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# TPACK Competencies and Technology Integration Self-Efficacy Perceptions of Pre-Service Teachers*

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**ABSTRACT**. This study compared the technological pedagogical content knowledge (TPACK) competency of pre-service teachers with their self-efficacy perception towards technology integration, based on various variables; and the correlation between their TPACK competencies and self-efficacy perceptions towards technology integration were examined. The study sample comprised 713 freshmen and senior class students studying at different departments at Ankara University Faculty of Educational Sciences on 2012-2013 academic year spring semester. The data collection tools used in the study were Personal Information Form, Technopedagogical Education Competency Scale and Technology Integration Self Efficacy Scale. At the end of the study, TPACK competencies of pre-service teachers' studying at first and fourth years and their self-efficacy perceptions towards technology integration were revealed; and these competencies were examined by gender, grade and department variables. In addition, the correlation between pre-service teachers' TPACK competency levels and self-efficacy perceptions towards technology integration were predicted.
**Keywords:** TPACK, technology integration, teacher education

## Introduction

There have been serious investments in Turkey on integrating technology and education recently. The biggest mission of these investments is to educate technology literate individuals. Beyond doubt, this is possible if teachers are well-equipped. The important thing in this process is not how intense technological resources are used, but the use of proper pedagogical approach and technology.

With the use of new technologies in education, new technology integration models that use technology in learning and teaching process started to be developed (Mazman & Usluel, 2011). One of these models is technological pedagogical content knowledge (TPACK). According to Beaudin and Hadden (2005) a teaching process towards TPACK covers self-learning, use of technology and critical thinking. In such a teaching process, teachers' responsibility is high. It is important that teachers offer an environment where students are able to learn effectively and efficiently and that teachers have field knowledge as well as pedagogical knowledge. With the inclusion of technology in the process of teaching as a tool, it has become a necessity to think the knowledge of technology along with field knowledge and pedagogical knowledge. Studies that have been carried out until present day support that the technology used in learning-teaching process should have a pedagogical ground (Ferdig, 2006). Combining technology with education in an efficient way requires having a strong technology, pedagogy and content knowledge (TPACK). Therefore, teachers should combine technology and pedagogy with the curriculum they use in their learning-teaching environment (Mishra & Koehler, 2006).

With the rise of new technologies and expansion of their use in teaching, the use of technology, pedagogy and content concepts has become important. Mishra and Koehler (2005) who created TPACK for the integration of new technologies in education stated that TPACK was an understanding that results from the interaction of technology, pedagogy and content knowledge and that has a further meaning beyond each of the concepts themselves. The model is shown in Figure1.

TPACK is characterized as the knowledge that results from teacher's concurrent and interdependent understanding of content, general pedagogy, technology and learning contexts (Harris & Hofer, 2011). TPACK emphasizes the connections among technologies, curriculum content, and specific pedagogical approaches demonstrating how teachers' understandings of technology,

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pedagogy and content can interact with one another to produce effective discipline-based teaching with educational technologies (Harris, Mishra, & Koehler, 2009).

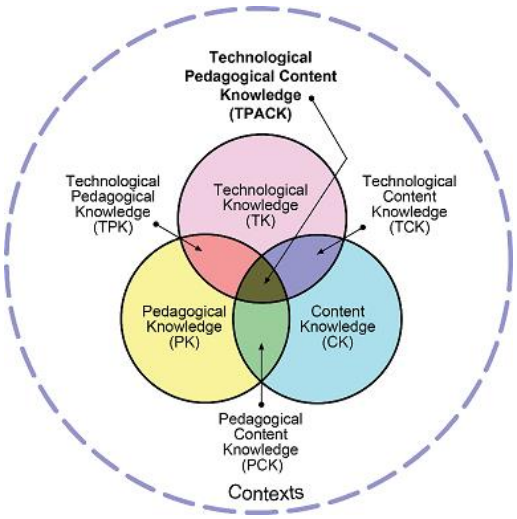


**Figure 1**. Technological pedagogical content knowledge (TPACK) model (Mishra & Koehler, 2006)

When the studies on TPACK are reviewed, it is seen that most of these studies were carried out to reveal the TPACK knowledge of teachers (Chai, Koh, & Tsai, 2010; Chuang & Ho, 2010; Kabakçı-Yurdakul, 2011; Schmidt et al., 2009), and focused on teachers' opinions on teacher competencies in the process of integration of technology into teaching (Lin, Tsai, Chai, & Lee, 2013; Usluel, Mumcu, & Demiraslan, 2007) and on the indicators of these competencies (Kuşkaya-Mumcu, Haşlaman, & Koçak-Usluel, 2008; Kabakçı-Yurdakul et al. 2012; Oster-Levinz & Klieger, 2010). The information from the literature reveals that teachers should have TPACK for effective integration of technology into education. This requires, first of all, researching TPACK competencies of pre-service teachers who will reflect their TPACK competencies on instructional design activities or activities in the classroom.

Another important thing for teachers to integrate new technologies into learning-teaching process is their self-efficacy perceptions on integration of technology (Wang, Ertmer, & Newby, 2004). The teachers' high perception level of self-efficacy on technology integration could be an indicator of their self-confidence in effectively use of technology (Nathan, 2009). In this respect, teachers who have high self-efficacy level on technology integration tend to be more successful in the technology integration process (Nathan, 2009; Wang et al. 2004). Pre-service teachers attend to various teacher training courses in order to use information and communication technologies in the classroom. It is necessary to find out how these courses effect the self-efficacy perceptions of teachers towards the integration of technology. In addition, it is necessary to study the correlation between self-efficacy perceptions of pre-service teachers in integrating new technologies into learning-teaching process and their TPACK competencies based on grade. In other words, it is believed that determining and comparing the self-efficacy perceptions towards integration of technology and TPACK of freshmen and senior class students will contribute to the evaluation of the teacher programmes with regards to these two variables (technology integration and TPACK competencies) and with regards to what kind of revisions can be made in the curricula of the departments (Ling Koh, Chai, & Tay, 2014).

The aim of this study, which was carried out based on the rationale given above, was to examine the TPACK competencies of freshmen and senior class students with their self-efficacy perception towards technology integration, based on various variables; and to find out the correlation between them. Within this framework, answers to the following research questions were sought for:

1. What is the self-efficacy perception level of pre-service teachers about TPACK competencies and technology integration?
2. Is there a statistically significant difference among pre-service teachers';

a) TPACK competency levels in terms of their gender?
b) Self-efficacy perception levels towards technology integration based on gender?

3. Is there a statistically significant difference among pre-service teachers';
   a) TPACK competencies levels based on their grades?
   b) Self-efficacy perception levels towards technology integration based on their grades?
4. Is there a statistically significant difference among pre-service teachers';
   a) TPACK competency levels based on the department they study?
   b) Self-efficacy perception levels towards technology integration based on the department they study?
5. Is there a statistically significant correlation among pre-service teachers' TPACK competencies and their self-efficacy perceptions towards technology integration?

## METHOD

This section includes information on the model, sampling, data collection tool and analysis of data.

### Research Model

Survey method was used in this study which was carried out to find out the self-efficacy perception levels of freshmen and senior class pre-service teachers towards TPACK competiencies and technology integration. As is known, survey method helps researchers describe an event or circumstance in the form they exist. The event or circumstance is defined in the conditions they happen and in the form they exist (Fraenkel & Wallen, 2006).

### Sampling and Data Collection Tools

The study was designed on the basis of quantitative research approaches and used purposive sampling technique. Purposive sampling is elected when certain groups are likely to provide rich information (Fraenkel & Wallen, 2006). The research sample comprised 713 freshmen and senior class students studying at Ankara University Faculty of Educational Sciences on 2012-2013 academic year spring semester. Information on the demographical features of the students is given in Table 1.

**Table 1.** *Demographical data of participants*

| Variable | Group | N | % |
|---|---|---|---|
| Gender | Female | 449 | 63 |
| | Male | 264 | 37 |
| **Total** | | **713** | **100** |
| Grade | Freshmen | 385 | 54 |
| | Senior | 328 | 46 |
| **Total** | | **713** | **100** |
| Department | Computer Education and Instructional Technologies | 94 | 13.2 |
| | Religious Culture and Moral Knowledge | 126 | 17.7 |
| | Preschool Education | 125 | 17.5 |
| | Psychological Counseling and Guidance | 79 | 11.1 |
| | Primary Education | 120 | 16.8 |
| | Social Studies Teaching | 89 | 12.5 |
| | Mentally Handicapped Teaching | 80 | 11.2 |
| **Total** | | **713** | **100** |

In the current study, Technopedagogical Education Competency Scale developed by Kabakçı-Yurdakul et al. (2012) was used to find out TPACK competencies of students. The scale, whose reliability and validity studies were carried out on pre-service teachers, included 33 items; and had four factors. The scale was a five-point likert scale including: "I can easily do", "I can do", "I

can partly do", I can't do" and "Definitely I can't do". All the items in the scale were positively stated and there are no reversely coded items. Cronbach's alpha coefficient for the whole scale was found as .95 and the Cronbach's alpha coefficient of the factors in the scale ranged between .85 and .92. In addition, four-factor structure of the scale was confirmed with confirmatory factor analysis. And the test-retest reliability coefficient of the scale was found as .80. The lowest score that one can get from the scale is 33 while the highest is 165. TPACK competencies increases as the score from the scale gets closer to 165 and decreases as it gets closer to 33 (Kabakçı-Yurdakul et al., 2012).

In order to find out the self-efficacy beliefs of pre-service teachers in technology integration, the "Technology Integration Self Efficacy Scale" developed by Wang et al. (2004) and adapted into Turkish by Ünal (2013) was used. The scale, whose reliability and validity studies were carried out on pre-service teachers, included 19 items; and had two factors which were "Perception of the ability of self-efficacy in making others use computer technology" and "Perception of Computer Technology Use Self-Efficacy". The scale was a 5-point likert scale including: "Strongly agree", "Agree", "Undecided", "Disagree", "Strongly disagree" options. All the items in the scale were stated positively and there were no reversely coded items. Cronbach's alpha coefficient for the whole scale was found as .94 while the same coefficient for the factors in the scale ranged between .92 and .88. In addition, two-factor structure of the scale was confirmed with confirmatory factor analysis. The lowest score that one can get from the scale is 19 while the highest is 95. Self-efficacy perception towards technology integration increases as the score from the scale gets closer to 95 and decreases as it gets closer to 19 (Ünal, 2013).

## FINDINGS

Findings related to gender, grade and department within the scope of aims and sub-goals of the research are listed below.

In line with the first research question of the study, descriptive statistics showing the levels of pre-service teachers towards TPACK competencies and self-efficacy perception of technology integration are shown in Table 2.

**Table 2.** Breakdown of the scores of self-efficacy perception levels of pre-service teachers towards TPACK competencies and technology integration

| Scales | Number of Items | Lowest Score | Highest Score | $\bar{x}$ | sd | $\bar{x}$/k |
|---|---|---|---|---|---|---|
| Technopedagogical Education Competency Scale | 33 | 47.00 | 165.00 | 131.65 | 19.97 | 3.99 |
| Technology Integration Self Efficacy Scale | 19 | 19.00 | 95.00 | 74.96 | 12.64 | 3.95 |

According to Table 2, the mean score of pre-service teachers from the Technopedagogical Education Competency Scale was 131.65 (3.99 over 5) whilst their mean score from the Technology Integration Self Efficacy Scale was 74.96 (3.95 over 5). Moving from these results, it can be said that the levels of pre-service teachers towards TPACK competencies and perception of technology integration self-efficacy is high.

Kolmogorov-Smirnov test of normality was carried out to see whether pre-service teachers TPACK competencies and self-efficacy perceptions of technology integration scores showed a normal distribution. The results of the test showed that whilst the data obtained from Technopedagogical Education Competency Scale showed a normal distribution ($p>0.05$), the data obtained from self-efficacy perception towards technology integration did not show a normal distribution ($p<0.05$). Therefore, T-test and Anova, parametric tests, were used in analyzing data with a normal distribution while Mann-Whitney U and Kruskal Wallis, non-parametric tests, were used in analyzing data that did not show a normal distribution. .05 reliability level was based on in the significance tests in the study.

To find out whether there was a statistically significant difference among TPACK competency levels of pre-service teachers based on gender, in line with the second research question of the study, t-test was used and the results are given in Table 3.

**Table 3.** *T-test results of TPACK competency levels of pre-service teachers based on gender*

| Gender | n | $\bar{x}$ | sd | df | t | p |
|---|---|---|---|---|---|---|
| Female | 449 | 131.82 | 19.56 | 711 | .30 | .080 |
| Male | 264 | 131.36 | 20.68 | | | |

When Table 3 is analyzed, it is seen that while TPACK competency score averages of female pre-service teachers is 131.82, the same average is 131.36 among males. There was no statistically significant difference found between male and female students' TPACK competency levels [t(711)= .30, p>0.05]. In other words, being male or female does not have an impact on TPACK competency level.

Descriptive values of pre-service teachers' self-efficacy perception levels towards technology integration based on gender, in line with the second research question of the study, are given in Table 4.

**Table 4.** *Descriptive statistics of pre-service teachers' self-efficacy perception levels towards technology integration based on gender*

| Gender | n | $\bar{x}$ | sd |
|---|---|---|---|
| Female | 449 | 74.71 | 12.57 |
| Male | 264 | 75.40 | 12.76 |

When Table 4 is analyzed, it is seen that while mean score of female pre-service teachers' self-efficacy perception levels towards technology integration was 74.71, the same mean score was 75.40 among males. It is seen that there are differences in self-efficacy perception levels towards technology integration based on gender. In order to find out whether this case is a statistically significant case, Mann Whitney-U, a non-parametric test, was used. The results of the test are given in Table 5.

**Table 5.** Mann whitney-u test results of pre-service teachers' self-efficacy perception levels towards technology integration based on gender

| Gender | n | Mean Rank | Sum of Ranks | U | p |
|---|---|---|---|---|---|
| Female | 449 | 349.44 | 156900.50 | 55875.50 | .201 |
| Male | 264 | 369.85 | 97640.50 | | |

When Table 5 is analyzed, it is seen that there are no statistically significant differences among pre-service teachers' self-efficacy perception levels towards technology integration based on gender (U=55875.50, p>.05). In other words, being male or female does not have an impact on self-efficacy perception level towards technology integration.

To find out whether there was a statistically significant difference among TPACK competency levels of pre-service teachers based on grades, in line with the third research question of the study, t-test was used and the results are given in Table 6.

**Table 6.** *T-test results of TPACK competency levels of pre-service teachers based on grades*

| Grade | n | $\bar{x}$ | sd | df | t | p |
|---|---|---|---|---|---|---|
| Freshmen | 385 | 127.11 | 19.24 | 711 | 6.79 | .000 |
| Senior | 328 | 136.99 | 19.50 | | | |

When Table 6 is analyzed, it is seen that while TPACK competency mean scores of freshmen is 127.11, the same mean score is 136.99 among senior students. There was statistically significant difference found between freshmen and senior students' TPACK competency levels [t(711)= 6.79, p<0.05]. In other words, this finding can be interpreted as grade level has an impact on TPACK competency level.

Descriptive values of pre-service teachers' self-efficacy perception levels towards technology integration based on grades, in line with the third research question of the study, are given in Table 7.

**Table 7.** *Descriptive statistics of pre-service teachers' self-efficacy perception levels towards technology integration based on grades*

| Grade | n | $\bar{x}$ | sd |
|---|---|---|---|
| Freshmen | 385 | 72.41 | 12.52 |
| Senior | 328 | 77.97 | 12.12 |

When Table 7 is analyzed, it is seen that while mean scores of freshmen's self-efficacy perception levels towards technology integration was 72.41, the same mean score was 77.97 among seniors. It is seen that there are differences in mean scores in self-efficacy perception level towards technology integration based on grades. In order to find out whether this case is a statistically significant case, Mann Whitney-U, a non-parametric test, was used. The results of the test are given in Table 8.

**Table 8.** *Mann whitney-u test results of pre-service teachers' self-efficacy perception levels towards technology integration based on grades*

| Grade | n | Mean Rank | Sum of Ranks | U | p |
|---|---|---|---|---|---|
| Freshmen | 385 | 312.02 | 120129.00 | 45824.00 | .000 |
| Senior | 328 | 409.79 | 134412.00 | | |

When Table 8 is analyzed, it is seen that there is a statistically significant difference among pre-service teachers' self-efficacy perception levels towards technology integration based on grades (U=45824.00, p<.05). This finding can be interpreted as the grade that one studies has an impact on self-efficacy perception levels towards technology integration.

Descriptive values of pre-service teachers' TPACK competency levels based on the department they study, in line with the fourth research question of the study, are given in Table 9.

**Table 9.** *Descriptive statistics of pre-service teachers' TPACK competency levels based on the department*

| Department | n | $\bar{x}$ | sd |
|---|---|---|---|
| Computer Education and Instructional Technologies | 94 | 129.39 | 22.09 |
| Religious Culture and Moral Knowledge | 126 | 131.31 | 22.83 |
| Preschool Education | 125 | 134.86 | 18.34 |
| Psychological Counseling and Guidance | 79 | 127.22 | 18.55 |
| Primary Education | 120 | 135.35 | 19.16 |
| Social Studies Teaching | 89 | 134.16 | 17.40 |
| Mentally Handicapped Teaching | 80 | 125.88 | 18.23 |

When Table 9 is analyzed, it is seen that while TPACK competency mean scores of students studying at Computer Education and Instructional Technologies is 129.39; the same mean score for students at Religious Culture and Moral Knowledge is 131.31; Preschool Education is 134.86, Psychological Counseling and Guidance is 127.22; Primary Education is 135.35; Social Studies Teaching is 134.16 and Mentally Handicapped Teaching is 125.88. It is seen that there are differences among average scores of TPACK competency levels based on departments' students study at. In order to find out whether this case is a statistically significant case, one-way Anova for independent groups was used. The results of the test are given in Table 10.

**Table 10.** *Anova results of TPACK competency levels of pre-service teachers based on departments they study*

| Source | Sum of Squares | df | Mean Square | F | p | Sig. |
|---|---|---|---|---|---|---|
| Between Group | 8208.497 | 6 | 1368.083 | | | Preschool Education - Mentally Handicapped Teaching |
| Within Group | 275647.242 | 706 | 390.435 | 3.504 | .002 | |
| Total | 283855.739 | 712 | | | | Primary Education - Mentally Handicapped Teaching |

When Table 10 is analyzed, it is seen that is statistically significant difference among TPACK competency levels of students studying at different departments [F(6,706)=3.50, p<.05]. In other words, pre-service teachers' TPACK competencies levels change significantly based on the department they study. Because F test was significant and variances did not provide homogeneity Dunnett's C test was used to find out between which departments this difference existed. The results of the test showed that the difference was between Preschool Education and Mentally Handicapped Teaching; and between Primary Education and Mentally Handicapped Teaching.

Descriptive values of pre-service teachers' self-efficacy perception levels towards technology integration, in line with the fourth research question of the study, are given in Table 11.

**Table 11.** *Descriptive values of pre-service teachers' self-efficacy perception levels towards technology integration based on department*

| Department | n | $\bar{x}$ | sd |
|---|---|---|---|
| Computer Education and Instructional Technologies | 94 | 74.20 | 13.20 |
| Religious Culture and Moral Knowledge | 126 | 75.10 | 15.12 |
| Preschool Education | 125 | 76.90 | 12.95 |
| Psychological Counseling and Guidance | 79 | 71.01 | 12.76 |
| Primary Education | 120 | 76.38 | 10.14 |
| Social Studies Teaching | 89 | 76.42 | 11.28 |
| Mentally Handicapped Teaching | 80 | 72.78 | 10.93 |

When Table 11 is analyzed, it is seen that mean scores for self-efficacy perception levels towards technology Integration among students studying at Computer Education and Instructional Technologies is 74.20; the same score for students at Religious Culture and Moral Knowledge is 75.10; Preschool Education is 76.90; Psychological Counseling and Guidance is 71.01; Primary Education is 76.38; Social Studies Teaching is 76.42 and Mentally Handicapped Teaching is 72.78. It is seen that there are differences among mean scores of self-efficacy perception levels towards technology integration based on departments' students study at. In order to find out whether this case is a statistically significant case, Kruskal Wallis for independent groups was used. The results of the test are given in Table 12.

**Table 12.** *Kruskal wallis test results of pre-service teachers' self-efficacy perception levels towards technology integration based on department*

| Department | n | Mean Square | df | $x^2$ | p | Sig. |
|---|---|---|---|---|---|---|
| Computer Education and Instructional Technologies | 94 | 355.62 | 6 | 22.82 | .001 | Computer Education and Instructional Technologies - Psychological Counseling and Guidance |
| Religious Culture and Moral Knowledge | 126 | 369.17 | | | | Religious Culture and Moral Knowledge - Psychological Counseling and Guidance |
| Preschool Education | 125 | 396.81 | | | | Religious Culture and Moral Knowledge - Mentally Handicapped Teaching |
| Psychological Counseling and Guidance | 79 | 285.51 | | | | Preschool Education - Psychological Counseling and Guidance |
| Primary Education | 120 | 371.59 | | | | Preschool Education - Mentally Handicapped Teaching |
| Social Studies Teaching | 89 | 381.16 | | | | Psychological Counseling and Guidance - Primary Education |
| Mentally Handicapped Teaching | 80 | 299.10 | | | | Psychological Counseling and Guidance - Social Studies Teaching |
| | | | | | | Primary Education - Mentally Handicapped Teaching |
| | | | | | | Social Studies Teaching - Mentally Handicapped Teaching |

In line with the fifth research question of the study, the results of the correlation analysis carried out to find out whether there was a statistically significant relationship among pre-service teachers' TPACK competencies and their self-efficacy perceptions towards technology integration scores is given in Table 13.

**Table 13.** *Results of the correlation analysis between pre-service teachers' TPACK competencies and their self-efficacy perception levels towards technology integration*

| | | TPACK Competiencies | Self-Efficacy Perception Levels towards Technology Integration |
|---|---|---|---|
| **TPACK Competiencies** | Spearman's rho | 1 | .779** |
| | Sig. (2-tailed) | | .000 |
| | N | 713 | 713 |
| **Self-Efficacy Perception Levels towards Technology Integration** | Spearman's rho | .779** | 1 |
| | Sig. (2-tailed) | .000 | |
| | N | 713 | 713 |

If the correlation coefficient is 1.00 that shows a perfect positive correlation; and if it is -1.00 that shows a perfect negative correlation; and if it is 0.00 that shows that there is no correlation.

According to Büyüköztürk (2007) whilst there are no commonly agreed ranges in interpreting correlation coefficient in terms of size, it should be noted that below given limits can be used frequently. If the correlation coefficient is between 0.70-1.00 absolute value that means a high correlation; while an absolute value between 0.70-0.30 means a medium correlation and an absolute value between 0.30-0.00 means a low correlation. Accordingly, while Table 13 is examined it is seen that there is a high positive and significant correlation between self-efficacy perception towards technology integration and TPACK competencies levels ($r=.779$, $p<.01$). In other words, as the TPACK competencies level increases, it effects the self-efficacy perception towards technology integration positively.

## RESULTS AND DISCUSSION

This study examined and compared the TPACK competencies of freshmen and senior class students with their self-efficacy perception towards technology integration, based on various variables; and the correlation between their TPACK competencies and self-efficacy perceptions towards technology integration was examined.

It was found that there was no statistically significant difference among pre-service teachers' TPACK competencies and self-efficacy perception levels towards technology integration based on gender. In a study by Ünal (2013) it was found that pre-service teachers TPACK competencies did not differ based on gender while their self-efficacy perceptions towards technology integration did and that male students' self-efficacy perceptions were higher. In another study by Erdoğan and Şahin (2010), it was found that TPACK competencies of pre-service mathematics teachers differed by gender and this difference was in favor of males.

It was found that there was a statistically significant difference among pre-service teachers' TPACK competencies and self-efficacy perception levels towards technology integration based on grades and this difference was found to be in favor of senior class students. In the light of this finding of the study, it is believed that technology, pedagogy and field knowledge education and courses students take during their studies improved their self-efficacy perceptions towards technology integration and TPACK competencies. The results of the study by Ünal (2013) support these findings.

Pre-service teachers' TPACK competency levels and self-efficacy perception levels towards technology integration differed significantly based on the department they study. The departments with highest TPACK competencies were Primary Education, Preschool Education respectively while the department with the lowest scores was Mentally Handicapped Teaching. Similarly, it was found that pre-service teachers' self-efficacy perception levels towards technology integration differed and that the departments with the highest self-efficacy perception were Preschool Education and Primary Education, respectively while the department with the lowest self-efficacy perception was Psychological Counseling and Guidance. Unlike the results of the current study, the results of the study by Ünal (2013) found that there were no statistically significant differences in TPACK competencies and self-efficacy perceptions of pre-service teachers towards technology integration.

When the curriculum used in the departments, where pre-service teachers who attended to this research studies, were examined it was found that it was Computer Education and Instructional Technologies department where there were the highest number of technology-related courses. It was followed by Primary Education, Preschool Education and Social Sciences Education departments. However, the findings of the study revealed that there were no statistically significant differences among the four departments in the study in terms of their self-efficacy perceptions towards technology integration and their TPACK competency levels. It was found that it was Mentally Handicapped Teaching and Psychological Counseling and Guidance Departments where there were the lowest number of technology-related courses and that there was a statistically significant difference between these two departments and the remaining four departments in the study in terms of their self-efficacy perceptions towards technology integration and their TPACK competency levels.

All this information shows that increasing the number of technology-related courses in the curriculum up to a certain level improves pre-service teachers' self-efficacy perceptions towards

technology integration and their TPACK competency levels. On the other hand, the finding that there were no statistically significant differences between Computer Education and Instructional Technologies department, which had the highest number of technology-related courses, and Primary Education, Preschool Education and Social Sciences Education departments, which had relatively less number of technology-related courses, in terms of their self-efficacy perceptions towards technology integration and their TPACK competency levels, shows that high number of technology-related courses does not guarantee an increase in self-efficacy perceptions towards technology integration and TPACK competency levels. This result can be interpreted in the following way: it is possible to improve technology-knowledge of pre-service teachers in technology-related courses, however depending on the fact that they will not know how to integrate these technologies into learning environments, it might not create a significant change in self-efficacy perceptions towards technology integration and TPACK levels.

When this case is considered from the TPACK framework introduced by Mishra and Koehler (2006) it is seen that pure technology-related courses improved pre-service teachers' technological knowledge but did not have a significant impact on their content and pedagogical knowledge. As for Wang et al. (2004) although technological knowledge of the teachers does not guarantee to automatically increase self-efficacy perceptions towards technology integration, it is considered as a prerequisite in the process of technology knowledge integration. Therefore, keeping the number of technology-related courses at a certain level in the curriculum (as in Primary Education, Preschool Education and Social Sciences Education) will be useful in order to ensure true integration of new technological practices, which have started to be frequently used in educational practices into education and to improve teachers' self-efficacy perceptions towards technology integration and their TPACK competency levels. It is normal that the number of technology-related courses in Computer Education and Instructional Technologies, which is directly related to technology, is high. However, in addition to knowledge about technology, teaching how to integrate those learned technologies into learning environments will make the courses more functional in terms of self-efficacy perceptions towards technology integration and TPACK competency levels. Therefore, combining the content of field-specific courses of pre-service teachers with technology and pedagogy and showing/implementing how to utilize convenient educational technology in teaching the content and how to integrate relevant technology to the course subject will be more useful (So & Kim, 2009).

According to Ertmer, Ottenbreit-Leftwich, Sadik, Sendurur and Sendurur's (2012) study, teachers consider the negative attitudes and perceptions towards technology integration as the biggest obstacle in technology integration. This is followed by insufficient technological support as the second biggest obstacle. It is possible to change these negative attitudes and perceptions of teachers by including technology-related courses in the curricula. On the other hand, in order to remove the problem of insufficient technological support, which is the second biggest obstacle, teachers might not always have a tech expert for support. According to Koh and Chai (2014) teachers' self-efficacy for ICT integration was found to influence their learning behaviors during ICT courses as well as the motivational strategies instructors used. Therefore, using such frequently used hardware as computer, tablet, projection, interactive board, printer, scanner, İnternet connection as well as software and online apps (web conference, whiteboard, blog, podcast, wiki, social networks, e-assessment tools and other web 2.0 tools etc.) should be demonstrate. During the demonstrations with regards to the use of hardware and apps, teachers will see the problems they face in hardware and software and understand the solutions to these problems. So in order to improve pre-service teachers' self-efficacy perceptions towards technology integration and their TPACK competency levels, courses offered in the curricula can be designed as applied courses where pre-service teachers can demonstrate their performances. Thus, according to Technology Acceptance Model (Davis, Bagozzi, & Warshaw, 1989) teachers' perceived ease of use towards technology and perceived usefulness will increase and thus, their attitude towards usage will be developed positively. As a result, the negative perceptions and attitudes towards technology integration which are considered to be an obstacle before technology integration and TPACK will be reduced (Kim, Kim, Lee, Spector, & DeMeester, 2013; Teo, 2010) and teachers' self-efficacy perceptions of technology integration will be improved. As for Oliver and Shapir (1993) self-efficacy perceptions towards technology integration is a significant

indicator of a successful technology integration process. So improving teachers' self-efficacy perception towards technology integration is important for the success of this process.

The results of the correlation analysis between the self-efficacy perceptions of pre-service teachers towards technology integration and their TPACK competency levels showed a highly positive and significant correlation between the two variables. In other words, increasing TPACK competencies levels increased self-efficacy perception towards technology integration as well. The studies in the literature also found a medium level, positive and significant correlation between the two aforementioned variables (Abbitt, 2011; Ünal, 2013).

As a result, the result of this study, in which TPACK and self-efficacy perceptions of pre-service teachers was examined, showed that self-efficacy perceptions of pre-service teachers towards technology integration was an important predictor of TPACK. It is expected that the results of the study will contribute to the literature on TPACK and technology integration (Abbitt, 2011; Tokmak, 2013; Ling Koh et al. 2014). And in order to improve pre-service teachers' self-efficacy perceptions towards technology and TPACK, they should be demonstrated with which technology subject area knowledge should be combined with a pedagogical approach during the courses (Chai, Ling Koh, Tsai, & Lee Wee Tan, 2011). In the present study, technology integration process was informed by TPACK approach. However, Integration process is influenced by the systemic elements in relation to political system, economic system as well as elements such as belief, self-regulation, motivation and also by the interplay between these elements (Koçak-Usluel, Özmen, & Çelen, 2015). Therefore, in this study which focuses on technology integration, due to its constructs the TPACK model was utilized only for examining the teacher candidates' technology, pedagogy and content knowledge and their relation to self-efficacy in regards to technology integration. The elements such as political system, economic system, self-regulation and motivation were not in the scope of this study. This could be regarded as limitation of the study and future studies could deal with technology integration process and self-efficacy of the teacher candidates in relation to technology integration apart from TPACK model by including the other elements which are not in the scope of this study.

## REFERENCES


Abbitt, J. T. (2011). An investigation of the relationship between self-efficacy beliefs about technology integration and technological pedagogical content knowledge (TPACK) among pre-service teachers. *Journal of Digital Learning in Teacher Education, 27*(4).

Beaudin, L., & Hadden, C. (2005). Technology and pedagogy: Building techno-pedagogical skills in pre-service teachers. *Innovate: Journal of Online Education, 2*(2).

Büyüköztürk, Ş. (2007). *Sosyal bilimler için veri analizi el kitabı ["Data analysis handbook for social sciences"]*. Ankara: PegemA Publication.

Chai, C. S., Koh, J. H. L., & Tsai, C. C. (2010). Facilitating pre-service teachers' development of technological, pedagogical, and content knowledge (TPACK). *Journal of Educational Technology & Society, 13*(4), 63-73.

Chai, C. S., Ling Koh, J. H., Tsai, C. C., & Lee Wee Tan, L. (2011). Modeling primary school pre-service teachers' technological pedagogical content knowledge (TPACK) for meaningful learning with information and communication technology (ICT). *Computers & Education, 57*(1), 1184-1193.

Chuang, H. H., & Ho, C. J. (2010). The development of early childhood teachers' technological pedagogical content knowledge (TPACK) in Taiwan. *4th International Computer and Instructional Technologies Symposium Proceedings*, Selçuk University, Konya, Turkey.

Davis, F. D., Bagozzi, R. P., & Warshaw, P. R. (1989). User acceptance of computer technology: a comparison of two theoretical models. *Management Science, 35*(8), 982-1003.

Erdoğan, A., & Şahin, I. (2010). Relationship between math teacher candidates' technological pedagogical and content knowledge (TPACK) and achievement levels. *Procedia-Social and Behavioral Sciences, 2*(2), 2707-2711.

Ertmer, P. A., Ottenbreit-Leftwich, A. T., Sadik, O., Sendurur, E., & Sendurur, P. (2012). Teacher beliefs and technology integration practices: A critical relationship. *Computers & Education, 59*(2), 423-435.

Ferdig, R. E. (2006). Assessing technologies for teaching and learning: Understanding the importance of technological pedagogical content knowledge. *British Journal of Educational Technology, 37*(5), 749-760.

Fraenkel, J. R., & Wallen, N. E. (2006). *How to design and evaluate research in education (6th ed.)*. New York: NY: McGraw-Hill.

Harris, J., Mishra, P. & Koehler, M. (2009). Teachers' technological pedagogical content knowledge and learning activity types: Curriculum-based technology integration reframed. *Journal of Research on Technology in Education, 41*(4), 393–416.

Harris, J. B., & Hofer, M. J. (2011). Technological pedagogical content knowledge (TPACK) in action: A descriptive study of secondary teachers' curriculum-based, technology-related instructional planning. *Journal of Research on Technology in Education, 43*(3).

Kabakçı-Yurdakul, I. (2011). Examining technopedagogical knowledge competencies of pre-service teachers based on ict usage. *Hacettepe University Journal of Education*, 40, 397-408.

Kabakçı-Yurdakul, I., Odabaşı, H. F., Kılıçer, K, Çoklar, A. N., Birinci, G., & Kurt, A. A. (2012). The development, validity and reliability of tpack-deep: A technological pedagogical content knowledge scale. *Computers & Education, 58*(3), 964-977.

Kim, C., Kim, M. K., Lee, C., Spector, J. M., & DeMeester, K. (2013). Teacher beliefs and technology integration. *Teaching and Teacher Education, 29*, 76-85.

Koçak-Usluel, Y., Özmen, B., & Çelen, F.K. (2015). Integration of ICT in learning and teaching process and a critical overview of TPACK model. *Education Technology Theory and Practice, 5*(1), 34–54.

Koh, J. H. L., & Chai, C. S. (2014). Teacher clusters and their perceptions of technological pedagogical content knowledge (TPACK) development through ICT lesson design. *Computers & Education, 70*, 222-232.

Kuşkaya-Mumcu, F., Haşlaman, T., & Koçak-Usluel, Y. (2008). Indicators of effective technology integration based on technological pedagogical content knowledge model. *8th International Educational Technology Conference Eskişehir, Turkey*.

Lin, T. C., Tsai, C. C., Chai, C. S., & Lee, M. H. (2013). Identifying science teachers' perceptions of technological pedagogical and content knowledge (TPACK). *Journal of Science Education and Technology, 22*(3), 325-336.

Ling Koh, J. H., Chai, C. S., & Tay, L. Y. (2014). TPACK-in-action: Unpacking the contextual influences of teachers' construction of technological pedagogical content knowledge (TPACK). *Computers & Education, 78*, 20-29.

Mazman, S. G., & Usluel, Y. K. (2011). ICT integration into learning-teaching process: Models and indicators. *Education Technology Theory and Practice. 1*(1), 62-79.

Mishra, P., & Koehler, M. (2005). Educational technology by design: Results from a survey assessing its effectiveness. In *Society for Information Technology & Teacher Education International Conference* (Vol. 2005, No. 1, pp. 1511-1517).

Mishra, P., & Koehler, M. (2006). Technological pedagogical content knowledge: A framework for teacher knowledge. *The Teachers College Record*, *108*(6), 1017-1054.

Nathan, E. J. (2009). *An Examination of the Relationship between Preservice Teachers' Level of Technology Integration Self-Efficacy (TISE) and Level of Technological Pedagogical Content Knowledge (TPACK).* Ph.D. Thesis, University of Houston.

Oliver, T. A., & Shapir, J. F. (1993) Self-efficacy and computers. *Journal of Computer-Based Instruction, 20*, 81-85.

Oster-Levinz, A., & Klieger, A. (2010). Indicator for technological pedagogical content knowledge (TPACK) evaluation of online tasks. *Turkish Online Journal of Distance Education*, *11*(4), 47-71.

Schmidt, D. A., Baran, E., Thompson, A. D., Mishra, P., Koehler, M. J., & Shin, T. S. (2009). Technological pedagogical content knowledge (TPACK): The development and validation of an assessment instrument for pre-service teachers. *Journal of Research on Technology in Education*, *42*(2).

So, H. J., & Kim, B. (2009). Learning about problem based learning: Student teachers integrating technology, pedagogy and content knowledge. *Australasian Journal of Educational Technology*, *25*(1), 101-116.

Teo, T. (2010). A path analysis of pre-service teachers' attitudes to computer use: Applying and extending the technology acceptance model in an educational context. *Interactive Learning Environments*, *18*(1), 65-79.

Tokmak, H. S. (2013). Changing preschool teacher candidates' perceptions about technology integration in a TPACK-based material design course. *Education as Change*, *17*(1), 115-129.

Usluel, Y. K., Mumcu, F. K., & Demiraslan, Y. (2007). ICT in the learning-teaching process: Teachers' views on the integration and obstacles. *Hacettepe University Journal of Education*, *32*(32).

Ünal, E. (2013). *Öğretmen adaylarinin teknoloji entegrasyonu öz-yeterlik algilari ve teknolojik pedagojik içerik bilgisi yeterlikleri arasindaki ilişkinin incelenmesi ["An examination of the relationship between pre-service teachers' perceptions of technology integration self-efficacy and technological pedagogical content knowledge competiencies"]*. Master's Thesis, Ankara University.

Wang, L., Ertmer, P. A., & Newby, T. J. (2004). Increasing pre-service teachers' self-efficacy beliefs for technology integration. *Journal of Research on Technology in Education, 36*(3), 231-250.

# Öğretmen Adaylarının TPİB Yeterlilikleri ve Teknoloji Entegrasyonu Öz-Yeterlik Algıları*

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**ÖZ.** Bu çalışmada öğretmen adaylarının teknolojik pedagojik içerik bilgisi yeterlikleri ile teknoloji entegrasyonuna yönelik öz-yeterlik algıları çeşitli değişkenlere göre incelenerek karşılaştırılmış ve teknolojik pedagojik içerik bilgisi yeterlikleri ile teknoloji entegrasyonuna yönelik öz-yeterlik algıları arasındaki ilişki belirlenmeye çalışılmıştır. Araştırmanın çalışma grubunu; 2012-2013 öğretim yılı bahar döneminde Ankara Üniversitesi Eğitim Bilimleri Fakültesinin çeşitli bölümlerinde bir ve dördüncü sınıfta öğrenim görmekte olan 713 öğretmen adayı oluşturmaktadır. Araştırmada veriler; kişisel bilgi formu, Teknopedagojik Yeterlikleri Ölçeği ve Teknoloji Entegrasyonuna Yönelik Öz-Yeterlik Algısı Ölçeği ile toplanmıştır. Araştırma sonucunda bir ve dördüncü sınıftaki öğretmen adaylarının teknolojik pedagojik içerik bilgisi yeterlik ve teknoloji entegrasyonuna yönelik öz-yeterlik algıları durumları ortaya konularak, bu yeterlikler cinsiyet, sınıf düzeyi, bölüm değişkenleri dikkate alınarak incelenmiştir. Ayrıca, öğretmen adaylarının teknoloji entegrasyonuna yönelik öz-yeterlik algıları ile teknopedagojik yeterlik durumları arasındaki ilişki yordanmaya çalışılmıştır.
**Anahtar Kelimeler:** TPİB, teknoloji entegrasyonu, öğretmen eğitimi

## ÖZET

Bu çalışmanın amacı üniversite bir ve dördüncü sınıfta öğrenim gören öğretmen adaylarının TPİB yeterlikleri ile teknoloji entegrasyonuna yönelik öz-yeterlik algılarını cinsiyet, sınıf seviyesi, öğrenim görülen bölüm değişkenlerine göre incelemek ve TPİB yeterlikleri ile teknoloji entegrasyonuna yönelik öz-yeterlik algıları arasındaki ilişkiyi belirlemektir.

Bu çalışmada üniversite bir ve dördüncü sınıfta öğrenim gören öğretmen adaylarının TPİB yeterlik ve teknoloji entegrasyonuna yönelik öz-yeterlik algı düzeylerini ortaya koyabilmek için tarama modeli kullanılmıştır. Araştırmanın çalışma grubunu; 2012-2013 öğretim yılı bahar döneminde Ankara Üniversitesi bilgisayar ve öğretim teknolojileri eğitimi, din kültürü ve ahlak bilgisi öğretmenliği, okul öncesi eğitimi, rehberlik ve psikolojik danışma, sınıf öğretmenliği, sosyal bilgiler eğitimi ve zihin engelliler öğretmenliği bölümlerinin bir ve dördüncü sınıfında öğrenim görmekte olan 713 öğretmen adayı oluşturmaktadır. Araştırma kapsamında, öğretmen adaylarının TPİB yeterliklerini belirleyebilmek için Kabakçı-Yurdakul ve diğerleri (2012) tarafından geliştirilen Teknopedagojik Yeterlikleri Ölçeği ve teknoloji entegrasyonu konusuna yönelik öz yeterlik algılarını belirlemek amacıyla ise Wang ve diğerleri (2004) tarafından geliştirilen ve Ünal (2013) tarafından Türkçeye uyarlanan Teknoloji Entegrasyonuna Yönelik Öz Yeterlik Algısı Ölçeği kullanılmıştır.

Araştırma bulgularına göre, öğretmen adaylarının Teknopedagojik Yeterlikleri Ölçeğinden elde ettikleri toplam puan ortalaması 131.65 (5 üzerinden 3.99) olup, Teknoloji Entegrasyonuna Yönelik Öz Yeterlik Algısı Ölçeğinden elde ettikleri toplam puan ortalaması ise 74.96'dır (5 üzerinden 3.95). Bu bağlamda, öğretmen adaylarının TPİB yeterlik ve teknoloji entegrasyonuna yönelik öz yeterlik algı düzeylerinin yüksek olduğu söylenebilir.

Cinsiyet değişkenine göre kadın öğretmen adaylarının TPİB yeterlik puan ortalaması 131.82 iken, erkek öğretmen adaylarının puan ortalaması 131.36'dır. Öğretmen adaylarının cinsiyetlerine göre TPİB yeterlik düzeyleri istatistiksel olarak anlamlı farklılık göstermemektedir. Bir diğer deyişle kadın ya da erkek olmanın TPİB yeterlik düzeyini etkilemediği görülmüştür. Kadın öğretmen adaylarının teknoloji entegrasyonuna yönelik öz yeterlik algı puan ortalaması 74.71 iken, erkek öğretmen adaylarının puan ortalaması 75.40'dır. Cinsiyet değişkenine göre teknoloji entegrasyonuna

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yönelik öz yeterlik algı puan ortalamaları arasında farklılıkların olduğu görülmektedir. Bu durumun istatistiksel olarak anlamlı farklılık olup olmadığını belirlemek için parametrik olmayan testlerden Mann Whitney U testi kullanılmıştır. Test sonucuna göre öğretmen adaylarının cinsiyetlerine göre teknoloji entegrasyonuna yönelik öz yeterlik algı düzeyleri istatistiksel olarak anlamlı farklılık göstermediği görülmüştür. Bir diğer deyişle kadın ya da erkek olmanın teknoloji entegrasyonuna yönelik öz yeterlik algı düzeyini etkilemediği söylenebilir.

Sınıf seviyesi değişkenine göre birinci sınıfta öğrenim gören öğretmen adaylarının TPİB yeterlik puan ortalaması 127.11 iken, dördüncü sınıfta öğrenim gören öğretmen adaylarının puan ortalaması 136.99'dur. Öğretmen adaylarının sınıf seviyesine göre TPİB yeterlik düzeyleri istatistiksel olarak anlamlı farklılık göstermektedir. Bu bulgu, sınıf seviyesinin TPİB yeterlik düzeyini etkilediği şeklinde yorumlanabilir. Teknoloji entegrasyonu açısından bakıldığında ise birinci sınıftaki öğretmen adaylarının teknoloji entegrasyonuna yönelik öz yeterlik algı puan ortalaması 72.41 iken, dördüncü sınıftaki öğretmen adaylarının puan ortalaması 77.97'dir. Sınıf değişkenine göre teknoloji entegrasyonuna yönelik öz yeterlik algı puan ortalamaları arasında farklılıkların olduğu görülmektedir. Bu durumun istatistiksel olarak anlamlı farklılık olup olmadığını belirlemek için parametrik olmayan testlerden Mann Whitney U testi kullanılmıştır. Testin sonuçları öğretmen adaylarının sınıf seviyelerine göre teknoloji entegrasyonuna yönelik öz yeterlik algı düzeyleri istatistiksel olarak anlamlı farklılık oluşturduğunu göstermektedir.

Bölüm değişkenine göre TPİB yeterlik puan ortalamaları arasında farklılıkların olduğu görülmektedir. Bu durumun istatistiksel olarak anlamlı farklılık olup olmadığını belirlemek için ilişkisiz ölçümler için bir yönlü Anova kullanılmıştır. Test sonuçlarına göre öğretmen adaylarının TPİB yeterlik düzeyleri arasında bölümlere göre anlamlı bir fark olduğu görülmektedir. Bir diğer deyişle, öğretmen adaylarının TPİB yeterlik düzeyleri, öğrenim görülen bölüme göre anlamlı bir şekilde değişmektedir. F testinin anlamlı çıkması ve varyansların homojenliği sağlamadığı için Dunnett's C testi öğrenim görülen bölümler arası farkların hangi gruplar arasında olduğunu bulmak amacıyla kullanılmıştır. Yapılan analiz sonuçlarına göre farkın Okul Öncesi Eğitimi ile Zihin Engelliler Öğretmenliği ve Sınıf Öğretmenliği ile Zihin Engelliler Öğretmenliği arasında olduğu belirlenmiştir. Teknoloji entegrasyonu açısından bakıldığında ise bölüm değişkenine göre teknoloji entegrasyonuna yönelik öz yeterlik algı puan ortalamaları arasında farklılıkların olduğu görülmektedir. Bu durumun istatistiksel olarak anlamlı farklılık olup olmadığını belirlemek için ilişkisiz ölçümler için Kruskal Wallis testi kullanılmıştır. Testin sonuçları incelendiğinde öğretmen adaylarının teknoloji entegrasyonuna yönelik öz yeterlik algı düzeylerinin bölümlere göre istatistiksel olarak anlamlı bir şekilde farklılık gösterdiğini ortaya koymaktadır. Teknoloji entegrasyonuna yönelik öz yeterlik açısından bölümlere ait ortalamalar incelendiğinde, en yüksek ortalamaya Okul Öncesi Eğitimi bölümünde öğrenim gören öğretmen adayları sahip iken, en düşük ortalamaya ise Rehberlik ve Psikolojik Danışma bölümünde öğrenim gören öğretmen adaylarının sahip oldukları görülmektedir.

Öğretmen adaylarının teknoloji entegrasyonuna yönelik öz-yeterlik algı ile teknopedagojik yeterlik ölçeğinden elde edilen puanlar arasında anlamlı bir ilişki olup olmadığını belirlemek amacıyla yapılan korelasyon analizi sonuçlarına göre teknoloji entegrasyonuna yönelik öz-yeterlik algısı ile TPİB yeterlik düzeyleri arasında ($r=.791$, $p<.01$) yüksek düzeyde pozitif ve anlamlı bir ilişkinin olduğu görülmektedir. Bir diğer deyişle TPİB yeterlik düzeylerinin artması teknoloji entegrasyonuna yönelik öz-yeterlik algısını da olumlu yönde etkilediği anlaşılmaktadır.

Söz konusu bu araştırmada teknoloji entegrasyon sürecine TPİB çerçevesinde yaklaşılmıştır. Oysa ki entegrasyon sürecinin politik sistem, ekonomik sistem gibi sistemle ilgili unsurlar ile inanç, öz-düzenleme, güdülenme gibi bireyle ilgili unsurlar ve bunların birbirleriyle etkileşimi ile ilişkili olduğu ortaya konulmuştur (Koçak-Usluel, Özmen ve Çelen, 2015). Dolayısıyla teknoloji entegrasyonu ile ilgili bu araştırmada TPİB modeli yapısı gereği öğretmen adaylarının yalnızca teknoloji, pedagoji ve içerik bilgisi boyutları ve bunların entegrasyon özyeterliği ile ilişkisi incelenmiş olup, politik sistem, ekonomik sistem, öz-düzenleme, güdülenme gibi unsurlar ele alınmamıştır. Bu durum araştırmanın bir sınırlılığı olarak görülüp, gelecek çalışmalarda yalnızca TPİB modeline göre değil de entegrasyon sürecini etkileyen diğer unsurların da dikkate alınarak öğretmen adaylarının ve öğretmenlerin teknoloji entegrasyonu öz-yeterlik algılarının incelenmesi önerilmektedir.