IMPROVING TEACHERS' TEACHING PRACTICES WITH TECHNOLOGY FOR 21ST CENTURY LEARNING

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Abstract

Learning to teach 'digital natives' learners in the 21st century can be challenging, mainly due to the proliferation and evolution of multimedia 'e-tools', which has changed the means through which individuals learn and work in a globalized setting. Hence, it has become crucial that teachers design lessons that incorporate ICT for problem-solving, collaboration, and knowledge construction so that their students will be equipped with the requisite 21st century competencies. This project was designed to augment in-service teachers' integration of technological, content, pedagogical knowledge by incorporating the TPACK-DBL-PPPR model, a design-based learning initiative, aimed at developing digital storytelling (DST) materials for the ESL settings. Soon after its implementation, the proposed design model's efficacy in helping teachers develop their TPACK was examined. Data were qualitatively obtained utilizing reflective journals and focus groups interviews from a total of 22 respondents. The results indicate that integrative consideration of TPACK-DBL-PPPR can be a useful framework to help teachers to create the desired practices to teach 21st century learners.

Keywords: Design-based Learning (DBL); Digital Storytelling (DST), Technological Pedagogical Content Knowledge (TPACK), In-service Teacher.

1. Introduction

Preparing in-service teachers to teach 'digital native' learners of the 21st century can be overwhelming. To help bridge this gap, digital immigrant teachers are thus required to design lessons which incorporate ICT for problem-solving, collaboration and knowledge construction so that their pupils will be equipped with the requisite 21st century-competencies (Kala, 2016; Baran & Uygun, 2016). Recently, a number of DBL approaches have been explored and have been found useful in helping teachers connect theoretical knowledge with practice, particularly in integrating pedagogies with technologies in various teaching contexts through the development of TPACK (Mishra & Koehler, 2006; Angeli & Valanides, 2009; Koh & Divaharan, 2011). Koehler and Mishra, (2005) found that involving teachers in designing authentic teaching situations is one of the best methods for developing TPACK. However, studies on teachers' design literacy to promote creative and flexible applications of TPACK are still lacking (Chai, et al., 2013). In an attempt to fill the gap, a prototypical instructional design approach, TPACK-DBL-PPPR, was introduced to help the in-service teachers to develop their TPACK in an academic course entitled *Materials Development in ESL Classroom*. The TPACK-DBL-PPPR model was created to provide a theoretically underpinned and principles-driven approach to engage the teachers through

conversations about computer tools, pedagogy and content to better prepare teachers for technology integration.

In this paper, the researcher first presents the Technological Pedagogical Content Knowledge (TPACK) framework, Design-based Learning (DBL) and digital storytelling (DST). This is followed by sections that discuss the research methodology, findings, and analysis of the current research. The paper concludes with the presentation of both the positive and negative factors found in the implementation of the TPACK-DBL-PPPR.

Table 1: Sample Table

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2. Literature Review

The TPACK framework provides educators a 'mental roadmap' to view the nexus of intersection of knowledge relating to subject matter (CK), teaching philosophy (PK), and educational technology (TK) and contextualized learning (Koehler & Mishra, 2009). However, challenges are aplenty to understand and integrate the complex and multifaceted nature of TPACK development (Koehler& Mishra, 2009). This study specifically focused upon four areas of knowledge intersection as the teachers apply DBL approach to plan, implement and reflect on their DST project. The areas of focus are: (a) Pedagogical context knowledge (PCK) – teacher's knowledge base of content-specific material (b) The Technological Content Knowledge (TCK) – teacher's knowledge in selecting the best fit technologies to support the learning of the best practices in utilizing specific tools in teaching; (c) Technological pedagogical knowledge (TPK) – teacher's knowledge on how to use particular technologies and tools in teaching; and (d)the means by which specialized content and technological tools (TPACK) are fittingly matched to learners' needs and preferences.

Design-based learning (DBL) has been efficacious in teacher education, primarily due to its integration of technology during designing processes (Baran & Uygun, 2016). One of the main attractions of DBL is its emphasis on inquiry in complex environments (Koehleret al., 2007). Baran and Uygin, (2016) in citing Koh and Divaharan, (2013, p. 48) study, commented that design based learning permits the discovery of meaningful relationships in the natural classroom setting. Thus, DBL provides a meaningful exposure for teachers to see how "technology, pedagogy, content, and contextual factors mutually reinforce and/or constrain each other".

DST is an effective instructional tool for teachers to facilitate learning (Robin, 2015). There are numerous studies that have examined the implementation of DST, for instance the examination of the effects of DST in developing learners as critical and reflective individuals (Matthews-DeNatale, 2008); DST as a standard-based evaluative tool (Clemens & Kreider, 2015); and DST as facilitative medium for special needs learners (Sylvester & Greenidge, 2009). In all these studies, teachers utilised a fair balance of technology, pedagogy and knowledge content during the creation of DST to enhance learning. The findings indicate that an effective way to ensure a stable perpetual motion between these affordances is by considerate preparation and a comprehensive understanding of the interplay of these constructs (McLoughlin & Lee, 2007). In learning to produce the DST, the teachers were made to think, discuss, and write about their experiences as learners.

The innovative feature of the project was the addition of Baran & Uygun, (2016) TPACK-DBL model in the design of the course. This model was chosen as it strengths in developing teachers' TPACK with DBL. The TPACK-DBL model consisted of eight important design principles that could foster learners' TPACK development (see Figure 1).

Figure 1: TPACK-DBL principles (Baran & Uygun[24])

These principles were culled from the literature involving TPACK development and application of DBL in educational contexts Baram & Uygun, (2016, pp. 49-50). The eight principles are:

1. *brainstorming of design ideas* - learners ponder imaginative ideas for lessons and activities.
2. *design of technology-integrated artefacts -* TPACK-based lesson plans
3. *examination of design examples* - learners explore and criticise existing materials of their own/peers design
4. *engagement with theoretical knowledge -* discussed theories related to the design of ICT integrated lessons that supported authentic, meaningful, self-directed and collaborative learning
5. *investigation of information and communication technology (ICT) tools* - explore technical capabilities and pedagogical affordances of ICT tools prior to designing technology-integrated materials
6. *reflection on design experiences* - reflection help learners elaborate on their experiences, identify difficulties they encountered, and conduct self-assessment of TPACK development.
7. *applying design in authentic settings* - help learners to elaborate on how TPACK is put into action and what contextual elements affect the implementation of designed lessons.
8. *collaboration within design teams* - working together on authentic technology integration problems, help learners discover several potential solutions through 'satisficing'.

Amalgamating the TPACK-DBL and PPPR together, we developed a prototypical model called TPACK-DBL-PPPR model which is utilised in this study (see Table 1). The instructional design framework, TPACK-DBL-PPPR, was created to provide a theoretically-underpinned and principles-driven approach to engage the teachers through conversations about computer tools, pedagogy and content to better prepare teachers for technology integration.

Table 1. Key Components of TPACK-DBL-PPPR Model

Plan, Produce, Publish, Reflect (PPPR) Model	TPACK-DBL principles (Baran & Uygun, 2016)	Key features
Plan	P1-brainstorming of design ideas P4 -engagement with theoretical knowledge	Acquire content knowledge and task analysis, design user interface, objectives, content outline, storyboards
Produce	P5- investigation of ICT tools; P2 - design of technology-integrated artifacts P8 -collaboration within design teams	Develop performance support content, script, create graphics and animation sequences, create supplemental learning guides
Publish	P7 -applying design in authentic settings	Implementation of DST in their own classrooms
Reflect	P3 - examination of design examples P6 -reflection on design experiences	Test functionality, usability, validate content accuracy and revision based on feedbacks; Assess and critique other design team of their DST

3. Methodology

This study adopted a case study design approach to frame the complex and multifaceted nature of TPACK development in producing DST via the TPACK-DBL-PPPR instructional design framework. The course was structurally divided into three chronological phases based on PPPR framework adapted from ADDIE (Analyse, Design, Develop, Implement, and Evaluate) informational design system to capture the teachers design thinking processes as they embarked on producing the DST.

The current research was carried out at a Malaysian public university, whereby 22 Cohort 4 in-service teachers attended an academic course on *Materials Development in ESL Classroom*. In order to find out the effectiveness of the TPACK-DBL-PPPR in developing teachers' TPACK, two main data sources were used. The main data collection tools were reflective journals and focus group interviews. The Reflective journal was chosen because it can provide an insight into the teachers' thinking and decision making processes, specifically during the preparation, execution and outcome analysis stages of DST. Focus group interviews (FGI) were conducted with four voluntary groups of teachers (each group consisting of 6 to 8 teachers) at the end of the semester to probe deeper into the experiences of the teachers. The main data analysis technique employed was thematic analysis. According to (Braun & Clarke, 2007, p. 6), thematic analysis can be used for "identifying, analysing, and reporting patterns within data." In this study, qualitative data were coded and analysed iteratively based on two criteria, that of saliency and saturation (Lincoln, & Guba, 1985). To identify tacit aspects of TPACK and teachers change in developing technology-dependent teaching and learning tools, triangulation was mainly used (Patton, 1990). Attempts were made to capture and document the data in their original form to ensure referential adequacy. To ensure consistency in data coding, two coders were used until consensus was reached.

4. Research and Discussion

How did the TPACK-DBL-PPPR model helped the in-service teachers to develop their TPACK? Based on the criteria of saliency and saturation (Campbell & Dobozy, 2013), three major themes were identified (see Figure 1): (a) pedagogical skills, (b) ICT skills, and (c) collaboration (see Figure 2). The TPACK-DBL-PPPR framework benefited the teachers in three major ways - firstly in improving their ICT skills; secondly in enhancing their collaboration; and thirdly in cultivating their pedagogical skills.

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Figure 2. Nvivo Inductively generated theme

According to the in-service teachers, their ICT skills have improved the most. A total of 20 students believed that the efforts in producing the DST helped them to improve their ICT skills. The second most helpful theme was working together. Altogether 16 students responded that producing the DST materials helped to enhance their collaboration. The third theme generated was pedagogic skills, where a total of 10 students claimed that the digital project was congruent to the utilization of DST as an effective form of pedagogy. The TPACK-DBL-PPPR instructional framework emerged as relevant to the implementation of DST as pedagogy for the teachers in a number of ways. To further understand how teachers integrate TPACK at varying degrees into the planning, production, publication and reflection stages of the DST, the following analysis of a case study is illustrated.

Sequence of PPPR	Examples	Types of knowledge being developed
Plan	First, we brainstormed on our target group and materials we want to develop. We decided to choose the latest Year 1 KSSR theme World of Stories with the topic "*Dilly Duck's Doughnut*". We chose this topic because it is easy, simple and most of my group members were teaching KSSR Year 1 pupils. We found that this topic was nice and useful to pupils to understand and learn better as children love to watch cartoon or animal characters	**Pedagogical Content Knowledge (PCK)**
	In the learning standard, we want the pupils to listen and enjoy simple stories focusing on listening and speaking skills.	**Pedagogical Content Knowledge (PCK)**
	We all agreed to select a topic from the KSSR Year 2 textbook, Unit 17, page 133 to 134. There is a story on those pages entitled 'Wishes' that really caught our attention. It was about a mermaid who wishes that she could fly and a seagull who wishes that he could swim. We thought that the story would be the best one for this project since it was interesting and had all the elements that we need in a story – a starting point and also a very good climax.	
	We read up the articles that we had downloaded from Schoology and exchange ideas and opinions with one another. Though the textbook does not provide any ending for the story, we really like the idea in the textbook where the pupils are encouraged to think of a suitable ending for the story. We think it provides the opportunity for us to teach our pupils thinking skills (predicting outcome) as well as encourage them to think creatively.	**Pedagogical Content Knowledge (PCK)**
Produce	We found that there are many ways and strategies to	**Technological**

	make DST. We went through all the information and analyzed it, my leader Safrina suggested to use FLASH at the beginning but we found out that it was so hard to handle and take time to prepare.	**Content Knowledge (TCK)**	
	We had to download a free software from the Internet called the 'DVD Video Soft Audio Converter' so that we could convert the files to *wav or *mp. We also used 'Power MP3 Cutter' to edit the length of each of the files.		
	When it came to editing the voice of the mermaid character, we realized that the recording of Cornelia's voice was too soft and it was being drowned by the background music. We tried a software called 'Audacity'. 'Audacity' allowed us to amplify Cornelia's voice recordings and make it loud enough for our movie.		
	In completing the image for the digital storytelling, we used the Microsoft Office Picture Manager and Paint. At first, we planned to scan the picture but the outcome was not attractive. So, we draw them to make it livelier.		
Publish	We worked hard for the rest of the week, editing the video and importing the voices. Since our voices were saved in *amr files, we could not import them directly to Windows Movie Maker.	**Technological Pedagogical Knowledge (TPK)**	
	After uploading the video on Youtube, I copied the embed code and posted our video to Wikispaces		
	Before showing our DST to the children, we discussed how we can use the DST with the English Teachers in our school	**Technological Pedagogical Knowledge (TPK)**	
Reflect	In our opinions, as teachers we must practice how to make and use the DST in the teaching process so that our pupils will achieve something from the technology. Integrating technology in the teaching and learning session is better than using books.	**Technological Pedagogical Content Knowledge (TPACK)**	
	I think that DST would be extremely useful not only in teaching the Listening and Speaking skills, but also the Reading and Writing skills. I could also see the DST potentials in teaching Level 2 classes, Year 6 particularly		
	As most of my Year 6 pupils are struggling with Reading Comprehension, I believe I could use DST to solve this problem and help my pupils. I believe that with the aid of graphics and sounds and other audio-visual stimuli, the pupils' comprehension could be improved.	**Technological Pedagogical Content Knowledge (TPACK)**	

As shown in the narratives, the in-service teachers appeared to have developed and cultivated an array of knowledge and expertise in coming up with the DST materials. In the planning stage, the teachers were required to research a topic, write the script and gather the raw material (media—such as photos, videos, and music) for their digital stories. They collaborated to collect media, research and wrote the scripts, and produced their stories as an out-of-class assignment. The planning stage did not pose much of a problem to the

teachers as most of them have the necessary pedagogical knowledge (PK), content knowledge (CK), and pedagogical content knowledge (PCK) as to how to plan their DSTs.

The production stage required the teachers to produce the DSTs. This phase was the most challenging for the teachers, as many of them were not too familiar with the various tools needed to put the DST together. The teachers explored knowledge such as TCK (knowledge in selecting the best fit technologies to support the learning of particular content-based precepts) to produce the DST. The third phase required the teachers to evaluate and publish their finished projects on public sharing sites such as Youtube and Wikispaces. The process of doing so helped develop their TPK (knowledge on how to use particular technologies and tools in teaching). The final phase of the reflection exercise offered teachers the opportunity to create networks of connections among the content, pedagogy and technological constructs during the instructional process.

5. Implications

The utilization of TPACK-DBL-PPPR approach to guide the development of DST described in this study has yielded insights which could be used for ongoing research to incorporate TPACK into both in- and pre-services teacher education (Campbell & Dobozy, 2017). Purposeful use of reflection within the TPACK-DBL-PPPR framework allowed the teachers educators to create connections between the prevalent technology and their framework for instruction, much akin to (Campbell and Dobozy, 2013; Baran and Uygun, 2016; Papanikolaou et al, 2017) call to explore the nexus between TPACK development and learning by design. In using and reflecting on the model to develop digital materials (DST), the teachers were to analyse, enunciate and physically record the experiences gained from two perspectives, as learners and teachers. The TPACK-DBL-PPPR model provided a structure for the teachers to synthesis an amalgamation of the ideas and multimedia utilized in their digital stories, thereby supporting Papanikolaou et al, (2017) study that call for teacher educators to view teacher digital literacy in an integrative way. Kiraz and Ozdemar, (2006) found that teachers' perceptions of the usefulness of instructional technology had a greater influence on the frequency of use than the perceived ease of use. This finding underscores the importance of establishing a solid rationale for using technology application before addressing the skills and competencies needed to use the tool. To better prepare teachers for technology integration, conversations about computer tools, pedagogy and content needs to be extended in other academic courses. Continued research and exploration is required to ascertain how effective teachers consolidate their branches of knowledge with particular emphasis on content, philosophy and technological application. This is essential to produce an effective instructional framework. With this study, a clearer picture has emerged on how to prepare digital expatriate teachers to instruct digital natives in an L2 context.

Conclusion

Utilizing the proposed framework produces a more solid epistemological viewpoint in producing effective designed teaching methodology. Therefore, it is suggested that this particular area of learning be pursued further in the hope to develop a better understanding of the nexus between TPACK and Learning Design, so that teachers can better improve their teaching practices with technology in helping our learners to learn better in the 21st century.

References

i. Angeli, C. & Valanides, N, 2009. Epistemological and methodological issues for the conceptualization, development and assessment of ICT-TPCK: advances in technological pedagogical content knowledge (TPCK). Computers and Education, 2009; 52 (1), pp. 154 – 168.

ii. Baran, E., & Uygun, E., 2016. Putting technological, pedagogical, and content knowledge (TPACK) in action: An integrated TPACK-design-based learning (DBL) approach. Australasian Journal of Educational Technology, 32(2), pp. 47-63.

iii. Braun, V., & Clarke, V., 2007. Using thematic analysis in psychology. Qualitative Research in Psychology, Volume 3, pp. 77–101. [Online] Available at: DOI:10.1191/1478088706qp063oa.

iv. Campbell, C. & Dobozy, E., 2013. What is the relationship between Learning Design and TPACK? 2013 IEEE 63rd Annual Conference International Council for Educational Media, pp. 1-6.

v. Chai, C. S., Koh, J. H. L., & Tsai, C.-C., 2013. A review of technological pedagogical content knowledge. *Educational Technology & Society* 16(2), pp. 31–51.

vi. Clemens, S. & Kreider, M., 2015. *Digital storytelling in the curriculum.* [Online] Available at: http://web.mac.com/digistoryteller/DigitalStorytelling/Home.html. [Accessed 2 May 2015].

vii. Kala S. Retna, 2016. Thinking about "design thinking": a study of teacher experiences. *Asia Pacific Journal of Education*, Volume 36, pp. 5-19. [Online] Available at: DOI: 10.1080/02188791.2015.1005049

viii. Kiraz, E. & Ozdemir, D., 2006. The Relationship between Educational Ideologies and Technology Acceptance in Preservice Teachers. *Educational Technology & Society*, 9(2), pp. 152-165

ix. Koehler, M. J., & Mishra, P., 2009. What is technological pedagogical content knowledge? *Contemporary Issues in Technology and Teacher Education*, 9(1), pp. 60-70.

x. Koehler, M.J., Mishra, P., & Yahya, K., 2007. Tracing the development of teacher knowledge in a design seminar: Integrating content, pedagogy, & technology. *Computers and Education*, 49(3), pp. 740-762. [Online] Available at: DOI: 10.1016/j.compedu.2005.11.012

xi. Koehler, M., & Mishra, P., 2005. What happens when teachers design educational technology? The development of technological pedagogical content knowledge. *Journal of Educational Computing Research*, 32 (2), pp. 131-152.

xii. Koh, J. H. L., & Divaharan, S., 2013. Towards a technological pedagogical content knowledge-fostering information and communication technology instructional process for teachers: Lessons from the implementation of interactive whiteboard instruction. *Australasian Journal of Educational Technology*, 29(2), pp. 233-247.

xiii. Koh, J. L., & Divaharan, S, 2011. Developing pre-service teachers' technology integration expertise through the TPACK developing instructional model. *Journal of Educational Computing Research*, 44(1), pp. 35-58.

xiv. Lincoln, Y. S. & Guba, E. G, 1985. *Naturalistic inquiry*. Beverly Hills, California: Sage Publications.

xv. Matthews-DeNatale, G., 2008. *Digital storytelling: tips and resources*. Boston, MA: Simmons College.

xvi. McLoughlin, C. & Lee, M. J. W., 2007. Social software and participatory learning: Pedagogical choices with technology affordances in the Web 2.0 era. In ICT: Providing choices for learners and learning. *Proceedings Ascilite Singapore* Volume 2007, pp. 664 – 675.

xvii. Mishra, P., & Koehler, M. J., 2006 Technological Pedagogical Content Knowledge: A new framework for teacher knowledge. *Teachers College Record*, 108(6), 1017-1054.

xviii. Patton, M., 1990. *Qualitative evaluation and research methods*. Beverly Hills, CA: Sage.

xix. Papanikolaou et al., 2017. *International Journal of Educational Technology in Higher Education,* Volume 14, p. 34. [Online] Available at: DOI 10.1186/s41239-017-0072-z