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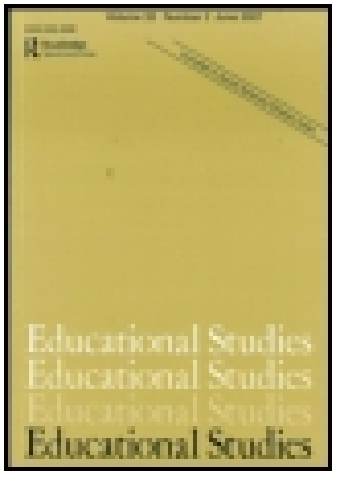


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# Effects of creating digital stories on foreign language education pre-service teachers' TPACK self-confidence

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This study aimed to examine the effects of creating digital stories (DSs) on the self-confidence of foreign language education (FLE) pre-service teachers with regard to technological, pedagogical and content knowledge (TPACK). A one-group pretest/posttest experimental research design was applied, supported by a qualitative approach. A total of 71 FLE pre-service teachers created DSs on a topic from the national foreign language programme. Data were collected through a self-confidence TPACK scale, demographic questionnaire, open-ended question and observations. Results showed positive significant differences between TPACK self-confidence scores before and after DS creation. Specifically, scores on technological pedagogical knowledge and technological knowledge improved significantly. The mean scores of technological content knowledge also improved, but the change was not significant. Moreover, qualitative data showed that FLE pre-service teachers used TPACK-relevant adjectives to describe their DSs as instructive, consistent with aims, appropriate for target students, thought provoking and creative.

**Keywords:** TPACK; digital stories; self-confidence; foreign language education (FLE); pre-service teachers

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## Introduction

As technology has been disseminated throughout every aspect of modern society, having members who are able to use it well has become compulsory. Some researchers (Albion 2009; Baek 2009) have suggested that self-regulated, highly interactive, media-rich environments such as YouTube and iTunes have changed the student profile in schools, and teachers must use new and relevant instructional strategies. Malita and Martin (2010) have named today's students the "Net generation." Similarly, Ng (2012) calls them "digital natives," while Bennett, Maton, and Kervin (2008) and (Prensky 2001) have both asserted that these terms describe a generation familiar with and dependent on information communication technology. Although Bennett, Maton, and Kervin (2008) have proposed a literature that encompasses different views about digital natives' technological skills, they have clearly stated that most young people are interested in technology. Whatever the reason for the change, a consensus has arisen in the literature that new members of society should have the skills to use technology effectively for information seeking and learning activities.

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For that reason, schools have the responsibility to provide education about technology use (Kersaint et al. 2003). The charge of this responsibility falls primarily on teachers (Akpınar 2005), the driving force of reaching goals within educational systems. The literature has focused on teachers' and pre-service teachers' competencies with regard to technology use and integration into instructional activities. One framework for assessing these competencies, technological, pedagogical, content knowledge (TPACK), has made a significant impact on educational technology. According to Cox and Graham (2009) and Bos (2011), this framework has earned considerable interest in recent years. One way to enhance teachers' and pre-service teachers' TPACK is by providing opportunities to create digital stories (Robin 2008; Sancar-Tokmak, Sürmeli, and Ozgelen 2014; Yuksel-Arslan 2013).

This study aimed to investigate the effects of creating digital stories (DSs) on the self-confidence of foreign language education (FLE) pre-service teachers with respect to TPACK. Two research questions guided the study:

(1) Is there any significant difference between FLE pre-service teachers' TPACK self-confidence before and after the course?
(2) How do the pre-service teachers describe their TPACK self-confidence while evaluating their DSs?

### *The theoretical framework of study: TPACK and the DS creation process*

TPACK is a framework by Mishra and Koehler (2006) extending upon Shulman's (1986) pedagogical content knowledge (PCK). Shulman (1986) described PCK as "the blending of content and pedagogy into an understanding of how particular topics, problems, or issues are organised, represented, and adapted to the diverse interests and abilities of learners, and presented for instruction" (8). Descriptions of TPACK have been summarised by Niess et al. (2009) as "a body of knowledge teachers needed for teaching with and about technology in their assigned subject areas and grade levels" (7). Moreover, Thompson and Mishra (2007–08) have advocated that the TPACK acronym should be used for TPACK since it means "TotalPACKage: the knowledge that lies at the intersection of knowledge of Content, Pedagogy And Technology i.e., TPACK" (38). In other words, TPACK includes three kinds of knowledge as well as the intersections of each pair, focusing on teachers' skills and knowledge about technology integration (Mishra and Koehler 2006; Niess et al. 2009).

The TPACK framework has seven components (Mishra and Koehler 2006; Ozgun-Koca, Meagher, and Edwards 2010; Schmidt et al. 2009): content knowledge (CK), pedagogical knowledge (PK), technological knowledge (TK), PCK, technological content knowledge (TCK), technological pedagogical knowledge (TPK) and TPACK, as shown in Figure 1.

Chai et al. (2011) explained these components by combining Cox and Graham (2009), Mishra and Koehler (2006), and Shulman (1986) as follows:

(1) TK – knowledge of how to operate computers and relevant software.
(2) PK – knowledge of how to plan instruction, deliver lessons, manage students and address individual differences.
(3) CK – subject matter knowledge such as knowledge about languages, Mathematics and Sciences.

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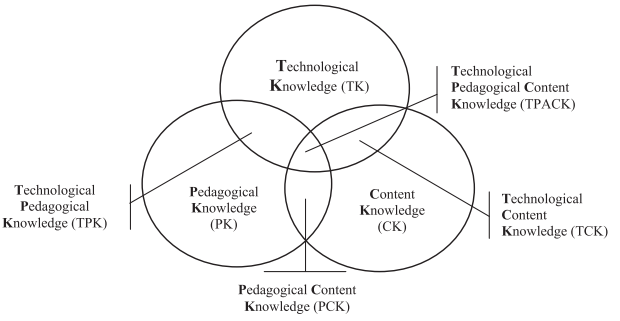


Figure 1. Schematic view of TPACK (Mishra and Koehler 2006).

(4) TCK – knowledge of how content can be researched or represented by technology such as using computer simulation to represent and study movement of the earth crust.
(5) PCK – knowledge of "the ways of representing and formulating the subject that make it comprehensible to others" (Shulman 1986, 9).
(6) TPK – knowledge of how technology can facilitate pedagogical approaches such as using asynchronous discussion forum to support social construction of knowledge.
(7) TPACK – knowledge of facilitating students' learning of a specific content through appropriate pedagogy and technology. (1185)

Graham (2011) has advocated that TPACK has the potential to provide a theoretical background for teacher education programmes aiming to help students develop technology integration skills. One way to provide pre-service teachers practice with such skills is the digital storytelling creation process. Yuksel-Arslan (2013)

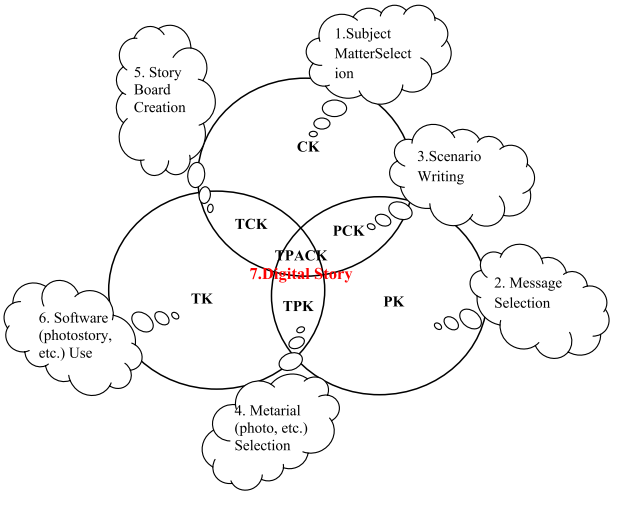


Figure 2. The place of the steps of creating DSs on the TPACK components (Yuksel-Arslan 2013, 113).

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explained the relationship between TPACK and each step of the digital storytelling process (shown in Figure 2):

(1) Subject matter selection: Subject matter selection from the curriculum for creating digital storytelling is related to the CK components of TPACK. The starting point of the digital storytelling process is to decide two things: (a) What is the story about and (b) who is the target audience (for whom the digital story is created)? For deciding this issue, the story teller should know the subject matter well.
(2) Message Selection: An appropriate message selection for students' level is related to the PK components of TPACK. The knowledge of teaching methods and the cognitive–affective–social development of target students are under the scope of PK. In digital storytelling creation, a teacher should select appropriate messages by taking into account students' cognitive–affective–social development and which teaching methods should be used.
(3) Scenario Writing: PCK includes knowledge about teaching methods applied to teach a specific field, such as art, literacy, science, math and music. The storyteller forms the scenario in line with the selected topic (subject matter, for example, problems in math or the cell in science) and target students' level. Economy is the key criteria in this step. Stories should have many details.
(4) Material Selection: This step included the selection of visual and audio materials in line with the scenario and target student level. The storyteller used TPK in this step, since TPK is knowledge about how the technology affects/supports the selected pedagogy. The storyteller uses the technology for selecting or creating the visual and audio materials used in DSs to support the pedagogy.
(5) Story Board Creation: The storyteller created a story board using TCK, which is about how content can be represented by technology. During the creation of the story board, the storyteller tried to organise how visual and audio materials used in DSs can be matched with a scenario by focusing on the keywords in the scenario about specific content.
(6) Software Use: Up to this step, the storyteller prepared the scenario and materials and decided the pace of the narrative. In this step, the only thing to do is to use software (for example, Movie Maker and PhotoStory) to create digital storytelling.
(7) Digital Story: The whole process is called digital story creation and requires that the storyteller uses TPACK. This process combined PK, CK and TK to create a digital story about a specific content and in line with student level and planned pedagogy. (114)

Robin (2008) has also advocated combining the digital storytelling process with TPACK, since it may cause deeper understanding of digital media's role in teaching and learning. Robin has offered three ways to use digital storytelling in education: (a) use of previously created stories, (b) creation of new, content specific stories and (c) creation of stories by students. The first two are primarily related to media's role in teaching, while the third is related to media's role in both teaching and learning.

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## Method

This experimental research study featured a one-group pretest/posttest design investigating the effect of creating DSs on FLE pre-service teachers' self-confidence related to TPACK. Data were collected before and after the DS creation process through a TPACK self-confidence scale developed by Graham et al. (2009). According to Marlow (2011), this design is used to understand "not only how well participants are functioning at the end of the programme, and minimum standards of outcome are being achieved, but also how much participants change during their participation in the programme" (96). In experimental research, the effect of a particular, independent variable on another, dependent variable is investigated (Fraenkel and Wallen 2000). In the current study, FLE pre-service teachers' self-confidence with regard to TPACK was used as the dependent variable, while the pre-service teachers' creation of the DSs on a specific topic from the national curriculum was the independent variable. The study was also supported with qualitative data collected through an open-ended questionnaire and observations.

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### *Participants*

The participants of the study consisted of 71 FLE pre-service teachers enrolled in a Computer II course. While 44 participants were female, 27 were male. The participants' ages ranged from 19 to 35, with a mean of 21.26 years. A convenience sampling strategy was applied to define participants, since all participants were enrolled in the same course. No participants had created DSs before or attended a course with assignments to create digital materials for educational purposes.

### *Context*

The Computer II course is a three-credit course offered by the Instructional Technology department to all undergraduate students in the Faculty of Education at a university in Turkey. The course content includes basic knowledge about the evolution of computers and their components, methods of data presentation and the use of office programmes. The main purpose of this course is to give undergraduate pre-service teachers experience with technologies, preparing them to use computer-based information in their future careers. The course meets in a computer laboratory with an Internet connection and 15 computers in a classroom style configuration: participants sit behind a row of desks or tables and face an instructor table. The laboratory also has a projector.

### *Instruments*

Four instruments were used to collect data: (a) a demographic questionnaire presented at the beginning, (b) the TPACK self-confidence scale conducted at the beginning and end, (c) an open-ended question asked at the end, and (d) an observation form utilised throughout the study.

#### *Demographics questionnaire*

This questionnaire was developed by the researcher and checked by two experts in order to collect data on the FLE pre-service teachers' demographics. The

questionnaire focused on gender, age, programme type enrolled in and whether the participant had previously created digital materials or attended a course including digital materials.

*The TPACK self-confidence scale*

The Turkish version of the TPACK self-confidence scale adapted by Timur and Taşar (2011) from Graham et al. (2009) was applied in the study. The scale consists of 31 items and 4 subscales: TPACK, TPK, TCK and TK (see Table 1). The maximum score is 155, with a minimum of 26.

All 31 items are positively worded in the TPACK self-confidence scale, which applies a 5-point Likert rating (5 = strongly agree, 1 = strongly disagree); items 16–20 also included 0 = I do not know these kinds of technologies. Cronbach's alpha coefficients for each subscale were found to be .95, .91, .97 and .92, respectively. The applied version of the instrument was translated and adapted by Timur and Taşar (2011) in a study applied to 393 science and technology teachers. Cronbach's alpha coefficients of the scale were found to be .92, and .89, .87, .89 and .86 for each subscale, respectively (Timur and Taşar 2011).

*Open-ended question*

One open-ended question was asked: Could you please describe your DSs using adjectives? The aim of this question was to learn satisfaction levels of the FLE pre-service teachers with their DSs. Moreover, results of this question also indicated the quality of the overall process.

*Observation form*

The observation form that was used by one of the researchers included two parts. The first part included the seven steps of creating a DS as described by Yuksel-Arslan (2013): subject matter selection, message selection, scenario writing, material selection, story board creation, software use and digital story. The second part featured a note-taking section related to the described DS creation steps.

***Procedure***

The study procedure included three parts. First, participants were asked to fill out a demographic questionnaire and a scale to determine their TPACK self-confidence. Next, FLE pre-service teachers created DSs related to a topic individually selected from the curriculum. The instructor assisted them by providing feedback and support

Table 1. Number of items and possible scores for each subscale of the TPACK scale.

| Subscale | Number of item | Possible minimum – maximum scores |
|---|---|---|
| TPACK | 8 | 8 – 40 |
| TPK | 7 | 7 – 35 |
| TCK | 5 | 0 – 25 |
| TK | 11 | 11 – 55 |

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during the creation process. While creating DSs, observations were noted. Finally, the FLE pre-service teachers were given the TPACK self-confidence scale again and asked an open-ended question to investigate their confidence changes.

### *The intervention (digital story creation)*

The current study was conducted over one semester (16 weeks) in the Computer II course offered to Foreign Language Education Department pre-service teachers in their first year at a university in Turkey. During the digital storytelling process, the instructor played the role of guide and coach. She separated the process into five main steps, as suggested by Yuksel-Arslan (2013): (1) defining the starting point of the story, (2) creating the scenario, (3) selecting the visual and audio materials (design and preparation), (4) creating the DSs by combining visual and audio materials and (5) presenting the DSs. The intervention with regard to the steps of this process and an explanation of the activities for each week is shown in Table 2.

The intervention started with an activity for FLE pre-service teachers to select a topic from the national foreign language programme. This activity aimed to explain the programme in terms of topic, behavioural objectives and learning philosophy. The pre-service teachers prepared a report related to the topic, including all possible behavioural objectives and those selected for the focus of the DSs. Moreover, participants identified their target students' level in the report, which was due during the second week. Then, the intervention included activities in which the FLE pre-service teachers were encouraged to create stories that they submitted to the instructor via email. During this step, from the third to the seventh week, participants shared their stories in class and received feedback from their friends. Next, from the eighth to the tenth week, the FLE pre-service teachers created or selected visual or audio materials for their DSs, preparing a PowerPoint storyboard to demonstrate those components and submitting it to the instructor via email. Weeks 11–13 were spent creating the DSs, followed by two weeks of presentations. During the creation process, the instructor taught students how to use the PhotoStory 3 program. The instructor applied the DS process created by Yuksel-Arslan (2013) and focused on the skills of adding or changing visuals, adding or changing the speed of audio and vocalising the story. Moreover, the instructor encouraged the FLE pre-service teachers to discuss what criteria deserved attention while selecting visuals (e.g. suitability of visuals to story, target students, clarity), vocalising the story (e.g. speed, grammar) and setting audio (e.g. suitability to scenario, volume). The FLE pre-service teachers created their DSs by combining visuals and audio in PhotoStory 3. Participants then shared their DSs in class and provided feedback, discussing how DSs could be incorporated during instruction in their own classrooms. The instructor provided feedback to the FLE pre-service teachers during and regarding all steps of the process.

### *Data analysis*

The data collected from the demographic questionnaire and two applications of the TPACK self-confidence scale were analysed using SPSS 17.0. The data were entered, and each FLE pre-service teacher's scores for the TPACK self-confidence scale and its subscales, TPACK–TPK–TCK–TK, were calculated and compared by employing a repeated samples *t*-test. Moreover, the practical value of the results was

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Table 2. The steps of intervention applied during the study.

| Sessions | Steps of intervention | Explanation of activities with regard to steps of digital storytelling |
|---|---|---|
| Week 1 | Course description | The course aim, expectations grading policy were presented to the FLE pre-service teachers |
| | Application of TPACK self-confidence scale, and demographic questionnaire | Volunteer FLE pre-service teachers filled the instruments instructor distributed |
| Week 2 | Starting point of the story<br>Observation notes were taken | A topic from national foreign language programme was selected by FLE pre-service teachers. The target students' needs were defined |
| Week 3,4,5,6,7 | Creating the scenario<br>Observation notes were taken | According to the topic and target students' needs, the scenario was created. During the scenario creation process, the FLE pre-service teachers shared their scenarios in class and got feedback from both class friends and instructor<br>Moreover, all FLE pre-service teachers sent their stories to instructor via email |
| Week 8, 9,10 | Selecting the visual and audial materials (design and preparation)<br>Observation notes were taken | The pre-service teachers selected or created visual or audio materials for their stories in accordance with the key points in the stories. During this step, the FLE pre-service teachers prepared storyboard including visuals through PowerPoints. They shared their storyboards in class and took feedbacks from both friends and instructor<br>Moreover, all FLE pre-service teachers sent their storyboards to instructor via email |
| Week 11,12,13 | Creating digital stories<br>Observation notes were taken | The pre-service teachers were instructed on the use of Microsoft PhotoStory 3 program to create their digital stories. During this process, they created digital stories as well<br>Moreover, all FLE pre-service teachers sent their digital stories to instructor via email |
| Week 14, 15 | Presentation of digital stories<br>Observation notes were taken | The FLE pre-service teachers who wanted to present their digital stories, presented them in class. They shared their storyboards in class and took feedbacks from both friends and instructor. Moreover, they discussed how the presented digital stories could be used during instruction |
| Week 16 | Application of TPACK self-confidence scale, open-ended question and demographic questionnaire | The FLE pre-service teachers' opinions were taken<br>Volunteer FLE pre-service teachers filled the instruments instructor distributed |

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calculated through the eta-squared statistic, in which the values are interpreted as .01 = small effect, .06 = moderate effect and .14 = large effect (Cohen 1988, 284–287). Demographic data were analysed through descriptive statistics using mean and standard deviation scores.

All adjectives used by the FLE pre-service teachers when answering the open-ended question were categorised under themes according to their similarities. Restated adjectives were counted as well; they represent the frequency. The data were coded by the researcher and a colleague. The observation notes were analysed through open coding by one researcher. Significant events were defined and themes were formed. All data and analysis were controlled via audit by an external expert.

### *Validity and reliability*

Threats to the one-group pretest/posttest design have been identified by Fraenkel and Wallen (2000) as mortality, location, instrument decay, data collector characteristics, testing (instrument implementation), statistical regression, attitude of the subjects and implementation. Mortality was not a threat for this study since the participants were volunteers, and no one dropped the course or left from the study. The second threat is related to location change. The entire experiment was conducted in the same computer laboratory, so location was not a threat, either. The third threat is related to validity of the instrument because of changes in standards of measurement. Instrument decay was not a problem in this study, as the original instrument was recently developed in 2009 by Graham et al. and adapted into Turkish by Timur and Taşar in 2011. The fourth threat is related to changes or biases of the data collector. Throughout the study, the data collector did not change, and moreover, the researchers discussed the ideas, problems and applications related to the intervention with an external colleague. The fifth threat is related to the pretest's effect on the posttest. Since the time between the pretest and posttest was 16 weeks, there was no validation problem in this study. The sixth threat is related to selecting participants according to extreme pretest scores. Since the participants were not selected based on pretest scores, this threat did not apply to the study. The seventh threat is related to a change in participants' attitudes, which did not affect the study since all participants received the same instruction. The eighth threat is related to a difference in instructors, which can affect implementation. Since the instructor and implementation were the same throughout the study, this threat was also avoided.

The open-ended question was checked by an expert, and the results were analysed by the researcher and a colleague to provide inter-rater reliability. Inter-rater reliability was assessed using Miles and Huberman's (1994) formula and found to be .78. Moreover, the data were triangulated by applying different collection methods: observation, an open-ended question and the TPACK self-confidence scale. The results collected through the different instruments were compared and validated. Moreover, expert opinion was taken throughout the data analysis and interpretation.

### *Ethical issues*

It was an experimental study in which no ethical issues related to potential harm to the participants, especially with regard to physical, sociological or psychological interventions arose. The participants do not meet any harm because the followed instruction included the participants create DSs on the selected subject matters.

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Since one of the authors was both the researcher and instructor of the study, the participants were assigned pseudonyms during the study to promote freedom of expression. Moreover, they used nicknames while filling the instruments, and the data were analysed after the course ended.

## Results

The results consist of the analysis of the data collected through the TPACK self-confidence scale, open-ended question and observations. For analysis of the TPACK confidence scale, three procedures were applied. First, data were cleaned and missing cases were checked. Then, the normality of the data was controlled. Finally, a paired *t*-test, an inferential statistic, was performed. The TPACK confidence scale has four constructs that involve technology – TK, TPK, TCK and TPACK. To analyse which constructs related to the participants' TPACK confidence improved, a paired *t*-test was conducted for each.

On the pretest, the FLE pre-service teachers scored a minimum of 58.63 and a maximum of 145 with a mean of 106.56 and standard deviation of 2.41. The mean and standard deviation for each construct were calculated to determine the FLE pre-service teachers' TPACK self-confidence (see Table 3).

The FLE pre-service teachers' mean score was 106.56, above the mean of scale (93), so self-confidence about TPACK was high. Moreover, the FLE pre-service teachers' demonstrated high self-confidence for all constructs of the scale on the pretest: TPACK construct (26.12; mean of scale, 24), TPK (24.36; mean of scale, 21), TCK (16.17; mean of scale, 15) and TK (39.51; mean of scale, 33).

On the posttest, the mean of the FLE pre-service teachers' self-confidence scores was 119.62 with 2.11 SD. The minimum confidence score was 79, while the maximum was 155. Additional mean scores from the posttest were 30.15 for TPACK construct, 27.57 for TPK, 17.73 for TCK and 44.17 for TK (see Table 4).

A paired-samples *t*-test was conducted to examine the FLE pre-service teachers' TPACK self-confidence. Results showed a significant difference in the scores before ($M = 106.56$, $SD = 20.27$) and after ($M = 119.62$, $SD = 17.8$) creating DSs, $t(70) = -5.93$, $p = .000$. According to these results, after creating DSs, the FLE pre-service teachers' TPACK self-confidence increased. Moreover, the eta-squared statistic (.33) showed a large effect size (see Table 5).

As shown in Table 5, significant increases were found in confidence scores on the following constructs of the scale: TK, $t(70) = -4.87$, $p = .000$, with a large effect size (.25); TPK, $t(70) = -4.90$, $p = .000$, with a large effect size (.26); and TPACK, $t(70) = -4.82$, $p = .000$, with a large effect size (.25). However, the results also showed that confidence scores for the TCK construct did not increase significantly, $t(70) = -1.61$, $p = .111$, with a small effect size (.036).

Table 3. FLE pre-service teachers' pretest TPACK confidence scores.

| Scale and constructs | *N* | Minimum | Maximum | $\bar{X}$ | *S* |
|---|---|---|---|---|---|
| TK | 71 | 18.63 | 55 | 39.51 | 8.29 |
| TPK | | 11 | 33 | 24.36 | 5.31 |
| TCK | | 0 | 25 | 16.57 | 5.57 |
| TPACK | | 11 | 40 | 26.12 | 6.24 |
| Total scale | | 58.63 | 145 | 106.56 | 20.27 |

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Table 4. FLE pre-service teachers' posttest TPACK confidence scores.

| Scale and constructs | *N* | Minimum | Maximum | $\bar{X}$ | *S* |
|---|---|---|---|---|---|
| TK | 71 | 27 | 55 | 44.17 | 6.79 |
| TPK | | 9 | 35 | 27.57 | 4.93 |
| TCK | | 0 | 25 | 17.73 | 5.23 |
| TPACK | | 13 | 40 | 30.15 | 5.98 |
| Total scale | | 79 | 155 | 119.62 | 17.8 |

The FLE pre-service teachers were asked to describe their DSs using adjectives. According to the data analysis, six themes emerged: descriptions of DS properties, use as instructional material, the creation process, assessment of the final product, TPACK and description of characters. A total of 45 adjectives were cited 157 times by the FLE pre-service teachers (see Table 6).

Observation notes were also analysed throughout open coding. The codes merged in line with the observation form, as shown in Table 7.

As seen from Table 6, the FLE pre-service teachers mostly used positive adjectives when describing their DSs. The most cited adjectives were instructive, entertaining and comprehensible. The concept of instructive indicates that the activity considered all components of TPACK, which includes PK, CK and TK. Moreover, participants found that their DSs could entertain students during instruction and were comprehensible in terms of language. This finding is also related to PK since it means that the participants thought the DSs they created were suitable for the target group. Table 6 shows that the pre-service teachers mostly used adjectives related to the instructional material, assessment of their final product and TPACK themes. They listed adjectives related to the effort they invested and describing their stories and characters. The themes that emerged as a result of the observation notes (as seen Table 7) supported the notion that most FLE pre-service teachers carefully created stories according to appropriate student level, content, story coherence and use during instruction in line with TPACK components. Most of them were pleased with their DSs as an instructive material.

Under the instructional material theme, the used adjectives showed that the FLE pre-service teachers mostly focused on the aims of DSs during instruction and what FLE programme goals the DSs intended to reach. This finding was related to CK: participants took national FLE programme topics and aims into account during the DS creation process. The aim of the DSs was to give information or explain something about content (related to CK), attracting the students' attention (related to PK),

Table 5. *T*-test results of FLE pre-service teachers' TPACK confidence scores after creating DSs.

| | *T* | d*f* | Effect size |
|---|---|---|---|
| TK | −4.87 | 70 | .25 |
| TPK | −4.90 | 70 | .26 |
| TCK | −1.61 | 70 | .036 |
| TPACK | −4.82 | 70 | .25 |
| Total scale | 5.93 | 70 | .33 |

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Table 6. Themes based on adjectives used by FLE pre-service teachers to describe their DSs.

| Description of DSs properties | Instructional material | Creation process | Assessment of last product | Description of characters | TPACK |
|---|---|---|---|---|---|
| in terms of components<br>○ illustrated<br>○ voiced<br>○ colourful ($n = 4$) | • in terms of use aim<br>○ informational ($n = 2$)<br>○ attractive ($n = 10$)<br>○ entertaining ($n = 29$)<br>○ effective ($n = 4$)<br>○ efficient ($n = 3$)<br>○ making teaching easy<br>○ explanatory<br>• in terms of student<br>○ making student wonder (investigate) ($n = 4$)<br>○ thought provoking<br>○ surprised<br>○ audio visual educational aid | • Tiring<br>• Beneficial<br>• Permanent ($n = 6$)<br>• Creative | • in terms of language used<br>○ comprehensible ($n = 13$)<br>○ fluent ($n = 4$)<br>• in terms of economy<br>○ economic<br>○ short<br>• in terms of general properties<br>○ coherent ($n = 3$)<br>○ plain<br>• in terms of scoring<br>○ good ($n = 2$)<br>○ mediocre ($n = 2$)<br>○ sufficient<br>• in terms of story properties<br>○ realistic<br>○ mystical | • beautiful ($n = 6$)<br>• hardworking<br>• tidy<br>• ugly<br>• happy<br>• lovely<br>• friendly<br>• strange | • instructive ($n = 29$)<br>• educative 4<br>• appropriate the FLE programme aim ($n = 4$)<br>• appropriate the student level<br>• easy programme set up and use ($n = 2$) |

Table 7. Themes based on observation notes taken throughout DS creation.

| Steps of DS creation process | Themes emerged |
|---|---|
| Selecting a topic from FLE programme in curriculum | • Learning the programme<br>  ○ goals<br>  ○ objectives<br>  ○ student level<br>  ○ activity examples |
| Message selection | • Focus on one part of topic<br>  ○ accordance with FLE programme<br>  ○ accordance with the topic<br>  ○ accordance with student level<br>  ○ by thinking story |
| Scenario writing | • Difficult to create a story<br>  ○ Story coherence<br>  ○ Story suitability to goals<br>  ○ Story suitability to student level<br>  ○ Focusing on how to use during instruction<br>  ○ Attractiveness of story<br>• Language use |
| Material selection | • Selection of material type<br>• The quality of photos<br>• The appropriateness of photos<br>  ○ to student level<br>  ○ to content<br>• Appropriateness of background music to story |
| Story board creation | • Focusing on combination of story with materials<br>• Thinking about vocalisation |
| Software use | • Easy to set up and use of photoStory programme<br>• Problems to vocalising<br>  ○ vocalising according to story pace<br>  ○ vocalising according to characters |
| Digital story | • Evaluation of DSs<br>  ○ good enough to be used<br>  - appropriate to students<br>  - appropriate to content<br>  - appropriate the FLE programme<br>  ■ make student investigate, wonder, search<br>  ■ make knowledge permanent<br>  - attractive<br>  - creative<br>  - instructive<br>  - using it at the beginning of the lesson for taking attention of student<br>  ■ juice up lesson<br>  ■ content introduction<br>  ■ taking students attention<br>  - quality of audio and visuals<br>  - language use<br>  ○ effort spend<br>  - tiring<br>  - entertaining<br>  - creativeness<br>  ○ not good enough<br>  - quality of photos<br>  - vocalising |

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making the lesson more effective and efficient (related to TPACK since teaching supported by technology includes all components of knowledge) and providing a valuable tool for teaching (related to TPACK). The observation notes taken during the course supported these themes and sub-categories, indicating how the FLE pre-service teachers focused on how to integrate their DSs into instruction, which was related to TPACK. Most of them planned to use their DSs at the beginning of a teaching session to capture students' attention (related to PK), to introduce content (related to CK) or to give colour to the lesson (related to TPACK). Observation notes also showed that participants considered DSs to be beneficial for students by providing an opportunity to think, investigate, wonder and search for information. This result represents PCK, since all mentioned aims were related both to FLE national programme goals and the suitability of the created DSs for students' preparedness levels in line with national FLE programme. According to the FLE pre-service teachers, the visual and audio components of DSs make knowledge permanent for students. The adjectives used by FLE pre-service teachers to describe their DSs supported the observation notes, with a focus on provoking thought, making students wonder, feeling surprised and having both audio and visual components (related to PCK).

The adjectives under the assessment of the activity showed that FLE pre-service teachers were pleased with their last product, their stories, because they used adjectives such as comprehensible, fluent, economic (i.e. DSs have sufficient detail about content), coherent and plain. Moreover, the adjectives under the scoring sub-category – good and sufficient – supported the finding of the FLE students being pleased with their DSs. Observation notes showed that most of the FLE pre-service teachers found the DSs good enough to use as instructional materials related to TPACK. They invested true effort and had difficulty creating the DSs since it required applying CK, knowledge about curriculum, students' level, and students' interest (PK), knowledge about using the computer to arrange photos and vocalise a story (TK), and creativity. They pointed out that they learnt about content, curriculum (CK), how to search for information (TK), how to use the computer (TK), how to address details such as students' interest and development (PK) and how to use technology during instruction (TPACK). According to the observation notes, most of the FLE pre-service teachers had difficulty during the second step of the digital story creation process, namely creating the stories. The adjectives under the creation process and TPACK themes also support the observation notes in that the FLE pre-service teachers described the process as creative, tiring, beneficial and permanent. Also, the pre-service teachers used the following adjectives to refer to TPACK: instructive (TPACK), appropriate to the programme aim (CK), appropriate to the students' level (PK), easy to set up and use the software (TK).

Some FLE pre-service teachers described their DSs as illustrated, voiced and colourful. These adjectives are consistent with audio and visual educational aids under the "in terms of student" sub-category related to instructional material, and observation notes indicated that participants planned to use DSs to add excitement to lessons. Moreover, FLE pre-service teachers used the following adjectives to describe the characters in their DSs: tidy, beautiful, ugly, happy, friendly, strange and hardworking.

Shortly, the statistical results, the adjectives used by the FLE pre-service teachers to describe their DSs and the observation notes showed that participant TPACK confidence increased during the digital storytelling creation process. Moreover,

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statistical results showed that, except for the TCK construct, scores on all constructs (TK, TPK and TPACK) of TPACK increased. The observation notes and adjectives used to describe the DS process showed that the FLE pre-service teachers applied CK, TK and PK together and described the process as tiring, creative, permanent and beneficial. Analysis of qualitative data showed that during the digital story creation process, the FLE pre-service teachers focused on how to use them during teaching sessions (TPACK) and to meet learning goals (CK) and to attract students' attention (PK). The adjectives showed that the FLE pre-service teachers plan to use DSs to provide information or explain content, gaining students' attention and making teaching more effective and efficient. The observation notes supported this result in that most participants intended to use DSs at the beginning of instruction to capture the attention of students. According to the qualitative data, the pre-service teachers were pleased with their DSs.

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## Discussion and conclusion

This study aimed to examine the effect of the digital storytelling creation process on FLE pre-service teachers' self-confidence with regard to TPACK. A total of 71 pre-service teachers enrolled in a Computer II course participated in the study. The one-group pretest/posttest experimental design was supported with qualitative data. Data on the FLE pre-service teachers' self-confidence related to TPACK were obtained through a TPACK confidence scale developed by Graham et al. (2009) and adapted into Turkish by Timur and Taşar (2011). The scale was administered at the beginning and end of the experiment or DS creation process. The process was separated into five steps, as suggested by Yuksel-Arslan (2013): (1) defining the starting point of the story, (2) creating the scenario, (3) selecting the visual and audio materials (design and preparation), (4) creating the DSs by combining visual and audio materials, and (5) presenting the DSs. Qualitative data were obtained through an open-ended question and observation notes, and a paired *t*-test was applied while open coding for analysis.

The results of the study showed a significant increase in the FLE pre-service teachers' self-confidence scores related to TPACK after the DS creation process. This result is consistent with Yuksel-Arslan's (2013) claim about the relationship of the DS creation process with TPACK. Moreover, similar results were found in a study conducted by Heo (2009), who investigated the effects of the digital storytelling process on pre-service teachers' self-efficacy towards educational technology. Results of his study showed that the pre-service teachers' openness to change in educational technology as well as their technology competency improved. The qualitative data of the current study supported the quantitative data in that the pre-service teachers defined their DSs in accordance with TPACK using adjectives such as instructive, educative, appropriate to the curriculum (PCK: the programme considered both content and students' levels), appropriate to student level (PK) and easy to use (TK). Moreover, they used adjectives such as tiring, creative, beneficial and permanent to describe the DS creation process. Observation notes showed that the FLE pre-service teachers invested the most effort during the second step while creating stories. Similarly, Sancar-Tokmak, Surmeli, and Ozgelen (2014) found that science pre-service teachers described the DS creation process as difficult since it requires creativity, especially when choosing a topic from the appropriate level and curriculum.

The current study results showed that the FLE pre-service teachers' self-confidence scores related to all constructs of TPACK except for TCK (TK, TPK, TPACK) showed a significant improvement. Qualitative data showed that participants had difficulty creating DSs because designing representations of content was challenging. This issue was related to PCK; Yuksel-Arslan (2013) has observed that creating stories, the second step of the DS creation process, includes using both CK and PK. As Chai et al. (2011) have stated, TCK is knowledge about specific content using technology. They found in their study that TCK tended to merge with TPACK, possibly because their study did not emphasise subject-based applications enough. The reason for the insignificant difference between the pretest and posttest scores for TCK in the current study might also be attributed to the nature of the course design. The only technology used was PhotoStory 3, which the FLE pre-service teachers used to create a DS to represent the topic they selected from the national FLE programme. Self-confidence related to TCK could be improved in a course design that includes more examples of content representation through different technologies.

The current study had limitations with regard to the design. One-group pretest/-posttest experimental design has been described as weak by Fraenkel and Wallen (2000). For that reason, future research should be designed by applying quasi-experimental research design with control and experimental groups. Also, the FLE pre-service teachers in the current study only received feedback about their DSs from the instructor and their classmates. Future research might be designed to offer opportunities to pre-service teachers to present their DSs in real school contexts, securing additional feedback from students. Another limitation of the study was related to the applied instruments, including the constructs TPACK, TCK, TPK and TK. The quantitative part of the study included results related to these four constructs. However, the TPACK framework includes seven components: CK, PK, TK, PCK, TCK, TPK and TPACK (Mishra and Koehler 2006). Although the qualitative part of the current study did determine the results related with the PK, CK and PCK constructs of the TPACK framework, empirical results were not possible because of the characteristics of the scale. Further research featuring similar designs might apply a scale that includes all constructs of TPACK. Moreover, scale development specific to the DS creation process and TPACK would be an appropriate aim of future research as well.

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## Disclosure statement

No potential conflict of interest was reported by the authors.

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