

Understanding writing teachers' technological pedagogical content knowledge: A study with five in-service teachers

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ABSTRACT

The growing emphasis on emerging technologies in education has required in-service teachers to develop more technological knowledge. However, little is known about the application of technological pedagogical content knowledge (TPACK) on subject matter knowledge in language teaching. This qualitative study examined five writing teachers' implementation of instructional objectives, instructional strategies, and technologies to teach writing as well as their assessment of learning using the TPACK-Writing perspective. Lesson observations were conducted for each teacher. Adopting a case study design, the observation transcripts were analyzed with a focus on the teachers' execution of the instructional objectives, instructional strategies, and technologies to teach writing as well as their assessment of learning. The results showed that the complex nature of writing pedagogy with TPACK-Writing as a construct was mediated by cultural factors such as an examination-oriented system and teacher-centered pedagogy. The results also suggested that the application of TPACK-Writing should involve a student-centered approach rather than a teacher-centered approach, which implies the need for teachers to acquire a high level of knowledge of learners and the instructional context to promote effective pedagogy.

Keywords: In-service teachers; technological pedagogical content knowledge; writing

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INTRODUCTION

Knowing technologies is not the same as knowing how to teach subject-specific content using them. With this difference as an impetus, Technological Pedagogical Content Knowledge (TPACK) has been widely investigated since Mishra and Koehler (2006) coined the term TPACK from pedagogical content knowledge (PCK) (Shulman, 1986). The TPACK framework shows the complex interplay among three knowledge types – content, pedagogy and technology

– to “find different ways to represent the subject matter and make it accessible to learners” (Mishra & Koehler, 2006, p. 1021). Although the concept of technology-integrated pedagogy is not new, given the relationships among content, pedagogy, and technology, the TPACK framework has been distinctively defined (Mishra & Koehler, 2006). Pedagogical content knowledge (PCK), technological content knowledge (TCK), and technological pedagogical knowledge (TPK) are also considered

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because of the emphasis on the interactions among the components (Angeli & Valanides, 2009).

For the last decade, there has been growing interest in content-specific TPACK (Harris et al., 2010a; Koh, 2013). The use of appropriate technologies and pedagogy is determined by content-specific subject matter. For example, Harris et al. (2010a) suggested suitable activities and technologies that can be used for particular subjects and levels of students. TPACK has been widely used in the fields of mathematics and science, but the framework has seldom been applied to language learning (see Chai et al., 2013; Grossman & Shulman, 1994; Wetzel & Marshall, 2011). Given that little is known about the application of TPACK to the development of subject matter knowledge in language teaching (Grossman & Shulman, 1994), this area is worthy of investigation.

The majority of previous studies (32 of 55 studies) examined the relationship between course effectiveness and the TPACK awareness of teachers (Chai et al., 2013). The data sources mainly included self-report instruments such as surveys (e.g., Archambault & Barnett, 2010; Archambault & Crippen, 2009; Koh et al., 2010; Yuksel & Yasin, 2014). Measuring TPACK using surveys represents a limitation, as it may not be an accurate reflection of teachers' TPACK in practice (Hofer et al., 2011; Koh, 2013). To date, little has been done to investigate the extent of the application of TPACK in primary schools using an objective approach such as classroom observation.

To help to fill the research gaps, our study focuses on how primary school writing teachers implement instructional objectives, instructional strategies, technologies to teach writing as well as the assessment of writing based on classroom observational data using the TPACK-writing perspective. This paper focuses on writing teachers because writing is arguably the most challenging skill to acquire among the four language skills (speaking, listening, reading, and writing). This study contributes new knowledge relating to teaching writing, as it is built upon the PCK perspective and adapted Magnusson et al.'s (1999) framework to take into account the differences in the implementation of instructional objectives, instructional strategies, and assessment of learning among the participant teachers. This suggests the dynamic relationship involving CK (content knowledge), TK (technological knowledge), PCK (pedagogical content knowledge) in effective teaching.

Pedagogical Content Knowledge (PCK)

The concept of PCK was suggested by Shulman (1987), who wrote that "teaching necessarily begins with a teacher's understanding of what is to be learned

and how it is to be taught" (Shulman, 1987, p. 7). He noted that teacher knowledge entails seven categories, including (1) content knowledge, (2) general pedagogical knowledge, (3) curriculum knowledge, (4) pedagogical content knowledge (PCK), (5) knowledge of learners and their characteristics, (6) knowledge of educational contexts, and (7) knowledge of educational purposes and values. Particularly, PCK refers to content knowledge that is teachable and "goes beyond knowledge of subject matter per se to the dimension of subject matter knowledge for teaching" (Shulman, 1986). In other words, PCK represents teachers' skillful mastery of both content and pedagogy to teach a subject in a comprehensible way to students (Shulman, 1986, 1987).

A number of researchers attempted to conceptualize PCK (e.g., Cochran et al., 1991; Cox & Graham, 2009; Grossman, 1990; Magnusson et al., 1999). According to Cochran et al. (1991) and Magnusson et al. (1999), a simple integration of content and pedagogy is not PCK. One of the essential characteristics of PCK is transformation (Angeli & Valanides, 2009), which involves the ability to transform content knowledge to make it more accessible to learners. However, the problem is that it is unclear how content and pedagogical knowledge can be transformed (Angeli & Valanides, 2009). Cochran et al. (1991) stated that teachers' knowledge of students and contexts are two important components that transform subject matter knowledge to PCK. Cochran et al. (1991) further developed the PCK model by including these two components in addition to content knowledge (CK) and pedagogical knowledge (PK). PCK forms as a result of the transformation, synthesis, and integration of the four domains of knowledge: knowledge of pedagogy, students, the subject matter, and the environmental context. PCK represents the core value of integration of four domains of knowledge.

In addition to the PCK model of Cochran et al. (1991), Magnusson et al. (1999) applied the components of PCK to science teaching based on the concept of PCK presented by Grossman (1990). Based on the model of Magnusson et al. (1999), orientation to teaching science (i.e., rationale and belief regarding teaching science) is emphasized in addition to the four domains of knowledge in PCK (Cochran et al., 1991). Although no universally accepted conceptualization of PCK exists, it is generally believed that PCK represents the teachers' knowledge of the subject matter, learners' conceptions as well as content-related dimensions and the environmental context, which are distinguished from general pedagogical knowledge, knowledge of educational purposes, and knowledge of learner characteristics (Angeli & Valanides, 2009).

Technological Pedagogical Content Knowledge (TPACK)

Mishra and Koehler (2006) coined the term TPACK to emphasize the integration of technology into PCK (Shulman, 1986). However, due to the lack of precise definitions (Graham, 2011) and unclear conceptualization of PCK (Angeli & Valanides, 2009), TPACK was defined differently by various researchers (Cox & Graham, 2009; Rosenberg & Koehler, 2015). Moreover, the boundaries among TPK, TCK and TPACK are not clear. Mishra and Koehler (2006) defined technological knowledge (TK) as knowledge about standard technologies and more advanced technologies, digital video and the Internet, for example. In the studies of Cox and Graham (2009) and Angeli and Valanides (2009), more advanced technologies refer to emerging technologies or ICT. In this study, Mishra and Koehler's (2006) definition of CK was employed.

While it is important to know how to use technology to teach subject matter, the crucial point is how to promote subject-specific knowledge development with an appropriate application of technological and pedagogical knowledge. Kushner and Ward (2013), who investigated the development of TPACK in online higher education teachers, found that a teacher with adequate TK showed the greatest TPACK development. This was because of her ability to discuss pedagogical and technological decisions in a deliberate manner. That is, the ability to integrate content and pedagogical knowledge is still important to enhancing the capacity to apply appropriate technologies in the classroom (Kushner & Ward, 2013; Tsai, 2015). Thus, in the current study, technology integration as one of the components that enhance students' comprehensibility of specific content was considered.

Technological Pedagogical Content Knowledge – Writing (TPACK-Writing)

Few studies have been conducted to examine TPACK in literacy learning (Chai et al., 2013; Grossman & Shulman, 1994; Wetzel & Marshall, 2011). To the best of our knowledge, no study has focused on fourth grade students' writing with TPACK. Studies that investigated PCK or TPACK in literacy or language learning and employed the framework of TPACK-Writing based on the model proposed by Magnusson et al. (1999) were reviewed. In terms of PCK in literacy learning, Carney and Indrisano (2013) identified themes in literacy learning and teaching that are related to Shulman's (1986) content knowledge, including PCK, subject matter knowledge, and curricular knowledge. By organizing themes according to knowledge type, they suggested that "blended" knowledge is necessary to teach complex

notions in disciplinary literacy. However, their study examined the teaching of reading. It did not show how PCK impacts students' learning. Another example is Wetzel and Marshall's (2011) study, which investigated middle school English classes facilitated by an experienced teacher, using the TPACK framework. The teachers established teaching objectives based on students' prior knowledge. This can lead to the usage of appropriate technology as a tool to enhance students' learning. In this study, to apply the model of TPACK-Writing, the PCK model of Magnusson et al. (1999), who conceptualized PCK in science teaching, based on the studies of Grossman (1989, 1990) and Tamir (1988) was adopted.

Knowledge of instructional objectives

Following Magnusson et al. (1999), this study considers curricular knowledge as a component of TPACK-Writing because it is an element that distinguishes writing teachers from content specialists. It should be noted that the writing curriculum may be implemented differently according to teachers' curricular knowledge of writing (Kramer-Dahl, 2008). On the other hand, knowledge of a mandated school curriculum (Griffith et al., 2013) may influence the way that teachers teach writing. Park and Oliver (2008) noted that there is a tension between covering the topics in the curriculum and teaching for understanding (Geddis et al., 1993). Teachers make various decisions between the curricular knowledge that focuses on students' level of understanding and the curricular knowledge that the school determines should be developed (Griffith et al., 2013). Knowledge of curriculums in writing is an essential element of TPACK-Writing (e.g., Grossman, 1989).

Knowledge of instructional strategies

Knowledge of instructional strategies refers to specific strategies to teach writing. These strategies include how to present a specific concept or topic and how to design activities that apply to given topics (Magnusson et al., 1999). There are three major theoretical approaches to teaching writing: (1) the cognitive approach (Bereiter & Scardamalia, 1987; Grabe & Kaplan, 1996), (2) the socio-cultural approach (Hyland, 2003), and (3) the socio-cognitive approach (Atkinson, 2002; Chandrasegaran, 2013; Flower, 1994; Harris & Graham, 1992, 1996; Tarone, 2010). To facilitate the cognitive writing process, knowledge-transforming strategies (Bereiter & Scardamalia, 1987) or metacognitive strategies can be used (Grabe & Kaplan, 1996) from planning to revision. However, teaching cognitive writing strategies has been criticized due to its lack of form (Grabe & Kaplan, 1996) and social interaction (Hyland, 2003).

Another well-known approach is the genre-based approach to writing. Among the different types of genre-based approaches, systemic functional linguistics (SFL) is commonly practiced in school contexts. In SFL, Rothery (1996) suggested the teaching and writing cycle (TWC) as an instructional tool to teach genre-based writing. The TWC comprises three stages: (1) the deconstruction stage during which the teacher models the target genre, (2) the joint negotiation of text between the teacher and students, and (3) the independent construction of text by individual students. Throughout the TWC, students are explicitly taught how to write a particular genre. However, some teachers may turn the genre-based approach into teaching specific discourse using worksheets without explaining the purpose of writing to the students (Chandrasegaran, 2013). That is, some teachers may wrongly teach genres as “moulds into which content is poured” (Hyland, 2003), rather than active constructions of meaning in social interaction.

The basic assumption of the socio-cognitive approach to writing is that “neither social nor cognitive theory makes genuine sense without the other” (Flower, 1994, p. 33). Self-regulated strategy development (SRSD) (Harris & Graham, 1992) and the study by Chandrasegaran (2013) are examples of applications of socio-cognitive writing instructional strategies. SRSD was developed to help struggling learners to write more effectively by explicitly teaching cognitive and metacognitive strategies due to the learners’ ineffectual ability to acquire those strategies via implicit instruction (Harris & Graham, 1992, pp. 284-286). By teachers’ modeling self-regulated strategies and cognitive writing strategies with genre knowledge, struggling learners benefit from SRSD instruction (Glaser & Brunstein, 2007). The study of Chandrasegaran (2013) emphasized the importance of the establishment of a macro-rhetorical goal in writing and awareness among readers. By ensuring all the information in the expository essay can help to achieve the macro-rhetorical goal in writing, combined with an awareness of the purpose, audience, and context of the writing, the quality of students’ subsequent written products would be improved.

Harris and Hofer (2011) suggested that an integration of technological knowledge is essential to effective writing pedagogy. To teach writing pedagogy to young learners, they recommended the application of technologies such as specific software, Internet resources, PowerPoint, blogs, or wikis, depending on the stage of the writing process and genre type. The key aspect of TPACK-Writing is how to make use of content knowledge using PK, TK, PCK, as well as knowledge of learners and the context in the teaching of writing occurs.

Knowledge of writing assessment

Inspired by Tamir (1988), Magnusson et al. (1999) added the element of knowledge of writing assessment to their study, which refers to the knowledge of writing to assess and the knowledge of assessing writing. Over the past decade, there has been a shift from “assessment of learning” (AOL) to “assessment for learning” (AFL) in teaching writing (Lee & Coniam, 2013). AOL focuses on a summative evaluation of student writing for administrative purposes (William, 2001), which is dominant in examination-oriented countries (Lam & Lee, 2010). In contrast, the purpose of AFL is to promote students’ learning (Black & William, 2006), which is a type of formative assessment. The results of empirical studies that investigated the effects of AFL on student learning generally have been positive. Although students showed some tensions between traditional and innovative assessment, their writing performance improved in post-tests as a result of their adopting the AFL approach (Lee & Coniam, 2013). Students expressed a positive reaction towards portfolio assessment, an example of AFL, through multiple drafts, peer review, and conferences (Lam & Lee, 2010). AFL strengthens students’ self-regulated learning. Both studies (Lam & Lee, 2010; Lee & Coniam, 2013) emphasized that teachers’ professional knowledge and skills to implement AFL in the classroom are crucial in the successful promotion of student learning. Therefore, professional development to improve in-service teachers’ knowledge of assessment in writing (including giving feedback on student writing) is necessary (Blankenship & Margarella, 2014; Lee, 2011; Lim & Chai, 2008).

The following research question guided the current study: How do writing teachers implement instructional objectives, instructional strategies, and technologies to teach English Language writing as well as the assessment of learning in Primary 4 classrooms?

METHOD

Based on the conceptualization of TPACK-Writing and observation rubrics (Hofer et al., 2011), writing teachers’ competence in TPACK-Writing was evaluated through in-depth classroom observations and observation transcripts of teachers’ and students’ discussions in the writing classroom.

Participants and context

Five fourth-grade teachers (Teachers B, C, D, E, and F) at a local neighborhood primary school in Singapore participated in the current study. They were experienced teachers who had taught English writing for more than five years at the time of the study. Two

teachers were male and three teachers were female. The school developed 12 writing units following the STELLAR (Strategies for English Language Learning and Reading) program, the implementation of which was launched nationally in 2010 by Singapore Ministry of Education. The 12 writing themes with three pictures were provided to teachers, although their teaching methods varied, depending upon the teachers' technological pedagogical content knowledge and classroom situations. The classroom observations occurred during the last semester of the year. The teachers had already built rapport with the students, who were average in their English language proficiency. There were approximately 40 students in each classroom.

The school curriculum is examination-oriented (Kramer-Dahl, 2008). Schools are under pressure to help students to earn higher scores on the public examination. At the end of fourth grade, schools make a recommendation to parents regarding the level of the subjects that students have reached based on the school examination results. Teachers are under pressure to complete the prescribed curriculum in an effective and efficient manner.

Data collection and analysis

The rubrics from Hofer et al. (2011) to assess TPACK via classroom observations were adopted. Hofer et al.'s (2011) rubrics were derived from Harris et al.'s (2010b) rubrics for assessing lesson plans. The Technology Integration Assessment Instrument (Britten & Cassady, 2005) was also reviewed. To assess TPACK-Writing among the primary school teachers, first, the rubrics adapted from Hofer et al. (2011) and Britten and Cassady (2005) to assess TPACK-Writing with regard to writing lessons were employed. Second, the transformation of knowledge that the teachers possessed, including TK, PK, CK, PCK, and knowledge about learners and the context of writing, was evaluated.

Fourth grade English language writing classes were observed from October 2015 to February 2016. In-depth observations of lesson writing involving each of the five teachers, with each lesson ranging from 60 to 90 minutes in length, were conducted. The researchers adopted the role of non-participant observers (Dörnyei, 2007). Whereas the lessons were video recorded, field notes using the time-sampling approach were jotted down (Foorman & Schatschneider, 2003). For every minute, what the teacher and students did was described in the field notes. To obtain accurate field notes, three language principles (Spradley, 1980) were employed. First, for the language-identification principle, the person (teacher and/or student) who spoke was noted. Second, for the verbatim principle, the spoken detail was

recorded. Finally, for the *concrete principle*, interactions among the teacher, students, and events were described using concrete language to avoid the use of abstract jargon in the field notes (Spradley, 1980).

Upon the completion of the classroom observations, the second author of this paper transcribed the teacher's and students' discussions by watching video recorded observations several times. The teacher's usage of a clip-on microphone for video recording helped to record full dialogues between the teacher and the individual student, including when the teacher provided feedback to students during pair/group activities. While transcribing the observational data, TPACK-Writing observation rubrics to assess teachers' TPACK-Writing patterns were used.

The transcriptions of videotaped writing lessons and detailed field notes from the classroom observations were analyzed using content analysis (Dörnyei, 2007). Based on the TPACK-Writing framework, the relevant parts of the transcribed data were labelled. Next, second-level coding was conducted. All teacher participants' data again were examined to identify the similarities and differences among labels as read by the researchers. Then, five teacher participants' TPACK-Writing to determine patterns or differences among them by clustering the labels under a broader label were compared. Finally, patterns of the TPACK-Writing of the teacher participants emerged.

FINDINGS

In this section, findings in the terms in emerging patterns were identified, particularly setting instructional objectives, implementing instructional strategies, using technologies in teaching writing, and assessing writing.

Establishing instructional objectives

All five teachers followed a process approach to teaching writing. Among the five teacher participants, Teachers F and C at the beginning of the lesson explicitly taught about the importance of setting a macro-rhetorical goal for the composition, i.e., writing a coherent and cohesive story. Teacher C set a macro-rhetorical goal, which was to make the readers like the intangible surprise of a story. Although the instructional strategies or activities that both teachers presented to achieve their goals were different, they set the goals and shared them with students throughout the lessons.

On the other hand, the other three teachers' instructional objectives were not clear to the students. For example, Teacher E set the goal of planning a

story based on a topic “Pets”. Since students were not guided by a specific macro-rhetorical goal, they seemed to plan and write in a way that was consistent with the knowledge-telling model. Teacher E gave each student a planning activity sheet. Students planned a story consisting of five paragraphs (paragraph 1 – main character; paragraph 2 – what was going on; paragraph 3 – conflict/problem; paragraph 4 – how to overcome the conflict/resolution; paragraph 5 – character’s lesson/realization/supervising twist). Students wrote down what they knew about the topic without establishing a macro-rhetorical goal for the story. Hence, they could not ensure that all the information could help them to achieve the goal (observation transcript 20150929, 23-40 minutes). Like Teacher E, Teacher B gave students a writing topic “Surprise”. Students formed their own groups and planned a story using a brainstorming sheet. Their teacher did not explicitly teach them to set a macro-rhetorical goal for the story. The students’ main concern was to finish the task assigned by the teacher as quickly as possible (observation transcript 20150930, 10-21 minutes). Similar to Teachers B and E, Teacher D did not teach what a macro-rhetorical goal was and how to formulate one in writing. Teacher D merely asked students to plan a story using their mind maps (observation transcript 20151001, 23-33 minutes). Generally, Teachers B, D, and E merely helped students to develop their topic knowledge. They did not consider the readers and the goal of writing.

Both discourse knowledge and topic knowledge helped fifth grade students to write significantly better in three different genre types. Discourse knowledge refers to knowledge about how to write, whereas topic knowledge is knowledge about the topic of the writing. In a lesson on writing a narrative story, Teachers E and D both spent approximately half of the total lesson time to elicit topic knowledge from students’ long-term memory. They spent too much time during the writing lesson on developing students’ knowledge on the topic. These teachers might have overlooked the importance of training the students and promoting the development of knowledge about how to write. Drawing on a knowledge-transformation approach, setting a macro-rhetorical goal is the first most important step before planning, writing, and revising the composition.

Implementing instructional strategies – PCK

Teacher F demonstrated strong content knowledge (CK) in teaching. He had a good understanding of writing strategies such as backtracking and referring to the macro-rhetorical goal in planning, writing, and revising a story. The strategies that Teacher F adopted were questioning, giving a hint, explaining, and

further questioning to clarify ideas. He could further improve upon his pedagogy. For example, the lesson observed was heavily teacher-centered to include the teacher-student co-construction of writing for 90 minutes. Few students were willing to speak up, and others seemed to be nervous about participating due to the teacher’s ‘one-correct answer’ syndrome. The instructional strategies might not have matched the large classroom size (number of students = 40) as well as the students’ needs and characteristics.

Compared with Teacher F, Teacher C demonstrated stronger PCK. To achieve the macro-rhetorical goal (i.e., writing an interesting story with an intangible surprise), he used various instructional strategies and activities. They included continuous group writing, writing down what first came to mind when students heard the topic, watching YouTube videos and writing do, say, think, and feel sentences that described the content of the videos, individual conferencing with students, and writing a paragraph that summarized the gist of the whole story. Various activities and instructional strategies were used to make the content more comprehensible for students and promote knowledge development. In other words, Teacher C successfully made CK more teachable and accessible using TPACK-Writing.

The greatest difference between Teachers C and F concerned their knowledge of the students and the classroom context. If Teacher F understood the impact of the large class size and fourth grade students’ learning styles on the effectiveness of student learning, he might not have provided a 90-minute lesson using a teacher-centered approach. Teacher F might be an expert with regard to knowledge of the writing process and writing/planning strategies. However, students did not participate actively in the task because of Teacher F’s insufficient understanding of the classroom context, students’ diverse learning styles, and TK and PK in motivating students.

Using technologies to teach writing

The application of technologies varied among the five teachers. The most commonly used technology was the visualizer. Teachers used it to show the activity sheet and model certain teaching points. MS Word and PowerPoint were also used by Teachers C, E and F. Video clips were used by Teacher C. As shown in Table 1, the usage of technologies was generally limited. The reason might have been that the teachers focused on the content, rather than the means of its delivery. Additionally, teachers’ TK in the context of a writing class was limited because they were under pressure to get through the syllabus. Hence, they primarily relied on non-technological means to deliver information such as activity sheets and realia.

Table 1

Application of Technologies and Non-Technological Means in Writing Lessons

Teacher	Technologies	Non-technological means
B	Visualizer	Activity sheets, pictures
C	Visualizer, PowerPoint, YouTube video clips	Pictures, activity sheets, small Post-it
D	Visualizer	Activity sheets, large Post-it
E	Visualizer, PowerPoint	Realia, activity sheets
F	Visualizer, MS Word	Activity sheets

Assessing writing

The writing topics that the fourth grade student participants were given were adapted from the Primary School Leaving Examination (PSLE). The PSLE is a national examination that is taken by all students towards the end of the sixth grade. Students were told to choose at least one picture of three pictures to write a composition. In other words, the

fourth grade students in our study were asked to practice the PSLE writing technique. The teachers practiced the assessment of learning, and the instructional strategies were linked to the PSLE. Excerpt 1 from the observation transcript shows the conversations between Teacher E and students during a writing lesson. Teacher E reminded the students how to write in the examination.

Excerpt 1

- T So, we have looked very carefully three pictures. Can I remind you? Do you have to use all the three pictures?
- S (Choral) No.
- T No, you must at least use?
- S (Choral) One.
- T One of them. Alright? If you are just going to write the third picture without writing on the second picture, is it possible?
- S (The whole class) Yes.
- T Ok, instead of using a dog, could I use a cat too?
- S (The whole class) Yes.
- T So it depends on where my story is taking me.
- S (A student asks the teacher how many pictures should be used.)
- T Yes, you don't have to use both the second and the third picture.

As long as the students must take the PSLE, examination-oriented lessons and assessments may hinder teachers from practicing assessment for learning. Teachers may introduce the assessment for learning approach to students if and only if the students can earn a high score on the examination.

DISCUSSION

The class observational data revealed that teachers' possessing PCK, rather than strong CK alone, helped to enhance student engagement in lessons (Shulman, 1986). Teachers' having strong CK may not imply that they can effectively communicate the content to the students. This finding can be considered to be consistent with Kushner Benson and Ward's (2013) insights that it is important to integrate PK, CK, and TK into teaching. In their study, two of three teachers showed strong CK and TK, but weak PK. Despite their having strong CK and TK, these two teachers failed to teach effectively. The remaining teacher who showed strong CK, PK and PCK, but weak TK, eventually articulated the key elements of TPACK in his teaching since PCK is the foundation of TPACK. Having CK, without PCK or PK, may not produce the desired outcomes in writing classrooms. In the current

study, Teacher F possessed strong CK. However, due to a lack of PCK, his instructional strategies may be seen as the "transmission", rather than the "transformation" of CK. Teacher C had strong CK and the ability to make it more comprehensible for students. This may enhance student engagement in writing class. With regard to effective writing instructional strategies, the use of appropriate PCK is indispensable.

The findings also show that the teachers' knowledge of the learners (Costa et al., 2016) and the instructional context contributes to PCK (Cochran et al., 1991). This evidence supports Moallem's (1998) argument that, through teaching experience, an expert teacher developed his own knowledge of the learners and the instructional context. Such knowledge is useful in helping the teacher to "identify appropriate content, activity, material and teaching strategies" (p. 49). In our study, Teacher C's knowledge of the learners and the context, becoming familiar with the instructional context (group, pair, and individual student activities), watching video clips that support the lesson objective, and having individual conferences with students all contributed to her PCK.

Modeling of collaborative writing is important (Dale, 1994), as it is related to PCK. Although the

participants in Dale's study were ninth graders who might have been more mature than the fourth grade students in our study, the teacher spent a considerable amount of time modeling collaborative writing in the classroom such as showing how to negotiate, plan, contribute ideas and write with group members. Teacher B did not model how to perform the collaborative writing task in the groups. Consequently, students in class B tried to finish the task within the allotted time without negotiating with group members. Through teacher modeling and careful instruction, the effectiveness of a group/pair activity can be enhanced (Dauite & Dalton, 1993).

Based on the analysis of classroom data using the TPACK-Writing framework, it was found that Teachers B, D and E did not demonstrate how to set a macro-rhetorical goal of writing (CK). Instead, they presented students with an unclear goal of writing such as to plan a story using a mind map or template. Teachers C and F illustrated for students how to establish a macro-rhetorical goal of writing such as to write an interesting story with an intangible surprise (Teacher C) or to convince readers that the story is coherent and cohesive (Teacher F). Teachers C and F constantly asked students to check the information that they planned to include in the story. In particular, the information should help to achieve the macro-rhetorical goal of writing. This finding may add support to Graham et al.'s (2002) study. In regard to effective writing pedagogy for primary school students, setting a macro-rhetorical goal positively impacts students' writing. That establishment of a clear macro-rhetorical goal in writing may corroborate Page-Voth and Graham's (1999) claim. Their results showed that students in an experimental group who set a clear macro-rhetorical goal when beginning to write managed to write longer essays with more supporting rationales and qualitatively better essays than students in a control group.

Although teachers employed classroom activities and various instructional strategies with integrated technology, their usage of technologies was limited and teacher-centered. This means that the teachers' TPACK-Writing was either limited or not well implemented in practice. The reason may be attributed to a lack of continuous training for in-service English writing teachers in the use of TPACK-Writing. It is worth noting that even teachers who possess strong TK without PCK may not be able to enhance students' understanding of the subject matter (Graham, 2011). Additionally, the quality of the lessons can be improved when the application of TK focuses on the needs of students (learner-centered), rather than teachers (teacher-centered) (Tsai, 2015). Li et al. (2014) noted that student-centered wiki-based collaborative writing can enhance fourth grade

Chinese students' writing abilities and attitudes. However, participants in Li et al.'s study completed the task in their mother tongue, which was not the case in our study.

CONCLUSION

The study illustrates the complex nature of writing pedagogy with TPACK-Writing as a construct mediated by cultural factors such as an examination-oriented system and teacher-centered pedagogy. This study contributes to our current knowledge of teaching writing in two main ways. First, it builds upon the perspective of PCK and adapts Magnusson et al.'s (1999) framework to take into account the differences in the implementation of instructional objectives, instructional strategies, use of instructional technologies, and assessment of learning among five fourth grade writing teachers at the same school. This suggests that a dynamic relationship exists among CK, TK, and PCK and offers support for Magnusson et al.'s (1999) contention that simple integration of content and pedagogy is not PCK. Second, an account of five teachers' usage of technologies in facilitating the teaching of writing has been provided. The application of TPACK-Writing should be more student-centered, which suggests the need for teachers to acquire thorough knowledge of the learners and the instructional context to promote effective pedagogy.

Nonetheless, this study has valuable implications for teaching writing in primary schools. To enhance teachers' TPACK-Writing in practice, professional development is necessary. If English language teachers can take the initiative to improve their knowledge of using technologies to teach writing, they would be able to expand their repertoire in TPACK-Writing and to improve the students' experiences in writing lessons. In-service writing teachers should participate in professional development on writing pedagogies that involve establishing an appropriate macro-rhetorical goal in writing, implementing writing-specific instructional strategies, using technologies to teach writing, and adopting alternative approaches to assessing writing. Attending professional development sessions can provide inspiration for writing teachers and offer new insights into how they can enhance their instructional practices in their educational contexts.

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