Examining Technological and Pedagogical Content Knowledge of Special Education Teachers Based on Various Variables

Mukaddes Sakalli Demirok [1], Basak Baglama [1]

[1] *Department of Special Education, Atatürk Education Faculty, Near East University, North Cyprus, Mersin 10 Turkey*

Abstract **– Integration of technology in special education has gained great importance recently and special education teachers are expected to have higher levels of competencies in integrating technology in special education settings and other important components of knowledge and skills related with technology. This study aims to examine technological and pedagogical content knowledge levels of special education teachers based on various variables. The study has quantitative nature and a survey model was used. Data were collected with demographic information form and Technological Pedagogical Content Knowledge Scale. Results showed adequate levels of technological and pedagogical content knowledge levels of special education teachers and significant difference was observed between the teaching experience and the technological and pedagogical content knowledge levels.**

Keywords **– Technological and pedagogical content knowledge, teacher competency, special education teacher, technology.**

1. Introduction

In today's world, rapid developments and innovations in technology have brought many facilities and current technologies provide supportive solutions to humans in every field. Technology and use of technology in education have become two concepts which can not be considered separately. Integration of technology in education includes obtaining and using current technologies for instructional purposes and it is a multi-dimensional and complex process in which different variables need to be considered in terms of administrative, instructional and institutional dimensions [12], [7].

Use of technology in education is crucial in helping individuals to accord with the changing world since more permanent and efficient learning is achieved when technology is used in the learning-teaching process. Students actively structure knowledge with technology and release product when technology is integrated effectively into education. Therefore, integration of technology into education comes into prominence. In general terms, it actually means using appropriate technology based on objectives which were determined in the learning-teaching process. Accordingly, teachers have important role in integrating technology into education since they are responsible for the learning-teaching activities at schools. Therefore, teachers are expected to be competent in using technology in education effectively in addition to have essential knowledge and skills on the teaching profession [22], [9].

Information and communication technologies facilitate learning since they appeal to more than one sense. Through the use of technology, abstract concepts become more concrete, individuals can easily realize relations between concepts visually, forgetting becomes less often and individuals gain learning experiences with pleasure [2]. In respect to these facilitative features of technology in education, it can be also used for individuals with special needs since their lives become more livable and sustainable through technological materials [1]. Technology needs to be integrated into special education environments for individuals with special needs to use and increase their existing potentials and gain essential skills to maintain their lives more

DOI: 10.18421/TEM73-06
https://dx.doi.org/10.18421/TEM73-06

Corresponding author: Basak Baglama,
Department of Special Education, Atatürk Education Faculty, Near East University,North Cyprus, Turkey
Email: basak.baglama@neu.edu.tr

Received: 14 March 2018.
Accepted: 25 June 2018.
Published: 27 August 2018.

independently [19]. Computers, cartoons, audio-books, games and animations are some of the various technologies that can be used to improve the lives of individuals with special needs in terms of both academic and social dimensions.

Considering the increased use of technology in both general and special education settings and the crucial role of the teachers in integrating technology into education, [20] developed a framework named as Technological Pedagogical Content Knowledge (TPACK). In this model, the interaction between technology, pedagogy and content are defined and the role of this interaction in integrating technology into education is emphasized. The model of this interaction is shown in Figure 1.

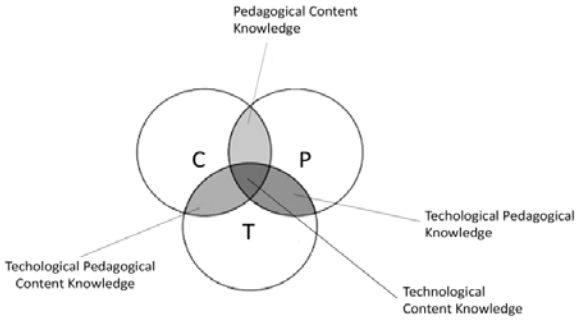

Figure 1. Technological Pedagogical Content Knowledge (TPACK) Framework [20]

Content knowledge refers to the subject area which will be taught or learned; pedagogical knowledge includes applications, processes, strategies, operations and learning-teaching methods and technological knowledge involves modern technologies such as computer, internet and video. Common interaction between these dimensions constitutes technological and pedagogical content knowledge (TPACK) [15]. In addition, essential components for an effective technopedagogical education are specified by [21] as;

- Understanding the technology used in instruction in every aspect,
- Knowing instructional strategies and presentation techniques for teaching a certain subject,
- Knowing students' knowledge level and how to use technology in an appropriate way,
- Knowing necessary technologies and materials to enhance learning in explaining the subject.

When the literature is examined, it is seen that there are many studies examining TPACK levels of teachers and factors affecting the TPACK [6], [4], [3], [17]. However, the number of studies examining the TPACK levels of special education teachers is limited. Therefore, the present study aims to examine technological and pedagogical content knowledge levels of special education teachers based on various variables. Based on this general aim, answers to the following questions were sought in this study.

1. What is the level of pedagogical content knowledge of special education teachers?
2. Do technological pedagogical content knowledge levels of special education teachers show difference based on demographic variables including age, gender, education level and teaching experience?

2. Method

2.1. Research Model

This is a descriptive study based on survey model. According to [14] survey model is a research method in which a past and existing situation or an event is examined, described and revealed as it exists without any manipulation or intervention.

2.2. Participants

Participants of the study included 60 special education teachers working at special education institutions in North Cyprus. Participants were determined based on simple random sampling method. Simple random sampling is a commonly used sampling method in which the sample is selected unit by unit and every unit in the population has the same probability of inclusion [10]. Demographic characteristics of the participants are shown in frequency and percentage in Table 1.

Table 1: Demographic characteristics of the participants

Demographic Characteristics		**f**	**%**
Age	18-30	33	55.0
	31-40	20	33.3
	41 and above	7	11.7
	Total	60	100
Gender	Male	23	38.3
	Female	37	61.7
	Total	60	100
Education level	Bachelor's degree	45	75
	Master Degree	15	25
	Total	60	100
Teaching experience	1-5 years	22	36.7
	6-10 years	26	43.3
	11-15 years	4	6.7
	16 years and above	8	13.3
	Total	60	100

Table 1. shows that 33 participants (55.0%) were between the ages of 18 and 30, 20 participants (33.3%) were between 31 and 40 and 7 of them (11.7%) were 41 and above. In addition, 23 participants (38.3%) were male and 37 of them (61.7) were female. It can be seen that majority of the participants (75%) have Bachelor's degree. 22 participants (36.7%) have teaching experience of 1-5 years, 26 of them (43.3%) have a teaching experience of 6-10 years, 4 of them (6.7%) have worked for 11-15 years and 8 of them (13.3%) have worked for 16 years and above.

2.3. Data Collection Tools

Demographic information form and Technological Pedagogical Content Knowledge Scale (TPACK-Deep Scale) were used to collect the data of the study. Demographic information form included questions on age, gender, education level and teaching experience of special education teachers participated in the study.

Technological Pedagogical Content Knowledge Scale (TPACK-Deep Scale) was developed by [13]. The scale was developed through focusing on technological and pedagogical content knowledge component of TPACK basic structure. The scale consists of 33 items and it has 4 factors which are design, application, ethics and specialization. Each item of the scale is rated on a 5-point Likert scale ranging from "I can easily do" (5), "I can do" (4), "I can slightly do" (3), "I can not do" (2) and "I can not do definitely" (1). Cronbach Alpha coefficient of the overall scale was .96. The highest score which can be obtained from the scale is 165 and the lowest score is 33 and higher scores refer to higher levels of techno-pedagogical competence and lower scores refer to lower levels of techno-pedagogical competence. When interpreting the scores obtained from the scale, "1.00-2.33" range is regarded as "low level", "2,34–3,67" range is "moderate level" and "3,68–5,00" is "high level".

The researchers made appointments with special education teachers and the whole questionnaire forms were administered to the participants when they are suitable at the special education institutions that they are currently working. It took participants approximately 10 minutes to complete the questionnaire form.

2.4. Data Analysis

Data of the study were analyzed with SPSS 20 program. Significance level was considered as $p < .05$ in statistical analysis. Percentage, frequency, t-test and Kruskal-Wallis test were applied in data analysis.

3. Results

Results obtained from the study in line with the general aim and sub-aims are provided in this section.

3.1. Descriptive statistics on special education teachers' technological and pedagogical content knowledge levels

Table 2. Descriptive statistics of TPACK levels and sub-dimensions of the scale

	n	$\overline{X}$	ss
TPACK	60	4.34	.33
Application	60	4.26	.41
Ethics	60	4.39	.42
Specialization	60	4.29	.46
Design	60	4.42	.36

Table 2. shows mean and standard deviation of total scores on TPACK. As it can be seen, mean value is =4.34. This result falls within "3,68–5,00" range which means higher levels of technological pedagogical content knowledge competency. When mean values of sub-dimensions of the scale are examined, it is seen that all results of sub-dimensions are at high level.

3.2. One-way ANOVA results on age and TPACK levels of special education teachers

Table 3. TPACK levels of special education teachers based on age variable

Age	n	Mean	SS	Sum of Squares	sd	Mean Square	F	p
18-30	33	4.37	.33	.083 (Between Groups)	2	.042	.369	.693
31-40	20	4.32	.36					
41 and above	7	4.25	.32	6.450 Within Groups)	57	.113		

$p < .05$

One-way ANOVA was applied to determine whether TPACK levels of special education teachers differ based on their age and results are shown in Table 3. As it can be seen from the table, no significant difference was observed between the TPACK levels of special education teachers and their age (F=.369; .693).

3.3. T-test results on gender and TPACK levels of special education teachers

Table 4. TPACK levels of special education teachers based on gender variable

Gender	n	S	sd	t	p
Male	23	.70	123	-1.565	.123
Female	37				

$p < .05$

T-test results on gender and TPACK levels of special education teachers are shown in Table 4. Results showed that TPACK levels of special education teachers do not show significant difference based on gender ($t(60) = -1.565$, $p < .05$).

3.4. Mann-Whitney U results on education level and TPACK levels of special education teachers

Table 5. TPACK levels of special education teachers based on education level variable

Educational level	n	Mean Rank	Sum of Ranks	M-Whitney U	z	p
Bachelor's degree	45	31.57	1420.50	289.500	-.820	.412
Master degree	15	27.30	409.50			

$p < .05$

Since the sample is not normally distributed, Mann-Whitney U which is a non-parametric was applied in order to determine whether TPACK levels of special education teachers significantly differ based on their education level. Table 5. demonstrates Mann-Whitney U results on education level and TPACK levels of special education teachers. As it can be seen, TPACK levels of special education teachers do not show significant difference based on education level variable.

3.5. Kruskal Wallis results on teaching experience and TPACK levels of special education teachers

Table 6. TPACK levels of special education teachers based on teaching experience variable

Teaching experience	n	Mean Rank	Chi-square	s	p
1-5 years	22	35.09			
6-10 years	26	28.96	9.098	3	.028
11-15 years	4	43.38			
16 years and above	8	16.44			

$p < .05$

Kruskal Wallis results on TPACK levels of special education teachers based on teaching experience variable are provided in Table 6. As it can be seen, TPACK levels of special education teachers show significant difference based on teaching experience variable. When the mean rank values are examined, it is observed that special education teachers with 1 and 5 years of teaching experience have the highest level of TPACK.

4. Discussion

This study aimed to examine technological and pedagogical content knowledge levels of special education teachers based on various variables including age, gender, education level and teaching experience. According to the results, it was revealed that TPACK levels of special education teachers is high and significant difference was observed between TPACK levels and special education teachers' teaching experience in terms of year. In addition, TPACK levels of special education teachers do not show significant difference based on their age, gender and education level.

[24] found that social science teachers reported a high level of TPACK and [11] stated that secondary mathematics teachers have high levels of TPACK. These results are similar with the result of the present study. In contrast, [8] showed that TPACK levels of geography teachers are not an adequate level. Therefore, it can be inferred that there are contradictory findings in the literature about TPACK levels of teachers.

Results of the study showed that TPACK levels of special education teachers do not show significant difference based on their age, gender and education level. In contrast with the findings of the present study, [16] showed that teachers at older ages reported lower levels of TPACK. In parallel with the results of the present study, [23] found that TPACK

levels of teachers do not significantly change based on gender.

According to the literature, it is seen that the research mostly focuses on the relationship between the teaching experiences of the teachers and TPACK levels instead of the education level of the teachers. This study examined the relationship between education level and TPACK levels and found no significant relationship. Nevertheless, findings from literature are parallel with the result of the present study showing that TPACK levels of special education teachers show difference based on teaching experience. [18] and [5] showed that there are significant differences between TPACK levels of teachers and their teaching experiences.

5. Conclusion and Recommendations

Overall results of the study provided an insight for TPACK levels of special education teachers working at special education institutions in North Cyprus. In the light of the results obtained from the study, the following recommendations for further research and practices are provided:

- Educational policies and programs should further focus and emphasize technological advances.
- There should be more courses on integrating technology in education in special education teacher training programs.
- Similar studies with qualitative or experimental research design might be carried out to provide a deeper understanding for what factors are associated with TPACK levels of special education teachers.
- Seminars, conferences and in-service training programs should be organized for special education teachers to use technology more frequently and effectively in special education.

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