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Teachers' Technological Pedagogical Content Knowledge (TPACK) Implementation in English for Specific Purposes (ESP) Classrooms at Vocational High School

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Abstract

This study aims to examine the implementation of Technological Pedagogical Content Knowledge (TPACK) by English teachers in ESP instruction within the tourism program at a vocational high school, using a descriptive qualitative approach with a phenomenological design involving two English teachers (T1 and T2) selected through purposive sampling, with data collected through classroom observations, semi-structured interviews, and documentation, then analyzed using the interactive model proposed by Miles, Huberman, and Saldaña, further enriched by the SAMR model and the Technology Integration Matrix (TIM) as complementary analytical frameworks. The findings reveal that both teachers successfully integrated all seven components of TPACK in a contextually appropriate manner, albeit through distinct technological configurations, with T1 utilizing authentic videos and Instagram to reach the Redefinition level within the SAMR model, while T2 optimized the use of PowerPoint and Blooket to reach the Modification level, and both teachers further succeeded in establishing active, collaborative, and authentic learning environments, as evidenced by the TIM analysis. These findings lead this study to conclude that the successful implementation of TPACK is determined not by the sophistication of the technology employed, but by teachers' capacity to contextually align technology, pedagogy, and content in accordance with the demands of the learning environment.

1. Introduction

In the 21st century, education has undergone a fundamental transformation driven by the rapid advancement of digital technology, which has permeated nearly every aspect of life, including the educational domain (OECD, 2020; UNESCO, 2023). This transformation demands the mastery of 21st-century competencies, encompassing digital literacy, critical thinking, collaboration, and technology-mediated communication (Voogt & Roblin, 2012), and has shifted the role of teachers from mere transmitters of knowledge to facilitators who cultivate active and contextualized learning environments through the pedagogical use of technology (OECD, 2020), consistent with the tenets of social constructivism wherein technology functions as a mediating tool in the construction of learners' understanding (Vygotsky, 1978).

Within the context of English language instruction at vocational high schools, however, technology integration remains largely fragmented and has yet to be systematically embedded within instructional planning (Redecker, 2017; Ritzhaupt et al., 2012), compounded by generic and insufficiently contextualized instructional materials (UNESCO, 2020), as well as first-order barriers such as infrastructural limitations and unstable internet connectivity, and second-order barriers relating to teachers' beliefs and pedagogical readiness (Ertmer & Ottenbreit-Leftwich, 2010).

Given the distinctive orientation of vocational education toward workforce readiness, the English for Specific Purposes (ESP) approach assumes particular significance in aligning language instruction with professional communication demands (Hutchinson & Waters, 1987; Basturkmen, 2010), yet its effectiveness is contingent upon teachers' capacity to meaningfully integrate technology, necessitating a coherent framework capable of aligning technology, pedagogy, and content. The Technological Pedagogical Content Knowledge (TPACK) framework, introduced by Mishra and Koehler (2006), offers a conceptually robust foundation for addressing this imperative, underscoring the dynamic interrelationship among Content Knowledge (CK), Pedagogical Knowledge (PK), and Technological Knowledge (TK), which converge into PCK, TCK, TPK, and ultimately TPACK as a holistic framework for instructional practice (Koehler & Mishra, 2009; Chai et al., 2013).

To further elucidate how technology is integrated within instructional practice, this study draws upon two complementary analytical models: the SAMR model (Substitution, Augmentation, Modification, Redefinition) developed by Puentedura (2006, 2010), which identifies the extent to which technology use transforms instructional tasks, and the Technology Integration Matrix (TIM) developed by the Florida Center for Instructional Technology (FCIT, 2011), which evaluates the quality of technology-enhanced learning environments through five characteristics: active, collaborative, constructive, authentic, and goal-directed learning (Jonassen et al., 2003). These three frameworks operate complementarily: TPACK delineates the knowledge base required of teachers, SAMR captures the depth of technological transformation, and TIM assesses the quality of classroom implementation (Kimmons et al., 2020; Hilton, 2016).

Empirically, extant research on TPACK implementation has predominantly been situated within general and higher education contexts, whereas investigations within vocational education, particularly concerning ESP instruction in tourism programs, remain markedly limited (Islama et al., 2022). Within this limited body of vocational-context research, studies such as those conducted by Destiani et al. (2022), Yanti and Said (2023), and Melinda et al. (2023) have contributed to mapping teachers' technological competencies and documenting the technical dimensions of classroom technology use.

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However, these studies have largely been confined to competency mapping and technical description, without extending their analysis toward how teachers adapt pedagogical strategies and instructional materials to align with vocational characteristics and industry-specific communicative demands, nor have they employed analytical frameworks capable of capturing both the depth of technological transformation and the quality of classroom implementation.

This gap is particularly consequential given that effective technology integration in vocational education is intrinsically linked to authentic classroom practices and instructional relevance to industry expectations (Mishra et al., 2020; OECD, 2022). To date, no study has combined TPACK with SAMR and TIM as complementary analytical lenses to examine ESP instruction within tourism vocational programs, leaving both the depth and quality of technology-integrated ESP practice in this setting empirically unexamined.

In light of the aforementioned gap, this study addresses the following research question: how do English teachers implement TPACK in ESP-based instruction within tourism programs at vocational high schools? Accordingly, this study aims to examine TPACK implementation by English teachers in ESP tourism instruction, employing the SAMR and TIM models to assess the depth of technological transformation and the quality of classroom implementation. The novelty of this study lies in integrating TPACK with SAMR and TIM as a combined analytical lens for ESP instruction in tourism vocational education, a combination unexamined in prior research, thereby contributing to the scholarly understanding of TPACK implementation within Indonesian vocational education.

2. Method

This study employed a descriptive qualitative approach with a phenomenological design to explore the implementation of Technological Pedagogical Content Knowledge (TPACK) by English teachers in the tourism program at a vocational high school in Medan (Creswell & Poth, 2018; Smith et al., 2009). Participants were selected through purposive sampling, comprising two English teachers with more than three years of teaching experience, prior training in technology integration, and formal teacher certification (Patton, 2015; Morse, 2000). Given this design and these selection criteria, the study was oriented toward capturing teachers' experiences and instructional practices in an in-depth and contextually grounded manner.

Data were collected through classroom observations, semi-structured interviews, and documentation (lesson plans, digital teaching materials, and student work), conducted iteratively to ensure data depth (Miles et al., 2014). The instruments used were an observation checklist and a semi-structured interview guide, both developed based on the seven components of TPACK (TK, PK, CK, PCK, TCK, TPK, and TPACK) and further enriched by indicators from the SAMR model, used to measure the level of transformation in technology use, and the Technology Integration Matrix (TIM), used to assess learning quality through the dimensions of active, collaborative, constructive, authentic, and goal-directed learning. This combination of three data-collection techniques and two complementary analytical frameworks allowed the resulting data to reinforce one another and yield a comprehensive picture of technology integration in the classroom.

Data were analyzed using the interactive model proposed by Miles, Huberman, and Saldaña, encompassing data collection, data condensation, data display, and conclusion drawing and verification. Trustworthiness was ensured through methodological and source triangulation, member checking with participants, and an audit trail comprising transcripts, observation notes, and the coding process (Denzin, 2012; Creswell & Miller,

2018). Through this layered process of analysis and verification, the credibility and consistency of the study's findings could be systematically substantiated.

3. Result

Implementation of Technological Pedagogical Content Knowledge (TPACK)

Data triangulation from classroom observations, semi-structured interviews, and document analysis showed that both English teachers (T1 and T2) implemented all seven components of TPACK in ESP instruction within the tourism program, although through different technological configurations.

Technological Knowledge (TK)

Both teachers used PowerPoint as the primary medium for delivering instructional materials, but each developed it further according to different pedagogical needs. T1 combined PowerPoint with authentic tour guide videos and used students' smartphones to document role-play performances that were uploaded to the class Instagram account as a form of digital portfolio and authentic assessment. T2 complemented PowerPoint with Blooket, a gamified quiz platform accessed through students' smartphones, which was used to deliver content and conduct formative assessment at the end of the lesson. These findings indicate that both teachers selected and varied their technology strategically according to instructional needs rather than using it merely as a presentation tool.

Pedagogical Knowledge (PK)

Both teachers implemented role-play grounded in Task-Based Language Teaching (TBLT) as their main instructional strategy. T1 organized learning into three stages — exploration through authentic video, elaboration through role-play, and confirmation through Instagram documentation — while actively joining student simulations to build their confidence. T2 combined group-based role-play with Blooket-based evaluation to sustain a competitive and participatory classroom atmosphere. In both classrooms, student engagement was high, with students taking active roles as performers, and in T1's case, also as peer evaluators during follow-up sessions.

Content Knowledge (CK)

Both teachers demonstrated mastery of content relevant to tourism communication needs. T1 taught foundational tour guide expressions such as welcoming tourists and providing destination information, applying immediate corrective feedback during role-play. T2 presented more complex material, such as "Steps in Guiding," consistent with the higher competency level of Grade XI students, and applied delayed corrective feedback after each performance. Both approaches reflected an understanding that ESP content must be tailored to students' professional communication needs rather than general English proficiency alone.

Pedagogical Content Knowledge (PCK)

Both teachers showed strong alignment between their teaching strategy and the nature of the ESP tourism content. T1 paired authentic videos with role-play so that students first observed real communication before practicing it themselves, while explanations were consistently grounded in real-life examples drawn from the videos and, later, from students' own recorded performances. T2 used scenario-based PowerPoint presentations to prompt students to analyze appropriate language choices before engaging

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in role-play, ensuring that pedagogical strategy and content remained closely connected throughout the lesson.

Technological Content Knowledge (TCK)

T1 relied on authentic tour guide videos to represent real communication practices, including intonation, gestures, and interactional patterns that could not be conveyed through text or verbal explanation alone. T2, in contrast, did not use video but embedded authentic situational scenarios directly into PowerPoint slides, a choice suited to Grade XI students who already possessed foundational understanding of tour guide practices. Both approaches show that technology was selected based on its capacity to represent tourism content meaningfully and appropriately for each group of students.

Technological Pedagogical Knowledge (TPK)

Technology was used by both teachers to support learning activities and extend student interaction. T1's use of authentic video functioned as scaffolding before role-play, while the class Instagram account extended interaction beyond the classroom by allowing students to view and comment on one another's performances. T2's use of Blooket transformed evaluation into an interactive, competitive activity, with the real-time scoring system encouraging even typically passive students to participate actively. These findings indicate that both teachers understood how to align technology with pedagogical strategies to support engagement rather than using it as a supplementary tool alone.

Technological Pedagogical Content Knowledge (TPACK)

The integration of all six preceding components was evident in the way both teachers designed cohesive instructional sequences. T1 combined PowerPoint, authentic video, role-play, and Instagram-based publication into an interconnected flow that extended from exploration to authentic assessment and, in the second observation, into reflective peer feedback. T2 combined contextual PowerPoint, role-play, and Blooket into a sequence that progressed systematically from understanding, to application, and to evaluation. Although realized through different technological configurations, both teachers achieved a genuine synthesis of technology, pedagogy, and content, reflecting a mature and contextually appropriate implementation of TPACK in ESP tourism instruction.

Supporting Models: SAMR and TIM

To further examine the depth and quality of technology integration, the findings were analyzed using the SAMR model and the Technology Integration Matrix (TIM). Based on the SAMR model, both teachers' use of PowerPoint, along with T1's use of authentic video, remained at the Augmentation level, where technology enriched content delivery without fundamentally changing the instructional task. T2's use of Blooket reached the Modification level by redesigning assessment into an interactive and competitive activity, while T1's use of Instagram reached the highest level, Redefinition, by creating a new form of learning task in which students became digital content creators with an authentic audience beyond the classroom.

Table 1: *SAMR Level of Technology Use by T1 and T2*

Teachers	Technology	SAMR Level
T1	PowerPoint & Authentic Video	Augmentation
T1	Instagram	Redefinition
T2	PowerPoint	Augmentation

T2	Blooket	Modification

Meanwhile, the TIM analysis showed that both teachers successfully created learning environments that were active, collaborative, and authentic, with the Authentic characteristic being the most consistently fulfilled in both classrooms due to materials and tasks grounded in real tour guide communication practices. T1 demonstrated stronger fulfillment of the Constructive and Goal-Directed characteristics through the production, publication, and reflection of Instagram-based digital artifacts, whereas T2 placed greater emphasis on active participation and interaction through Blooket-based classroom activities. Together, the SAMR and TIM findings reinforce that both teachers achieved meaningful technology integration, with T1 reaching a higher level of transformation and T2 excelling in creating interactive and formative learning experiences.

4. Discussion

The results presented above show that both teachers implemented all seven components of TPACK through different but equally purposeful technological configurations. This section discusses these results in relation to the TPACK framework, the SAMR and TIM models, and relevant prior studies.

Technological, Pedagogical, and Content Knowledge

The finding that both teachers strategically selected digital tools according to instructional needs — T1 through video and Instagram, T2 through Blooket — confirms Mishra and Koehler's (2006) conceptualization of TK as the ability to select technology purposefully rather than merely operate it, and is consistent with Foulger et al. (2017) and Baser et al. (2016), who linked strong TK to adaptive, goal-driven technology use.

Both teachers' consistent use of role-play grounded in Task-Based Language Teaching reflects Willis (1996) and Ellis (2003), who argue that authentic communicative tasks produce the most effective language learning; T1's active participation in simulations further illustrates Vygotsky's (1978) scaffolding. This is in line with González-Lloret and Ortega (2021) and Suwartono (2021), who found that technology-supported TBLT strengthens vocational students' communicative competence.

The finding that both teachers grounded instruction in workplace-relevant tourism expressions, applying immediate (T1) or delayed (T2) corrective feedback, supports Hutchinson and Waters' (1987) ESP principle that content must address learners' professional needs, and aligns with Basturkmen (2020) and Lyster and Ranta (1997) on the pedagogical value of contextualized feedback.

Integration of Technological, Pedagogical, and Content Knowledge

T1's use of Instagram to extend interaction beyond the classroom and T2's use of Blooket to sustain engagement during evaluation both confirm Mishra and Koehler's (2006) view of TPK as technology purposefully aligned with pedagogical goals, echoing Koehler et al. (2013) and Ibili et al. (2019) on the motivational value of gamified and socially extended learning.

The differing content representation strategies — T1's authentic video for foundational understanding versus T2's scenario-based slides for more advanced learners — reflect Mayer's (2021) multimedia learning theory and support Adipat (2021) and Tseng et al. (2022), who emphasize that technology should be matched to students' cognitive and competency levels. Likewise, the strong alignment between strategy and content observed in both classrooms (PCK) is consistent with Shulman (1986) and Graves (2000), who argue

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that effective ESP teaching depends on transforming content into contextually appropriate, professionally relevant tasks.

Most importantly, the finding that both teachers achieved a genuine synthesis of TK, PK, and CK rather than applying each in isolation reinforces Mishra and Koehler's (2006) central claim that effective technology integration emerges from the dynamic interaction of all three domains, and is consistent with Chai et al. (2013) and Angeli and Valanides (2009), who found that integrated TPACK implementation produces stronger student engagement than fragmented approaches.

SAMR and TIM as Supporting Models

The SAMR analysis, in which T1 reached Redefinition through Instagram while T2 reached Modification through Blooket, supports Puentedura's (2006) claim that technology's greatest value lies at the transformative levels, and is reinforced by Hamilton et al. (2016) and Tondeur et al. (2021), who associate higher SAMR levels with more authentic and meaningful learning.

Similarly, the TIM findings both teachers achieving active, collaborative, and authentic learning environments, with T1 stronger in the Constructive and Goal-Directed dimensions align with FCIT's (2011) premise that meaningful technology integration should be evaluated by learning-environment quality rather than tool sophistication alone, consistent with Harmes et al. (2016) and Jonassen's (1996) mindtools concept. Together, these results indicate that the differences between T1 and T2 reflect contextual and pedagogical orientation rather than differences in TPACK competence, reinforcing this study's central argument that effective TPACK implementation depends on teachers' ability to contextually align technology, pedagogy, and content rather than on the sophistication of the technology itself.

5. Conclusion

This study concludes that both English teachers successfully implemented all seven components of TPACK in ESP tourism instruction, with T1 using authentic videos and Instagram and T2 using PowerPoint and Blooket, a variation reflecting contextual flexibility rather than differing TPACK competence. The SAMR and TIM analyses reinforce this, with T1 reaching the Redefinition level and demonstrating stronger Constructive and Goal-Directed learning through Instagram, while T2 reached the Modification level with greater emphasis on participation and interaction through Blooket.

These findings indicate that effective TPACK implementation depends on the contextual alignment of technology, pedagogy, and content rather than technological sophistication. However, these findings should not be generalized beyond similar contexts, as this study involved only two teachers at a single vocational high school and examined the phenomenon solely from teachers' perspectives, without incorporating students' perspectives or learning outcomes.

Future research is encouraged to include more teachers, schools, and vocational programs, as well as students' perspectives and learning outcomes, to strengthen the generalizability of these findings. Future studies are also recommended to investigate how TPACK-informed instructional practices influence students' ESP achievement, communicative competence, and digital literacy, as well as to evaluate the effectiveness of professional development programs designed to strengthen teachers' TPACK implementation across diverse vocational education contexts. Such studies would extend the practical implications of this research and provide stronger evidence for improving technology-integrated ESP instruction in vocational schools.

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