The Role of Technological Pedagogical Content Knowledge (TPACK) of English Teachers on High School Learners' Acceptance of Mobile Learning Tools

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Abstract
Educational technology is benefitted in diverse areas of education and mobile learning tools are one of the components of educational technology. Therefore, using technology in accordance with content and pedagogy has become more important. It is also important for teachers to know how to integrate technology into the learning and teaching process using appropriate methods and techniques. The aim of this study is to understand how students perceive technological pedagogical content knowledge (TPACK) of teachers and adaptation of mobile learning tools by students. This research was designed as a quantitative study and survey methodology was used to collect data from 352 high school students during the spring term in 2018. Participants were identified using convenience sampling method and only one state school with all students was included in the study. Two scales were used to collect the data: TPACK scale developed by Tseng (314-315) and Mobile Learning Tools Acceptance Scale (MLTAS) developed by Özer and Kılıç (586). The results showed that high school students perceived the TPACK of EFL teachers positively with all subcategories. They were also found to have positive perceptions of mobile learning tools. The study concluded that the more knowledge students perceived, the more they accept mobile learning tools.
Keywords: TPACK, Mobile learning, Mobil Learning Tools Acceptance

Introduction

Recent developments in Information and Communication Technologies (ICT) have affected the expectations from today's teachers. Two key terms have become the focus of educational discussions due to these changes: Technological Pedagogical Content Knowledge (TPACK) and mobile learning (m-learning). It is expected from a teacher to make suitable connections among knowledge (content), how that knowledge is taught (pedagogy), and convenient tools to teach it (technology). The development of TPACK emerged and came to focus in educational discussion after 2005. Turkey remained back of these developments until 2010s. Then, TPACK Model gained importance in terms of educational approaches and curricula ("FATİH Projesi Öğretmen Eğitimi").

M-learning makes educational activities more flexible because there are not time or place restrictions in m-learning. Mobile tools such as laptops, mobile phones, smart phones, PDAs, MP3 players come along with m-learning.

M-learning has been also used in language teaching and learning process. Mobile Assisted Language Learning (MALL) is a term used to describe language learning or teaching with the help of m-learning tools (Miangah and Nezarat 313). With the changes in educational trends, which might be voluntary or compulsory due to pandemics, TPACK and m-learning studies have gained more importance. The implications of such studies can supply important hints for researchers, policy makers and teachers.

Literature Review

Until 1980s, content knowledge was one of the most important concept for a teacher to be qualified (Shulman 5). However; pedagogical knowledge gained importance in 1980s and both content and pedagogy started to be focused for meaningful learning (Feiman-Nemser and Buchman 258). Shulman emerged the concept of "pedagogical content knowledge" (PCK) combining the content knowledge (CK), one of the desired dimensions that teachers have to possess, with pedagogical knowledge (PK) (9). As technology developed, technological knowledge was also paid attention in addition to content and pedagogy knowledge. Koehler and Mishra added technology dimension to PCK concept and introduced "Technological Pedagogical Content Knowledge" (TPACK) ("What Happens" 132-134). The concept of TPACK asserted in Koehler and Mishra's work is outlined in Figure 1 ("What is" 63).
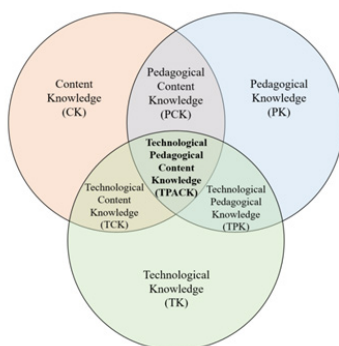

Figure 1 The Concept of TPACK (Koehler and Mishra, 63)

A teacher with TPACK knows how to use educational technologies in teaching, to solve

possible problems with specific technologies and how to organize the educational environment according to technology (Atasoy et al. 622).

English learning includes communicative skills and having linguistic knowledge may not be enough to use English practically. To improve English competence of the learners, teachers may utilize additional visual or audio tools and benefit from authentic materials (Liu et al. 683). Such materials can be supplied with the help of technology. Integration of technology into EFL context seems one of the basic demands of today's language education. There have been resources such as English podcasts, live sites, language learning applications, chatting rooms, social media, watching English movies and so on. As digitalization becomes more and more widespread, it is not an option but a necessity for teachers to integrate technology into classes in order to be effective (Mishra et al. 49).

As a result of the improvements in technology, mobile devices are getting more common. With the onset in 2000s, the studies that focus on m-learning has been conducted increasingly especially in many countries including Turkey (Çelik 172). There has not been a common definition of m-learning. According to Harris, m-learning is the intersection of e-learning and mobile computing learning without time and place restrictions. Kukulska-Hulme and Traxler define m-learning as learning through mobile technology that can increase access to training content with no bounds to time and place (27). Compared with traditional learning, distance learning and e-learning; m-learning takes the lead in terms of time and space flexibility as shown in Figure 2. (Akour 39).
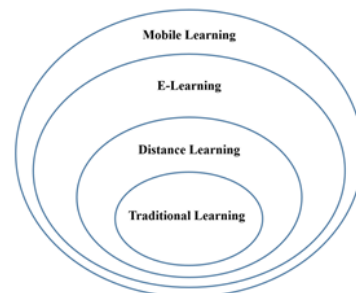

Figure 2 Learning Paradigms based on Time and Space Flexibility (Akour 39)

In Turkey, the Movement of Enhancing Opportunities and Improving Technology (FATIH) increased the Internet and mobile device (tablet PC) opportunities in schools ("FATİH Projesi"). Educational Informatics Network (EBA) and Dynamic Education (DynED) platforms are good examples of Turkey's big steps to integrate technology and m-learning in education. They enable students and teacher to access data at anywhere and anytime.

Technology acceptance means the adoption and use of a technology by a user to do a task (Teo "Development" 991). It has been a research topic since 1970s however; technology acceptance gained attention in 2000s in educational research field (Legris et al. 192; Teo "Unpacking" 128). In order to measure technology and m-learning tools acceptance, different scales have been developed by researchers (Hung et al. 1080; Pynoo et al. 568; Demir and Akpınar, 59; Uzunboylu and Özdamlı, 544; Özer and Kılıç, 577).

Studies on TPACK

Archambault and Crippen investigated the relationships between the seven dimensions of TPACK. The authors discovered that the highest scores were in PCK, PK, and CK showing that teachers were very confident in these fields. When paired with technology, teachers were found to be less confident. The results showed a low correlation between pedagogy and technology, technology and content and a high correlation between pedagogy and content (74-83).

Kurt conducted research based on Learning Approach with technological design, and TPACK. This study enlisted the participation of 22 Turkish EFL teacher candidates in order to look into their TPACK development. The implementation phase lasts 12 weeks. Comparing pre-test and post-test results, the researcher found that TPACK levels of the participants improved significantly due to the implementation. Furthermore, candidates are stated to bring their TPACK to the lessons and presentations they made (69, 187-190).

Cahyono et al. investigated how TPACK-oriented teaching practice courses helped Indonesian EFL teachers improve their EFL instructional teaching and design practices. 20 postgraduate students who were enrolled in the Teaching Practice course took a 16-session course Participants completed a questionnaire at the conclusion of the course in order to determine the effect of the course regarding improving their EFL teaching methods and instructional designs. The authors concluded that the TPACK-oriented teaching practice course provided several advantages to learners, and that teachers were able to effectively plan instructional designs and implement TPACK-oriented teaching practices (19-28).

Abbitt examined 45 teacher candidates' self-efficacy beliefs about technology integration and TPACK following the administration of a 16-week course. It was stated that there was a strong and positive correlation between the self-efficacy perception of technology integration and TPACK model. The findings stressed the impact of teacher candidates' perceptions of technology integration on TPACK potential areas (137-139).

Studies on M-Learning Tools

The impact of m-learning on EFL classes and learning process has been investigated by different scholars. It was concluded that EFL teaching and m-learning integration might provide significant developments and opportunities in pedagogical delivery (Tayebinik and Puteh 60). There have been many studies regarding m-learning tools.

Pettit and Kukulska-Hulme investigated participants' mobile device experiences as well as the personal reasons for using m-tools. The authors conducted a survey of 40 university students then semi-structured interviews were held. It was understood that students who had not previously used a mobile device with the same features perceived m-learning as disconcerting and considered it was better to begin m-learning with simpler devices (6-8). Corbell and Valdes-Corbell examined the educational value of cell phones in distance education regarding students and teachers' readiness for m-learning. A questionnaire was distributed to 107 undergraduate students and 30 lecturers. According to the findings of the study, both students and teachers utilized mobile phones in distance education (56-57).

Başoğlu and Akdemir aimed to understand the impact of cell phone vocabulary apps on undergraduate students. The authors used a mixed-method design with 60 students enrolled in the Undergraduate Compulsory Preparatory Program of a public university in Turkey. According to the findings, using cell phones as a vocabulary learning tool was much more beneficial than using conventional vocabulary learning tools (3-6). Similarly, Şad and Akdağ compared traditional written assignments to English performance assignments produced by cell phones. 112 students from Malatya Gazi Elementary School's 8th grade were chosen as the study group for this reason. According to the findings of the analyses, cell phones can be used even more effectively in the preparation of English performance tasks than conventional written performance assignments (726, 730-733).

According to the literature, there is a need to perform research on student-perceived TPACK of teachers because students' suggestions have been ignored in previous studies. Furthermore, while there have been several research studies on m-learning in terms of interpretation, readiness, and usage, researchers should also investigate m-learning tools and acceptance of them by students.

The Problem and Research Questions

There have been studies about pre-service or in-service English teachers' self reported TPACK (Angeli and Valanides 164) . Such studies are based on the self-reports by the teachers rather than what they genuinely have (Kaya and Kaya 130). The studies focusing on student-perceived TPACK of English teachers are not many (Tseng "Developing" 305). Students perceptions are important to understand whether teachers with TPACK can utilize that knowledge in the classroom or not.

Mobile technologies have been used by many universities with different purposes such as selecting courses, registration, management as well as sharing course tutorials. Such applications create the chance of being time and place independent. There have been studies about m-learning perception and readiness however; there is a discrepancy in literature and m-learning tools acceptance of students (Özer and Kılıç 581). The perception of students in terms of m-learning tools is important since student motivation may affect the success of educational activities directly. (Jovanović 6).

The goal of this study is to understand the role of student-perceived TPACK of English teachers on the acceptance of m-learning tools in language learning process. To realize this aim two research questions are asked:

1. What are the high school EFL learners' perceptions regarding English teachers' TPACK?
2. What is the role of English teachers' TPACK on the learners' acceptance of mobile learning tools?

Research Methodology
Research Design

This is a descriptive study that was designed in quantitative methodology using survey methodology for data collection. Objective and numerical data provide practicality to the researchers. It provides the researcher with systematic, precise measurement and produces reliable, replicable and generalizable data (Dörnyei, 34).

Participants and Setting

The present study employed convenience sampling. According to the information gathered from Muğla Provincial Directorate for National Education, there were 16 state and 6 private schools in the central district, Menteşe. The universe of the study was high school learners. One high school in the central district, namely Social Sciences High School was included in the study.

The number of active students was 361.There were 352 participants whose scales were properly filled to analyze. 249 female and 103 male students between 14-18 years old participated in the study. Students get twenty hours English class per week during the first year of school (preparatory class). In successive three years, they continue foreign language education with 4, 3 and 2 hours per week. There are interactive smart boards in each class but the students have not been distributed tablets in the scope of FATİH Project.

Data Collection

Data collection procedure was completed via two scales that were based on self-reports of the participants. The procedure and the aim of the study were explained to the participants and they were distributed parents approval forms to get back on the survey date.

Instruments

TPACK Scale developed by Tseng is a 5 point Liket-type scale that aims to examine EFL students' perceptions of teachers' TPACK. The scale was firstly developed in English with 35 items (305).The researcher had to adapt the survey as the participants are all non-native speakers of English. The adaptation process was completed in three phases: translation, administration, statistical phase. Validity and reliability of translated version of the scale were tested in another high school in Yatağan district. 34 items had acceptable item-total correlation score (r=.30). After Exploratory Factor Analysis there were 33 items that were adequately distributed to seven factors. Finally internal consistency of the scale was examined and total Cronbach's Alpha of the scale was .936.

Mobile Learning Tools Acceptance Scale (MLTAS) was developed by Özer and Kılıç in order to measure students' acceptance of m-learning tools. The scale was developed in Turkish as a 5 item Likert-type with 19 final items. Validity and reliability of the scale were ensured with data gathered from 407 EFL students from six universities in Turkey. MLTAS was validated in four dimensions: perceived ease of use, contribution to foreign language learning, negative perception and voluntariness of use. The total internal consistency reliability is .83 (589-587).

Data Analysis

SPSS program was used to analyze collected data. For the evaluation, descriptive statistical tools, sample t-test, one was analysis of variance (ANOVA) and multiple correlation analysis were utilized. The validity was assessed by the exploratory factor analysis and reliability was assessed by the Cronbach's alpha coefficient.

Results and Discussion

Student-perceived TPACK of English Teachers

High school students-perceived TPACK of English teachers were analyzed with descriptive statistics. Results are given in Table 1 and Table 2.

Table1 Descriptive Statistics for seven factors

Factor	Item number	Min - Max	$\bar{X}$	SS
TK (Technology Know.)	5	5 – 25	19.06	3.43
PK (Pedagogy Know.)	5	5 – 25	19.07	3.66
CK (Content now.)	3	3 – 15	12.77	1.79
TPK (Technology Pedagogy Know.)	5	5 – 25	18.69	3.94
TCK (Technology Content Know.)	5	5 – 25	18.28	4.59
PCK (Pedagogy Content Know.)	5	5 – 25	17.84	4.45
TPCK (Tech. Ped. Content Know.)	5	5 – 25	19.36	3.27

The results indicate that high school students-perceived teacher knowledge in all sub-scales of TPACK İS higher than the medium level.

Table 2 Descriptive Statistics of Items in TPACK

Item	SD		D		U		A		SA	
	f	%	f	%	f	%	f	%	f	%
1. TK1	1	0.3	13	3.7	51	14.5	149	42.3	138	39.2
2. TK2	6	1.7	19	5.4	55	15.6	176	50	96	27.3
3. TK3	8	2.3	56	15.9	78	22.2	157	44.6	53	15.1
4. TK4	22	6.2	56	15.9	99	28.1	148	42	27	7.7
5. TK5	2	0.6	12	3.4	41	11.6	176	50	121	34.4
6. PK1	4	1.1	9	2.6	9	2.6	188	53.4	142	40.3

7. PK2	1	0.3	9	2.6	16	4.5	176	50	150	42.6
8. PK3	17	4.8	68	19.3	133	37.8	88	25	46	13.1
9. PK4	18	5.1	83	23.6	73	20.7	118	33.5	60	17
10. PK5	10	2.8	18	5.1	55	15.6	185	52.6	84	23.9
11. CK1	1	0.3	1	0.3	10	2.8	205	58.2	135	38.4
12. CK2	2	0.6	2	0.6	47	13.4	175	49.7	126	35.8
13. CK5	2	0.6	5	1.4	9	2.6	226	64.2	110	31.2
14. TPK1	5	1.4	18	5.1	43	12.2	189	53.7	97	27.6
15. TPK2	7	2.0	16	4.5	64	18.2	174	49.4	91	25.9
16. TPK3	12	3.4	65	18.5	102	29	138	39.2	35	9.9
17. TPK4	13	3.7	23	6.5	61	17.3	190	54	65	18.5
18. TPK5	7	2	19	5.4	128	36.4	134	38.1	64	18.2
19. TCK1	7	2	26	7.4	29	8.2	180	51.1	110	31.2
20.TCK2	12	3.4	42	11.9	33	9.4	183	52	82	23.3
21.TCK3	14	4	40	11.4	47	13.4	185	52.6	66	18.8
22.TCK4	17	4.8	56	15.9	59	16.8	156	44.3	64	18.2
23.TCK5	27	7.7	83	23.6	76	21.6	121	34.4	45	12.8
24.PCK1	17	4.8	37	10.5	107	30.4	135	38.4	56	15.9
25.PCK2	8	2.3	19	5.4	47	13.4	178	50.6	100	28.4
26.PCK3	18	5.1	34	9.7	35	9.9	147	41.8	118	33.5
27.PCK4	26	7.4	60	17	81	23	136	38.6	49	13.9
28.PCK5	34	9.7	81	23	84	23.9	111	31.5	42	11.9
29. TPCK1	5	1.4	23	6.5	52	14.8	151	42.9	121	34.4
30.TPCK2	10	2.8	73	20.7	112	31.8	112	31.8	45	12.8
31.TPCK3	6	1.7	18	5.1	43	12.2	188	53.4	97	27.6
32.TPCK4	18	5.1	33	9.4	35	9.9	148	42	118	33.5
33.TPCK5	2	0.6	12	3.4	41	11.6	177	50.3	120	34.1

Table 2 reveals that all items get the highest frequency for 'Agree' except for PK3 item which is "My teacher understands students' learning difficulties". The participants (37.8%) are undecided about this item. The analysis shows that students seem to have positive perception of English teachers' TK, PK, CK, TPK, TCK, PCK, and TPACK.

Table 3 Cronbach's Alpha Reliability Coefficient of TPACK

Factor	Item Number	α
TK (Technology Know.)	5	.81
PK (Pedagogy Know.)	5	.85
CK (Content Know.)	3	.92
TPK (Technology Pedagogy Know.)	5	.91
TCK (Technology Content Know.)	5	.92
PCK (Pedagogy Content Know.)	5	.88
TPCK (Tech. Ped. Content Know.)	5	.71
Whole scale – TPACK	33	.95

The reliability of all subscales and the whole TPACK scale is calculated via Cronbach's reliability analysis. Cronbach's alpha reliability coefficient (α) of TK was .81, of PK was .85, of CK was .92, of TPK was .91, of TCK was .92, of PCK was .88 and

of TPCK was .71. Reliability of the whole scale was .95. All the subscales and the whole scale are proved to be reliable as shown in Table 3.

The focus of the literature has been limited to teachers' self-reported TPACK and students' perception has been ignored (Tseng, 2016). The number of studies concerning learners' perceptions of teachers' TPACK are a few (Chang, Jang and Chen, 2015; Jang and Chen, 2010). That makes the present study unique to some extent.

Interpreting descriptive data, high school students perceived TPACK of EFL teachers positively for all items; except for the item PK3 "My teacher understands learning difficulties". Teachers should be careful about difficulties that students deal with while learning English. Individual differences, learning styles should be kept in mind by teachers.

It was found that EFL teachers' technological competencies (especially software knowledge and keeping up with new technologies) were perceived positively by their students. Common use of social media might result in this situation. English teachers seemed to have basic hardware and software knowledge. Furthermore; they seemed to achieve good impression on the students in term of the use of social media or new technological devices.

In this study CK had the subscale with the lowest mean; on the other hand, Tseng collected data from 252 Taiwan students and concluded that students perceived their teachers CK a little more strongly than their TPACK ("Investigating"382). Furthermore; in the research study by Chai et al. CK was rated highest and TPACK was rated lowest by the teachers (662).

Analyzing student perceived knowledge of English teachers in Taiwan, Chuang et al. showed students' perceptions of teachers' technology knowledge and knowledge of students' understanding directly affected TPACK. Subject matter knowledge (SMK) and knowledge of students' understanding (KSU) were indirectly related to TPACK (202).

The Role of TPACK on Mobile Learning Acceptance

Table 4 Students' MLTAS level

Factor	Item number	Min - Max	$\bar{x}$	SS
Perceived ease of use (PEtoU)	4	4 - 20	15.44	2.67
Cont. to Foreign Lang. (CtoFLL)	5	5 - 25	18.18	3.37
Negative Perception (NP)	5	5 – 25	10.43	4.15
Voluntariness to use (VtoU)	5	5 – 25	18.89	3.61
Total Score of MLTAS	19	19 - 95	72.15	12.28

High school students' mobile learning tool acceptance level was higher than medium level ($\bar{x}$ = 72.15, SS= 12.28), perceived ease of use level wass higher than medium level ($\bar{x}$ = 15.44, SS= 2.67), contribution to foreign language learning level wass higher than medium level ($\bar{x}$ = 18.18, SS= 3.37), negative perception level was lower than medium level ($\bar{x}$ = 10.43, SS= 4.15) and voluntariness to use level was higher than medium level ($\bar{x}$= 18.89, SS= 3.61).

Table 5 Correlation Among Sub-scales of TPACK and of MLATS

Factors	2	3	4	5	6	7	8	9	10	11
1.TK	.546**	.364**	.591**	.490**	.428**	.755**	.714**	.610**	-.578**	.616**
2. PK	-	.587**	.535**	.411**	.423**	.596**	.543**	.483**	-.456**	.510**
3.CK		-	.498**	.333**	.285**	.491**	.414**	.366**	-.299**	387**
4.TPK			-	.651**	.492**	.753**	.685**	.637**	-.604**	.658**
5.TCK				-	.591**	.646**	.617**	.561**	-.526**	.583**
6.PCK					-	.665**	.635**	.548**	-.495**	.594**
7.TPCK						-	.893**	.791**	-.665**	.842**

8.MLTAS_PEoU								-	.749**	-.751**	.813**
9.MLTAS_Cto-FLL									-	-.609**	.846**
10.MLTAS_NP										-	-.643**
11.MLTAS_VtoU											-

Multiple correlation analysis was employed to understand the role of perceived TPACK on m-learning acceptance of students. Results were presented in Table 5. It was found that all 55 pairwise correlations were statistically significant.

Examining the findings, it can be stated that the higher knowledge the students perceive, the higher they have perceived ease of use, belief in contribution to foreign language learning and voluntary to use of mobile tools. Furthermore; the higher knowledge the students perceive, the lower they have negative perception regarding m-learning tools.

The findings have shown the importance of how students' perceive their teachers' knowledge. Based on the results, TPACK of teachers and m-learning practices should be studied more since teachers' knowledge can directly or indirectly affect students' perceptions and adoption of m-learning (tools) acceptance. Similarly, Angeli and Valanides argued that if teachers learned how to make good use of information and communication technology, they were more likely to create better learning environments for students (166).

Kukulska-Hulme et al. also stressed that students needed teacher guidance to utilize m-learning. It was therefore imperative for instructors to understand how to use mobile devices effectively in order to supplement their teaching, as well as student learning (16). Tai et al. argued the idea that prior to applying m-learning teachers must possess appropriate technological and pedagogical knowledge (787).

Hsu examined the effect of EFL teachers' TPACK on the adoption of mobile-assisted language learning. To get results, 158 in-service Taiwanese English teachers were surveyed. Even though the participants were teachers rather than students, the effect of TPACK on m-learning was examined. That is why the present study has basic similarity with that research. Similarly, the researcher found that TPACK

significantly affected the acceptance and adoption of technology in class. That is why the researcher ended up with the idea that EFL teachers'' TPACK affected their attitudes towards and adoption of MALL (1290, 1293).

Conclusion and Implications

High school students have positive perception of TPACK of English teachers for all subscales of TPACK scale. TPACK sub-scale has the highest mean while the lowest three means are found for TCK, PCK and CK. They have positive perceptions of m-learning tools. M-learning tools' contribution to foreign language learning is accepted by high school students. The role of student-perceived TPACK on students'' m-learning tools acceptance is shown in the findings. The stronger students perceive TPACK of English teachers, the more they accept m-learning tools in foreign language learning. Technological developments, m-learning opportunities should be taken into consideration by English teachers. More research studies should be conducted focusing on TPACK of teachers, m-learning, m-learning tools acceptance. Students' opinions and perceptions should be investigated more. Teachers should provide the students with guidance form-learning, mobile applications and mobile tools that can be beneficial for EFL learning. Learning styles, learning difficulties, personal differences among students should not be neglected. Teachers should be aware of the impact of their knowledge on students and they should update themselves continuously.

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