworks that explain the relationship between teachers' technology integration and their classroom practices. According to this model, as Wozney, Venkatesh and Abrami (2006) state if the perceived value of a new technology and the likelihood (expectancy) of success are high and the benefits of it are higher than the costs, then it is more likely for the new technology to be adopted. Therefore, in

expectancy-value theory, three dimensions are important, namely value, expectancy and cost. Value refers to the benefits to the teacher and to the students' learning. Expectancy refers to the expected outcomes stemming from technology use. These consist of internal attributions (e.g., self-efficacy) and external attributions (e.g., student characteristics, classroom environment). Cost refers to the effort and preparation time for the new technology. In the current study, beliefs of pre-service teachers about technology integration are investigated through a scale based on expectancy-value theory of motivation. However, in the adaptation process to Turkish the 'cost' dimension is excluded from the scale. Thus, the research questions were posed as the following:

1. What are pre-service teachers' beliefs regarding technology value, expectancy and integration in general in education?
2. Are there statistically significant differences between pre-service teachers' beliefs and their age, gender, grade level and department?

2. METHOD

In this part, research design, participants, data collection and data analysis are explained.

2.1. Research Design

This research was designed as a survey model. Survey models are used to describe the attitudes, opinions, behaviors, or characteristics of the population by studying a sample of that population (Creswell, 2009). The researcher makes some generalizations about the population from the results obtained from the sample. Therefore, in this study, pre-service teachers' beliefs about technology integration are analyzed and presented according to the research questions.

2.2. Participants

The population of this research included all 3rd and 4th grade pre-service teachers. Convenience sampling was used in sampling and the sample included all the volunteer pre-service teachers that were reached. Within this context, the sample of the research consisted of 395 pre-service teachers studying in different departments of an education faculty at a state university located in the west of Turkey. The demographic properties of the participants are presented in Table 1:

Table 1. Demographic Properties of Participants

Variables		N	%
Age	20-23	361	91
	24 and above	34	9
Gender	Female	282	71
	Male	113	29
Grade	3rd	213	54
	4th	182	46
Department	Turkish Language Teaching	64	16
	Elementary Mathematics Teaching	70	18
	Social Sciences Teaching	51	13
	Elementary Teaching	39	10
	Pre-school Teaching	57	14
	Computer Education and Instructional Tech.	21	5
	Guidance and Psychological Counselling	66	17
	Science Teaching	27	7
Total		395	100

2.3. Data Collection

The research data were collected during the last two week of the fall semester of 2019-2020 academic year. Data were collected via Technology Implementation Scale which was a six-point Likert type scale, ranging from I strongly disagree (1), I disagree (2), I partially disagree (3), I partially agree (4), I agree (5) and I strongly agree (6), developed by Wozney, Venkatesh and Abrami (2006) and adapted to Turkish by Uluay, Çalışkaner-Nibat and Arıkan (2019). The original scale consisted of three factors which were value, expectancy and cost. However, in the adaptation process of the scale to Turkish, all the 'cost' factor items were excluded from the scale. The final scale consisted of two factors; value and expectancy with 12 items. The value factor included seven items and the expectancy factor included five items. In the first part of the scale, four demographic questions; age, gender, department and grade level were included. The internal consistency of the scale was checked with Cronbach's alpha and split-half reliability and found α=.89 for the whole scale, α=.85 for value factor and α=.82 for expectancy factor. After the scale was implemented in this study, internal consistency was checked again and found α=.72 for the whole scale, α=.70 for value factor

and α=.72 for expectancy factor. Therefore, according to George and Mallery (2003), these are acceptable reliability values.

2.4. Data Analysis

The research data were analyzed using the Statistical Package for Social Sciences (SPSS. 23). In order to indicate pre-service beliefs about technology value and expectancy, descriptive statistics (frequency, mean and standard deviation) were run. Furthermore, independent samples t-test was conducted in order to investigate if there were statistically significant differences between pre-service teachers' beliefs and their age, gender and grade level. Besides, one-way ANOVA was implemented to find out if there were significant differences between pre-service teachers' beliefs and their department.

3. RESULTS

The results of the study were presented along the research questions.

3.1. Research Question 1. What are pre-service teachers' beliefs regarding technology value, expectancy and integration in general in education?

Pre-service teachers' beliefs regarding technology integration was analyzed as "Pre-service teachers' beliefs about technology value" and "Pre-service teachers' beliefs about technology expectancy" in parallel with the scale.

Table 2. Pre-Service Teachers' Beliefs about Technology Value

Items The implementation of technology in class	**SD** *f* %	**D** *f* %	**PD** *f* %	**PA** *f* %	**A** *f* %	**SA** *f* %	**X̄**	**Std**
1. results in students to ignore important conventional learning resources (e.g., books).	61 15	110 28	59 15	98 25	45 11	22 6	3.05	1.45
2. promotes student cooperation.	11 3	45 11	46 12	109 28	142 36	42 10	4.14	1.26
3. suppports the development of communication skills (writing and presentation skills)	10 3	32 8	39 10	90 23	171 43	53 13	*4.36	1.22
4. makes the teachers feel more skillful/competent as educators.	15 4	47 12	47 12	95 24	150 38	41 10	4.11	1.31
5. is an effective tool for all the skills of students.	22 5	65 17	69 18	135 34	79 20	25 6	3.65	1.29
6. supports students to develop communication skills (e.g., ability to relate or work with others).	14 4	58 15	75 19	99 25	120 30	29 7	3.86	1.29
7. improves students' learning in relation to important concepts and opinions	5 1	18 5	32 8	120 30	169 43	51 13	4.60	2.74
Technology value overall							3.97	1.50

Table 2 showed that pre-service teachers partially disagreed with Item 1. They partially disagreed that technology resulted in conventional learning resources such as books to be ignored by students. In addition, pre-service teachers partially agreed with Items 2, 4, 5 and 6. They partially agreed that technology promoted cooperation among students, made teachers feel more competent as educators, was effective for all the skills of students and helped students develop communication skills by leading them to work with others. Furthermore, pre-service teachers agreed with Items 3 and 7 in that technology supported their communication skills such as writing and presenting and improved students' learning. In general, it can be said that pre-service teachers had positive beliefs about technology value in part.

Table 3. Pre-Service Teachers' Beliefs about Technology Expectancy

Items The implementation of technology in class	**SD** *f* %	**D** *f* %	**PD** *f* %	**PA** *f* %	**A** *f* %	**SA** *f* %	**X̄**	**Std**
1. is effective because I believe I can conduct it successfully.	6 2	10 3	29 7	112 28	168 42	70 18	4.61	1.03
2. is successful only if teachers are trained adequately to use technology for learning.	4 1	20 5	30 8	73 19	166 41	102 26	4.72	1.13
3. is successful only if technical staff regularly maintain the computers.	7 2	27 7	53 13	97 24	137 35	74 19	4.39	1.22
4. is effective if teachers take part in the selection process of computer technologies that will be integrated.	7 2	19 5	45 11	93 24	153 38	78 20	4.51	1.17
5. is effective only if extensive/common computer resources are accessible.	4 1	32 8	33 9	135 34	123 31	68 17	4.37	1.16
Technology expectancy overall							4.52	1.14
Technology integration overall							4.25	1.32

It was unearthed in Table 3 that pre-service teachers agreed with all the expectancy items. They agreed that technology was effective and they believed they could apply it well. They also agreed that if teachers were trained for technology use, technical staff maintained the computers and extensive computer resources were accessible, then technology implementation could be successful. In general, it can be said that pre-service teachers had positive beliefs about technology expectancy.

If overall technology integration scores are evaluated in general, it is found that pre-service teachers' beliefs about technology integration are positive in part.

3.2. Research Question 2. Are there statistically significant differences between pre-service teachers' beliefs and their age, gender, grade level and department?

In order to answer if there were statistically significant differences between pre-service teachers' beliefs and their age, independent samples t-test was conducted and the results were presented in Table 4.

Table 4. Independent Samples T-Test Results for Revealing Differences between Pre-Service Teachers' Beliefs and Age

Dimensions	Student's Age	N	$\bar{X}$	Std	df	T	P
Value	20-23	361	3.95	0.81	393	-.953	.341
	24 and above	34	4.09	0.65			
Expectancy	20-23	361	3.23	0.79	393	.118	.906
	24 and above	34	3.22	0.78			
Overall	20-23	361	4.19	0.66	393	-.617	.538
	24 and above	34	4.26	0.57			

*$p < .05$

Based on the results of the independent samples t-test, it was found that there were not statistically significant differences between age and technology value and expectancy and overall scale. In other words, pre-service teachers' beliefs did not differ according to ages 20-23 and 24 and above. Independent samples t-test results for revealing differences between pre-service teachers' beliefs and gender were shown in Table 5:

Table 5. Independent Samples T-Test Results for Revealing Differences between Pre-Service Teachers' Beliefs and Gender

Dimensions	Gender	N	$\bar{X}$	Std	df	T	P
Value	Female	282	3.95	0.71	393		
	Male	113	4.01	0.98		-.647	.518
Expectancy	Female	282	4.54	0.56	393	.809	.419
	Male	113	4.47	0.79			
Overall	Female	282	4.20	0.62	393	-.053	.957
	Male	113	4.20	0.73			

*$p < .05$

Based on the results of the t-test, it was unearthed that there were not statistically significant differences between males and females in their beliefs regarding technology value and expectancy ($p>0.05$). Independent samples t-test results for revealing differences between pre-service teachers' beliefs and grade were indicated in Table 6:

Table 6. Independent Samples T-Test Results for Revealing Differences between Pre-Service Teachers' Beliefs and Grade

Dimensions	Grade	N	$\bar{X}$	Std	df	T	P
Value	3rd	213	3.90	0.74	393	-1.686	.093
	4th	182	4.04	0.85			
Expectancy	3rd	213	4.50	0.77	393	-.722	.471
	4th	182	4.55	0.80			
Overall	3rd	213	4.15	0.61	393	-1.558	.120
	4th	182	4.25	0.70			

*$p < .05$

As shown in Table 6, pre-service teachers' beliefs did not differ according to grade. In other words, being in the 3rd or 4th grade did not affect pre-service teachers' beliefs about technology integration. Descriptive statistics about pre-service teachers' departmental information were presented in Table 7:

Table 7. Descriptive Statistics about Department

Dimensions	Department	N	$\bar{X}$	Std
Value	Turkish Language (1)	64	27.67	5.50
	Elementary Maths. (2)	70	27.25	3.99
	Social Sciences (3)	51	28.50	4.23
	Elementary (4)	39	26.43	4.59
	Pre-school (5)	57	28.98	8.83
	Computer Education (6)	21	31.14	4.57
	Guidance Psy. Coun. (7)	66	26.15	5.05
	Science (8)	27	29.07	4.69
Expectancy	Turkish Language (1)	64	22.89	4.06
	Elementary Maths. (2)	70	22.81	3.50
	Social Sciences (3)	51	22.56	4.14
	Elementary (4)	39	22.35	4.41
	Pre-school (5)	57	22.54	4.04
	Computer Education (6)	21	24.71	3.88
	Guidance Psy. Coun. (7)	66	21.57	3.89
	Science (8)	27	23.25	3.40
Overall	Turkish Language (1)	64	50.56	7.60
	Elementary Maths. (2)	70	50.07	6.33
	Social Sciences (3)	51	51.07	7.21
	Elementary (4)	39	48.79	6.89
	Pre-school (5)	57	51.52	10.67
	Computer Education (6)	21	55.85	7.26
	Guidance Psy. Coun. (7)	66	47.72	7.51
	Science (8)	27	52.33	6.97

*$p < .05$

As it can be seen in Table 7, pre-service teachers studying in the department of Computer Education and Instructional Technology had the strongest beliefs about technology value, expectancy and technology integration in general. Whether there were statistically significant differences between pre-service teachers' beliefs and department, one-way ANOVA was conducted and results can be seen in Table 8:

Table 8. One-way ANOVA Results for Revealing Differences between Pre-Service Teachers' Beliefs and Department

Dimension	Source	Sum of Squares	df	Mean Square	F	p
Value	Between Groups	657.494	3	93.928	3.100	.003*
	Within Groups	11725.706	387	30.299		
	Total	12383.200	394			
Expectancy	Between Groups	185.467	3	26.495	1.711	.105
	Within Groups	5994.037	387	15.488		
	Total	6179.504	394			
Overall	Between Groups	1402.793	3	200.399	3.343	.002*
	Within Groups	23200.311	387	59.949		
	Total	24603.104	394			

*(p<.05).

To reveal whether there were any significant differences between pre-service teachers' beliefs in terms of the department they study at, one-way ANOVA was utilized. Before implementing one-way ANOVA, first of all homogeneity of variances was checked through Levene's test and found that value dimension was significant (p=.023<.05) which showed that the variances were not equal. However, the expectancy scale (p=.900>.05) and overall scores (p=.472>.05) were not significant which indicated that the homogeneity of variances was not ensured. Therefore, for value dimension Games-Howell test was conducted to find the sources of differences between pre-service teachers' beliefs and department. For expectancy dimension and overall scale, Tukey HSD test was utilized to look for the sources of differences between pre-service teachers' beliefs and department.

As shown in Table 8, there are significant differences between pre-service teachers' beliefs in terms of the department they study at and value dimension of the scale and their overall scale (p<0.05). Pre-service teachers studying at the department of Computer Education and Instructional Technology had significantly stronger value beliefs about technology than pre-service teachers studying at the department of Elementary Mathematics Teaching, Elementary Teaching and Guidance and Psychological Counselling. In addition, pre-service teachers at the department of Computer Education and Instructional Technology had statistically stronger expectancy from technology than pre-service teachers at the department of Guidance and

Psychological Counselling. For the overall scale, it was found that pre-service teachers at the department of Computer Education and Instructional Technology had statistically stronger beliefs about technology integration than those studying at the department of Elementary Teaching and Guidance and Psychological Counselling.

4. CONCLUSION AND DISCUSSION

In this research, two research questions were formulated to obtain information about pre-service teachers' beliefs about technology integration in education. According to the results, pre-service teachers had positive beliefs about technology value in part; however, their beliefs were positive about technology expectancy. In general, their beliefs were partly positive about technology integration. It was also exhibited in Huzzie-Brown's (2018) study that elementary mathematics teachers had positive beliefs about technology integration. This result obtained from the current study is important in that it determined pre-service needs for training about technology integration and that teachers' beliefs were in association with their classroom applications. As it was also found by Ertmer et al. (2012), there was close alignment between teachers' pedagogical beliefs and their classroom practices. Similarly, in Karasakaloğlu, Saracaloğlu and Uça's (2011) study, which investigated Turkish teachers' attitudes towards technology and levels of using technology that there was positive correlation between teachers' attitudes and their levels of using technology in teaching. Ertmer et al. (2012) suggested that if teachers' beliefs were not addressed, little would be achieved even if external barriers to technology integration were eliminated. Therefore, in the current study it is suggested that pre-service teachers should be trained about the value of the technology and presented with concrete samples of teaching with technology in various courses. In that sense, faculty members play an important role in training pre-service teachers for technology integration.

As the research also suggest, teachers' beliefs about technology may be negative because of the fact that they do not feel confident enough to use it (Huzzie-Brown, 2018; Miller et al, 2003). Therefore, faculty members should be role-models to pre-service teachers by integrating technology, pedagogy and content in their courses so that pre-service teachers may also improve their self-confidence.

Another result reached from this study was that pre-service teachers' beliefs did not differ in terms of gender. Similarly, Karasakaloğlu, Saracaloğlu and Uça (2011) found in their study that teachers' attitudes towards technology use did not differ according to gender. Şimşek and Yıldırım (2016) also found no differences between social sciences pre-service teachers' attitudes towards technology integration and gender.

Moreover, this study revealed that age and grade level of pre-service teachers did not create a difference in pre-service teachers' beliefs. Similarly, in Mustafina's (2015) study, there were not significant differences between teachers' attitudes towards technology integration and their age. In contrast, in Adedokun's (2018) study, significant differences were found between teachers' technology integration between the ages of 30 and under and 50 and above. In line with the present study, for grade level Şimşek and Yıldırım (2016) revealed in their study that there were not significant differences among 1st, 2nd, 3rd and 4th grade social sciences pre-service teachers' attitudes toward technology integration.

In contrast, department variable created a difference in pre-service teachers' beliefs regarding technology integration in education. As expected, pre-service teachers studying at the department of Computer Education and Instructional Technology had significantly stronger technology value and expectancy beliefs than those studying at the department of Elementary Teaching and Guidance and Psychological Counselling. As their department suggests and requires, the pre-service teachers studying Computer Education and Instructional Technology department should have positive beliefs about technology integration.

As Lei and Yong (2007) set forth, technology integration led to positive learning outcomes when teachers applied technology with suitable pedagogical principles. Besides, teachers' beliefs about the benefits of technology on student learning outcomes had the biggest influence on their success (Ertmer et al., 2012). Based on the research findings, it can be suggested that pre-service teachers during student teaching in their senior years are matched with mentor teachers who have positive beliefs about technology integration and implement technology practices in teaching so that it may be possible to alter the beliefs of those students who have negative beliefs regarding technology integration. Besides, technology based training may be organized for pre-service teachers in developing their competency and confidence in using technology in learning and teaching process. As Adedokun (2018) assert, professional development activities may help teachers change their beliefs and attitudes towards using and integrating technology and develop their technology skills.

Implemented at one university, generalizability of the results of the present study is limited. Further research with different settings may be realized. Besides, it can be recommended that further research is implemented to cover other stakeholders such as in-service teachers or instructors.

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