Turkish Adaptation of Technological Pedagogical Content Knowledge Survey for Elementary Teachers

Sibel KAYA[a]
Kocaeli University

Funda DAĞ[b]
Kocaeli University

Abstract

The purpose of this study was to adapt the Technological Pedagogical Content Knowledge (TPACK) Survey developed by Schmidt and colleagues into Turkish and investigate its factor structure through exploratory and confirmatory factor analysis. The participants were 352 elementary pre-service teachers from three large universities in northwestern Turkey. For statistical analyses SPSS and LISREL programs were used. Cronbach Alpha reliability coefficients of subscales ranged between 0.77 and 0.88. Exploratory factor analysis results showed that the factor structure of the Turkish version of the survey was similar with the original version. According to the confirmatory factor analysis results, the goodness of fit indices indicated a good model fit. Based on the results, it was concluded that the TPACK Survey is appropriate for Turkish culture.

Key Words

Technology, Pedagogy, Content Knowledge, Elementary Education, Factor Analysis, Adaptation.

The influence of technology on various fields has increased in recent years. In education, however, this influence is less pronounced (Oliver, 2002). The reasons were attributed to inadequate technological infrastructure of schools, low teacher motivation toward technology use and lack of technological knowledge (Cox, Preston, & Cox, 1999). However, even after the infrastructure was improved there are still problems in technology-instruction

a   **Sibel KAYA, Ph.D.,** is an assistant professor at the Department of Elementary Education. Her research interests include factors affecting elementary science achievement, constructivist science instruction in elementary schools and quantitative data analysis with SPSS and LISREL. *Correspondence*: Assist. Prof. Sibel KAYA, Kocaeli University, Faculty of Education Department of Elementary Education, 41380 Kocaeli/Turkey. E-mail: sibel.kaya@kocaeli.edu.tr Phone: +90 262 303 2454.

b   **Funda DAĞ, Ph.D.** Kocaeli University, Faculty of Education Department of Computer Education and Instructional Technology, 41380 Kocaeli/Turkey.

integration. The main reason might be that teachers are hesitant to use technologies due to lack of experience and knowledge; and most technological facilities are managed by information technology specialists at schools (Albion, 1999; Demetriadis et al., 2003; Gür, Özoğlu, & Başer, 2010; Hu, Clark, & Ma, 2003). In recent years, numerous studies have focused on how to improve teachers' knowledge and use of technologies in classrooms and how to develop successful technology-instruction integration (Gao, Choy, Wong, & Wu, 2009; Mishra & Koehler, 2006; Niess, 2005; Ottenbreit-Leftwich, Glazewski, Newby, & Ertmer, 2010; Sang, Valcke, van Braak, & Tondeur, 2010).

Based on Shulman's (1986) construct of Pedagogical Content Knowledge, a new model that integrates technology, pedagogy, and content, Technological Pedagogical Content Knowledge (TPACK) model was developed (Archambault & Crippen, 2009a; Chai, Koh, Tsai, & Tan, 2011; Koehler & Mishra, 2005, 2008, 2009; Lee & Tsai, 2010; Niess, 2005; Niess, Suharwoto, Lee, & Sadri, 2006). In this model, it was emphasized that teachers need not only pedagogical and content knowledge but also technological knowledge in

order to keep up with the technological developments in education (Mishra & Koehler, 2006). The TPACK is a model that integrates technology (computers, internet, digital video, etc.), pedagogy (teaching and learning methods and strategies) and content (subject matter) (Harris, Mishra, & Koehler, 2009). The TPACK model aims to help teachers to design and evaluate instruction that effectively combines pedagogical content knowledge and technology (Schmidt et al., 2009). Moreover, this model supports the use of technology in aiding learning difficulties and developing new knowledge by using previous and existing knowledge in students (Koehler & Mishra, 2009; Mishra & Koehler).

The TPACK model has three basic components: *(i)* Technology Knowledge (TK), *(ii)* Pedagogy Knowledge (PK), *(iii)* Content Knowledge (CK); from the combinations of these three, another three components are developed: *(iv)* Technological Content Knowledge (TCK), *(v)* Pedagogical Content Knowledge (PCK), and *(vi)* Technological Pedagogical Knowledge (TPK); and finally, the intersection of these six components creates *(vii)* Technological Pedagogical Content Knowledge (TPACK) (Koehler & Mishra, 2008).

The TPACK model provides a theoretical basis for using instructional technologies in teacher education programs (Angeli & Valanides, 2009). In order to measure in-service and pre-service teachers' understanding of the TPACK model, couple of surveys were developed. The participants of these survey studies were mostly American in-service and pre-service teachers (Archambault & Crippen, 2009b; Graham et al., 2009; Mishra & Koehler, 2006; Schmidt et al., 2009). Further validation of the TPACK model in other cultures is emphasized. There are some studies that tested the validity of the TPACK model developed by Schmidt et al. in other cultures including Turkey (e.g., Chai, Koh, & Tsai, 2010; Chai et al., 2011; Chueng & Ho, 2011; Kaya, Emre, & Kaya, 2010; Koh, Chai, & Tsai, 2010; Şahin, 2011). In another study, Timur and Taşar (2011) adapted the TPACK-Science survey developed by Graham et al. (2009) into Turkish. Studies that used Turkish samples relied either on the exploratory factor analysis (EFA) or confirmatory factor analysis (CFA) results. The current study, however, aims to adapt the original TPACK survey developed by Schmidt et al. (2009) into Turkish and examine the factor structure through both EFA and CFA.

Method

Sample

The participants of this study were 352 elementary pre-service teachers (246 female and 106 male) with an average age of 21 (sd=1.85) from three large universities in northwestern Turkey including Kocaeli University, Marmara University, and Uludağ University. Data were collected during 2010-2011 school year by professors of elementary education at each university. Participants were enrolled in school experience and teaching practicum courses during the study.

Instrument

The Technological Pedagogical Content Knowledge (TPACK) Survey developed by Schmidt and colleagues (2009) was used in this study. This 46-item survey is scored as 'Strongly Disagree'=1, 'Disagree'=2, 'Neither Agree or Disagree'=3, 'Agree'=4, 'Strongly Agree'=5. There are not any negative statements in the survey. The survey has seven subscales, namely, Technology Knowledge (TK) (items 1-6), Content Knowledge (CK) (items 7-18), Pedagogy Knowledge (PK) (items 19-25), Pedagogical Content Knowledge (PCK) (items 26-29), Technological Content Knowledge (TCK) (items 30-33), Technological Pedagogical Knowledge (TPK) (items 34-39), and Technological Pedagogical Content Knowledge (TPACK) (items 40-46). Since this survey was developed for elementary teachers, under the Content Knowledge sub-scale, there are Mathematics, Social Studies, Science and Literacy dimensions. Therefore, there is a total of 10 dimensions in the survey and the CFA tested the 10-factor structure in this study. The total score available on the survey ranges between 46 and 230. Cronbach Alpha reliability coefficients are between 0.78 and 0.93 in the original survey (Schmidt et al.).

The TPACK survey is available on the web for researchers (TPACK, 2011). With the permission of the authors, the original survey was translated into Turkish by three language specialists. Later, two Turkish language specialists examined the survey grammatically and the necessary changes were made.

Data Analysis

The construct validity of the TPACK Survey was tested through EFA and CFA. Cronbach Alpha reliability coefficients of subscales were reported. Item total correlations were computed for item

discrimination. For statistical analyses SPSS 15 and LISREL 8.7 programs were used. In order to test the sampling adequacy, Kaiser-Meyer-Olkin (KMO) and Bartlett sphericity tests were conducted. KMO test index was 0.91. A value close to 1 indicates the appropriateness of the sample for factor analysis (Tavşancıl, 2005). Bartlett sphericity test yielded a Chi-square of 9157,67 ($p < 0.01$), thus the null hypothesis was rejected. A significant Bartlett sphericity test indicates that the data is adequate for factor analysis (Çokluk, Şekercioğlu, & Büyüköztürk, 2010).

Results

Exploratory Factor Analysis (EFA) Findings

According to the EFA results the Turkish version of the TPACK survey was explained by 10 factors as in the original version (Schmidt et al., 2009). These 10 factors explained approximately 66% of the total variance. Considering the percent of explained variance ranging between 40% and 60% is accepted as adequate in social sciences (Tavşancıl, 2005) the current model was successful in explaining the variance.

Factor loadings were between 0.673 and 0.804 for TK, 0.826 and 0.844 for Mathematics, 0.779 and 0.848 for Social Studies, 0.729 and 0.866 for Science, 0.769 and 0.865 for Literacy, 0.463 and 0.831 for PK, 0.501 and 0.832 for PCK, 0.522 and 0.641 for TCK, 0.462 and 0.732 TPK, and 0.485 and 0.765 for TPACK. Cronbach Alpha reliability coefficients were above 0.7 for all of the 10 sub-scales (see Table 1). Corrected item total correlations were above 0.3; thus, in general, survey items were reliable and have good discrimination (Büyüköztürk, 2010)

Confirmatory Factor Analysis (CFA) Findings

The 10-factor model for the TPACK proposed by Schmidt et al. (2009) was tested by CFA using Lirsel 8.7. First-order CFA was used in the current study in which each observed variable directly measures the latent variables (Çokluk et al., 2010). For model fit, χ2/df (Chi-Square/Degrees of Freedom), CFI (Comparative Fit Index), NNFI (Non-Normed Fit Index), RMR (Root Mean Square Residual), RMSEA (Root Mean Square Error of Approximation) indices were examined. Goodness of fit indices were reported as χ^2/df= 2.37 (p<0.001), CFI= 0.96, NNFI=0.96, RMR=0.057, RMSEA=0.064. When goodness of fit indices are examined for a model fit in CFA, a χ²/df value below 3 indicates a perfect

model (Kline, 2005; Sümer, 2000), CFI and NNFI values above 0.90 (Sümer; Tabachnick & Fidell, 2001), RMR values below 0.08 (Brown, 2006), and RMSEA values below 0.08 shows a good fit for the model (Joreskog & Sorbom, 1993).

After the modification indices were examined, two modifications suggested significant contribution to χ². Therefore, error covariances were added between items 34 and 35 and items 19 and 20. Goodness of fit indices for the final model were χ^2/df= 2.20 (p<0.001), CFI= 0.97, NNFI=0.96, RMR=0.055, RMSEA=0.059. These indices indicated a good fit for the model.

In order to determine the associations among the survey sub-scales, correlational analysis was conducted and Pearson correlation coefficients as well as the descriptive statistics were reported. In general, there were moderate positive correlations among the sub-scales. In other words, as individuals' scores on a scale increase, scores on the other scales tend to increase. Among the correlation coefficients, those between PK and PCK (0.67), PK and TPK (0.71), PK and TPCK (0.65), PCK and TCK (0.74), PCK and TPK (0.70), PCK and TPACK (0.76), TCK and TPK (0.72) and finally, TPK and TPACK (0.82) were significant at p=0.05 level.

Conclusion and Recommendations

The purpose of this study was to adapt the Technological Pedagogical Content Knowledge (TPACK) Survey developed by Schmidt et al. (2009) into Turkish and investigate its factor sctructure through exploratory and confirmatory factor analysis. The participants were 352 elementary preservice teachers from three large universities in Northwestern Turkey. EFA results showed that the factor structure of the Turkish version of the survey was similar with the original version. According to the CFA results, the goodness of fit indices indicated a good fit. Based on the results, it was concluded that the TPACK Survey is appropriate for Turkish culture.

Teaching models based on TPACK provides inservice and pre-service teachers not only with technological skills, but also different point of views in their pedagogical and content applications in their classrooms (Tee & Lee, 2011). There are number of successful programs developed in recent years (e.g. Allan, Erickson, Brookhouse, & Johnson, 2010; Doukakis, Koilias, & Chionidou-Moskofoglou, 2011; Polly, 2011; Tee & Lee). Therefore, pre-

service and in-service training programs might consider integrating technology, pedagogy, and content in their curricula. Furthermore, the longitudinal effects of such programs on knowledge and skills might be investigated.

Recent research found significant relationships between teachers' demographics and their TPACK level (Lee & Tsai, 2010; Niess et al., 2006) and their self-confidence in technology, pedagogy, and content (Lee & Tsai). For instance, Niess et al. reported that novice teachers with less pedagogical knowledge had difficulties in integrating technology, pedagogy, and content. Similarly, Lee and Tsai found that inexperienced teachers can not differentiate between PK and PCK. Therefore, future studies might focus on teacher characteristics in relation to TPACK and the development of TPACK in Turkey and other cultures.

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