Teacher Contextual Knowledge (XK) Development: The Case of Yogyakarta, Indonesia

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ABSTRACT

Technological Pedagogical and Content Knowledge (TPACK) is one of the most prominent frameworks that outlines the types of knowledge teachers need to teach effectively with technology. Recent research on TPACK has emphasised Contextual Knowledge (XK), which accounts for teachers' understanding of where teaching and learning are situated. Aiming to contribute to advancing research on XK, this case study investigated teachers' development of XK and the challenges they faced in the process. The participants were five English language teachers across two secondary schools in Yogyakarta, Indonesia. The data were primarily gathered through in-depth interviews, informed by teachers' lesson plans and digital teaching artefacts. Three layers of context – micro (classroom level), meso (school and community levels), and macro (national and global levels) – were used as a framework for analysing the data. Derived through thematic analysis, the findings highlight that participating teachers benefitted from informal engagement with students at the micro level, as well as collegial collaboration and professional learning at the meso level. At the macro level, they talked about the usefulness of technology-mediated professional learning, particularly through social media. Time constraints due to teacher workload were identified as a key barrier to their XK development. The study highlights the implications of different spaces and modes of professional learning for XK development and calls for policies to regulate teacher administrative burdens.

Keywords: Contextual Knowledge, TPACK, English teachers, professional learning

Introduction

Teacher knowledge has been an area of intense research in teacher education. Among many frameworks, the Pedagogical Content Knowledge (PCK) framework (Shulman, 1986) was groundbreaking in conceptualising different types of teacher knowledge and their development. The PCK framework suggests that successful teaching requires both pedagogical knowledge,

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which accounts for understanding of appropriate teaching approaches, and knowledge of subject matter, better known as content knowledge. Shulman's work has been foundational to research on teacher knowledge across multiple disciplines (Herold, 2019).

Due to the accelerating incorporation of digital technologies in education, Mishra and Koehler (2006) expanded PCK to TPACK (Technological Pedagogical and Content Knowledge) by introducing a new domain of knowledge, Technological Knowledge, which describes teacher knowledge of digital technologies. Mishra and Koehler argue that integrating the three knowledge domains is critical to effective technology use in education. Since its introduction, there has been a growing body of TPACK-related research and the framework has been used in a variety of subject areas, with many studies focusing on English as a Foreign Language (EFL) teachers (Anjarani, 2020; Kusuma, 2021; Sari et al., 2021; Tseng et al., 2020).

Given the highly situated nature of teaching and knowledge, TPACK has always been described as contextually embedded. However, until recently, educational technology research has largely overlooked the contextual factors influencing how teachers and their students use technology (Harris & Huang, 2024). Moreover, when the concept of context was used in TPACK research, its meaning seemed to be inconsistent (Rosenberg & Koehler, 2015). Hence, Mishra (2019) suggested an upgrade to the TPACK diagram to include ConteXtual Knowledge (XK) as a distinct knowledge domain (see Figures 1 and 2). Thus, more recent TPACK research has shown a shift toward greater consideration of contextual factors (Brianza et al., 2022b; Greene & Jones, 2020; Koh et al., 2014; Porras-Hernández & Salinas-Amescua, 2013; Rosenberg & Koehler, 2015).

The question of how teachers develop their XK needs further investigation, particularly in under-researched contexts, such as the Global South, which refers to developing countries in Asia, Africa, Oceania, and Latin America (Dados & Connell, 2012). Researchers have identified that the Global South still suffers from technological divides and a scarcity of educational technology research (Impedovo et al., 2019; McCallum & Tafazoli, 2024; Ragnedda & Gladkova, 2020; Traxler, 2018). As a country situated in the Global South, Indonesia has its own unique characteristics. The World Bank recorded that Indonesia has one of the most diverse teacher populations in the world (Chang et al., 2014), marked by different types of schools and employment statuses, with the number of teachers reaching 3.4 million (Kementerian Pendidikan, 2024). In addition, the new Indonesian Merdeka Curriculum urges teachers to apply differentiated instruction (Martatiyana et al., 2023; Reza et al., 2023) and thus requires them to demonstrate a deep knowledge of context.

This study helps address a lack of qualitative TPACK research (Anjarani, 2020), and employs interviews as a data collection method to complement recent quantitative XK research (Foulger et al., 2021) and self-evaluation surveys (Anjarani, 2020; Greene & Jones, 2020; Willermark, 2018). In such self-evaluations, TPACK is often "exclusively viewed as knowledge that teachers possess regardless of their context" (Greene & Jones, 2020, p. 75).

Literature review

Overview of TPACK

Koehler and Mishra (2005) introduced the Technological Pedagogical Content Knowledge (TPCK) framework in 2005, which was later reformulated as TPACK (Mishra & Koehler, 2006). The framework expands Shulman's (1986) Pedagogical Content Knowledge (PCK) framework (Shulman, 1986). TPACK includes Technological Knowledge (TK) in addition to Pedagogical Knowledge (PK) and Content Knowledge (CK). TK accounts for teacher knowledge of technologies, PK is teacher knowledge about teaching approaches, and CK is teacher knowledge about subject matter. The three domains of teacher knowledge overlap and form TPACK, which becomes the base for effective teaching with technology in a given context, with the context originally represented by a dotted line around the diagram (see Figure 1). Since its introduction, the framework has become widely used in educational technology research (Brianza et al., 2022a). Up to March 2024, the TPACK references database listed around 3,000 publications that explored TPACK or used the framework as a primary theoretical construct (Harris et al., 2024).

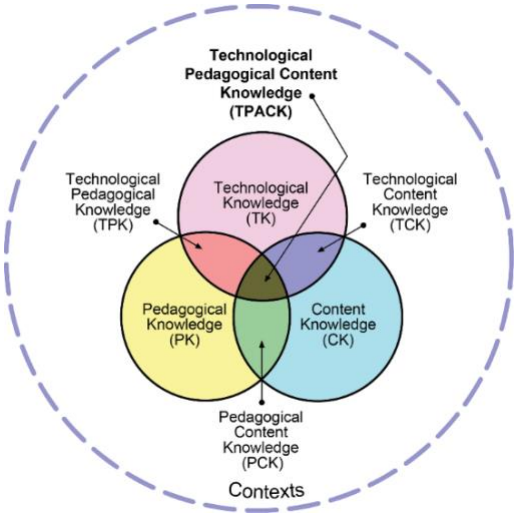

Figure 1. The TPACK Image reproduced by permission of the publisher, © 2012 by tpack.org

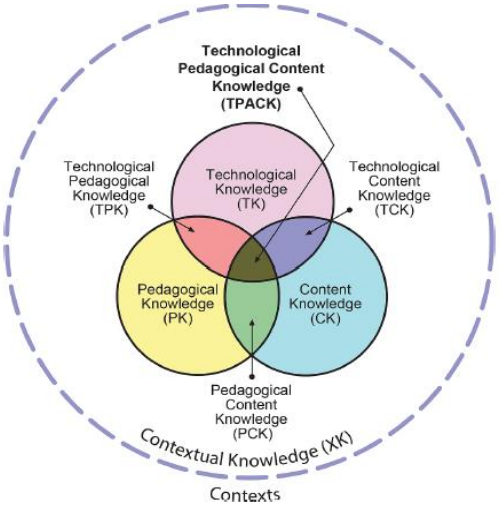

Figure 2. The updated TPACK model (Petko et al., 2025)

Despite its popularity, TPACK has been criticised for a lack of clarity. Angeli and Valanides (2008) critiqued ambiguities in the definitions and boundaries of the TPACK components, arguing that the framework is unclear in explaining the connections between the domains of knowledge and the role of tool affordances in learning. Involving pre-service teachers in their study, they argued that although the teachers possessed strong technological and pedagogical knowledge, they struggled to design effective technology integration if not provided with explicit instructions on how to leverage technology affordances to transform content and pedagogy (Angeli & Valanides, 2008). Because it is not always easy to disentangle knowledge domains, such as clearly distinguishing pedagogical and content knowledge, some scholars have questioned the practicality of TPACK. A number of studies have tried to implement the framework as a tool for measuring teacher TPACK. However, the methods used in such research were frequently not explicit, which has complicated the comparison of results (Willermark,

2018). Furthermore, research on TPACK has faced criticism for overly concentrating on measuring and validating the components of the framework (Saubern et al., 2020). Consequently, Saubern et al. (2020) proposed to "reboot" TPACK research, suggesting that further studies should shift their focus from the individual components of the TPACK framework to the integration of these components (Saubern et al., 2020).

Theoretical Foundations of Contextual Knowledge

Suggesting a novel perspective in approaching the framework, one of the TPACK originators proposed an upgrade by changing "contexts" to a distinct domain of knowledge known as "ConteXtual Knowledge" (XK) (Mishra, 2019). The most recent update of the framework (Petko et al., 2025), however, includes both contexts as external influences, placed outside the outer dotted circle, and XK as a domain of knowledge, placed inside the dotted circle (see Figure 2). Mishra (2019) argued that teachers' success in integrating technology relies more on their understanding of the context than on their knowledge of technology, pedagogy, content, and their intersections. Although the term XK was not introduced before the upgrade, Porras-Hernández and Salinas-Amescua (2013) had already recommended that "context be considered not only as a series of conditions for curriculum or lesson planning but also as an object of knowledge" (p. 241). Oakley (2020) also suggested that knowledge about students should be more explicitly incorporated into the TPACK model to highlight the importance of catering to their individual needs, interests, and strengths. Given that XK is now conceptualised as a domain of knowledge, this implies that it is something teachers must develop and use. However, Mishra (2019) did not propose a rigid definition of XK, stating that it comprises "everything from a teacher's awareness of available technologies to the teacher's knowledge of the school, district, state, or national policies they operate within" (Mishra, 2019, p. 76).

Since the introduction of XK, studies have acknowledged its crucial role in guiding teachers in responding to their unique teaching environments. Brianza et al. (2024) and Kosiol and Ufer (2024) maintain that teachers need to develop their XK since it informs their decisions with regard to the incorporation of technology and instructional design. Moreover, XK is a domain that can be cultivated over time in dynamic and diverse educational contexts (Brianza et al., 2024; McDougall & Phillips, 2024). XK is grounded in teachers' real-life experiences and may help them elevate their TPACK to be more expert and context-sensitive (Brianza et al., 2024). It not only includes an awareness of the proximal teaching environment but also comprises an understanding of larger systems and cultures and their influences (Mishra & Warr, 2021). In response to the accelerating use of Generative Artificial Intelligence (GenAI) in society, scholars suggest teachers need to understand not only how to use GenAI effectively for their lessons (TK), but also how their actions are influenced by external factors such as policies on AI use and academic integrity (XK) (Mishra et al., 2023). More specifically, Mishra et al. (2023) hope that teachers who develop their TPACK will look beyond their immediate context to also consider how GenAI may affect them and the students' personal and professional futures. Heath and Moore (2024) have maintained that ethical concerns are integral to XK, and may involve issues such as data rights, privacy, accessibility, and the socio-economic contexts of students.

Contextual Layers

Harris and Huang (2024) postulate that Bronfenbrenner's bioecological system has been the most commonly used framework for understanding contextual influences in educational technology. The framework was initially used to explain a child's development, consisting of five different layers of context: micro-, meso-, exo-, macro- and chronosystem. A microsystem refers to the immediate environment of the individual, which also encompasses the relationships and settings influencing the child's development, such as family, school, and peer interactions. The interconnections between different microsystems, such as the relationship between a child's school and home, form a mesosystem. An ecosystem is the broader social system that has an indirect influence on an individual, for example including a parent's workplace. The overarching cultural and societal influences are called a macrosystem. Finally, a chronosystem refers to the dimension of time that reflects changes and transitions in a child's life, such as moving between schools.

Some studies have built on the model to understand the contextual factors in teachers' use of TPACK, but most have simplified the model and focused on the main three layers, namely, micro, meso, and macro (Greene & Jones, 2020; Phillips & Koehler, 2016; Porras-Hernández & Salinas-Amescua, 2013; Rosenberg & Koehler, 2015). The framework that guided the present study was derived mainly from Porras-Hernández and Salinas-Amescua (2013), due to its practicality and specific focus on the three major layers and their actors (see Figure 3).

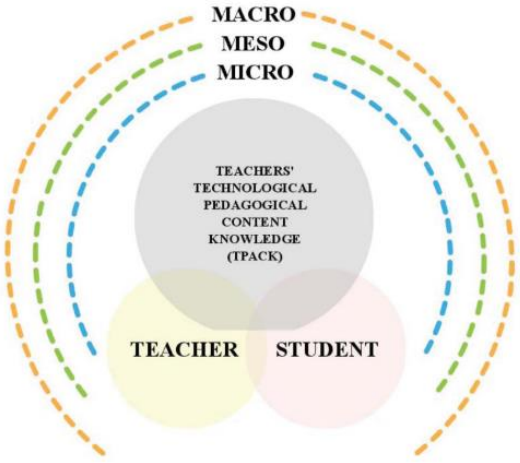

Figure 3. Context conceptual framework by Porras-Hernández and Salinas-Amescua (2013) as represented by (Rosenberg & Koehler, 2015)

The dimensions of context proposed by Porras-Hernández and Salinas-Amescua (2013) encompass two aspects: scope and actors. Based on the scope, contexts are divided into three layers: macro, meso, and micro. The macro context refers to the conditions at the national and global levels. Conditions at school and in the local community are part of the meso context. Finally, the micro context refers to the in-class conditions. In addition to the scope, there are two actors that may mutually influence teacher knowledge: teachers and students. Teacher-related factors are aspects such as teacher motivation and beliefs, while students' needs and

interests are examples of student-related factors (Porras-Hernández & Salinas-Amescua, 2013; Rosenberg & Koehler, 2015).

TPACK and EFL in the Global South

In the context of the Global South, TPACK has also been widely utilised in English Language Teaching (ELT) to enhance effective technology integration. In their critical review of research on TPACK in language teaching published between 2011 and 2019, Tseng et al. (2020) found that most studies were conducted in Asia with a focus on understanding how EFL (English as a Foreign Language)/ESL (English as a Second Language) teachers enact and develop TPACK. In examining TPACK enactment, Mainake and McCrocklin (2021) investigated technology literacy among 43 EFL teachers in Indonesian high schools. They suggested that while teachers acknowledged having employed various technological tools, there was a need for continued training and more accessible technologies (Mainake & McCrocklin, 2021). The issue of access was echoed by Kusuma (2021) who found that a few Indonesian universities had not provided pre-service teachers with access to technologies. He proposed that this could be due to the fact that Indonesia, like many other Southeast Asian countries, belongs to developing and sub-developed countries with relatively low resources (Kusuma, 2021). Investigating TPACK development, Sari et al. (2021) interviewed two EFL high school teachers in Indonesia and analysed their reflective journals upon their participation in a professional development workshop, suggesting the role of reflective practice in enhancing their TPACK.

However, while many studies have examined TPACK and EFL, very little attention has been given to XK in the Global South context, due to the novelty of the knowledge domain. In their survey conducted among 136 Vietnamese teachers, Nguyen et al. (2024) confirmed that XK is a TPACK subdomain that may alleviate the effects of personal beliefs, school environments, and broader educational policies. In addition, Gozali and Cahyono (2022) conducted a mixed-methods study among Indonesian students during the shift to online learning caused by the pandemic. They argued that the elements of XK were aligned with the principles of Pedagogy of Care, in which teachers give attention to and build relationships with their students (Gozali & Cahyono, 2022).

Modes and Formality of Teacher Professional Learning

In developing knowledge, including XK, teachers employ different strategies, including engaging in teacher professional learning (TPL). Prestridge (2019) distinguishes between teacher professional learning (TPL) and teacher professional development (TPD) based on the nature, engagement, autonomy, and outcome focus. TPL is described as more self-directed and personalised than TPD, and thus facilitates greater engagement and autonomy. In contrast, TPD is formal, often prescriptive, and focuses on content delivery and compliance, with limited flexibility and less emphasis on meaningful practice changes (Prestridge, 2019). Similarly, while preserving the term TPD, Rahman (2019) differentiates between restrictive and facilitative TPD, with the former resembling traditional TPD and the latter representing TPL.

Aiming for broader inclusion, this paper uses the term “teacher professional learning” (TPL) to encompass both formal TPD and informal professional learning (PL), through which teachers

undergo a continuous process of acquiring new knowledge, skills and competencies to improve their practices (Shanks, 2023). Formal TPD refers to structured activities, such as workshops, courses and training sessions that are often mandated by institutions (Shanks, 2023). Thus, formal TPD is typically agenda-based and top-down (Prestridge, 2019) and is often measured by participation rates (Shanks, 2023), rather than through a comprehensive evaluation of the learning outcomes or the effectiveness of the TPD itself (Lim et al., 2020). Conversely, informal PL is spontaneous, unstructured learning that occurs through everyday experiences and interactions (Shanks, 2023) and is self-directed and often driven by personal interests (Prestridge, 2019).

Recent research has underscored the importance of collaboration and informal learning in teacher knowledge development. Zhang and Wong (2021) found that effective knowledge development occurs in collaborative contexts, where teachers are encouraged to make their knowledge public and develop collective knowledge. In a multicase study involving teachers and principals across three different schools in Indonesia, Rahman (2019) identified teachers' and principals' preferences for personalised and participative professional learning programs over top-down, structured ones. In the same vein, Shanks (2023) suggested a shift towards recognising the importance of informal learning, such as informal coaching and mentoring, informal interactions and everyday learning experiences, in addition to formal education. In their research, Oakley and Pegrum (2015) found that teachers benefitted from a combination of formal and informal professional learning strategies. Since effective professional learning occurs over a span of time, formal TPD may serve as a trigger but informal interactions with colleagues and students are likely to be more effective (Oakley & Pegrum, 2015).

Furthermore, technology plays a vital role in facilitating TPL by offering flexible, accessible and engaging learning opportunities for teachers. In low- and middle-income countries[1], including Indonesia, technology is sometimes used to mediate professional learning, including virtual coaching, social messaging, blended learning, and video-stimulated reflection (Hennessy et al., 2022). Other applications of technology in TPL involve the use of online assessments to allow teachers to monitor their own PL, such as using Google Forms for pre- and post-tests (Lim et al., 2020). Moreover, teachers may also employ collaborative tools, such as Google Docs (Lim et al., 2020), and instant messaging platforms, such as WhatsApp (Hennessy et al., 2022; Lim et al., 2020) and Telegram (Lim et al., 2020). Prestridge (2019) reported the potential of social media to help teachers connect, share ideas and engage in self-directed PL, which goes beyond traditional settings. However, there are several sociocultural factors that significantly affect TPL for technology integration, namely access to technology, cultural contexts, school cultures, collaboration and community, and sociopolitical factors (Tondeur et al., 2016).

[1] Country classification by income level according to the World Bank (https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups)

Constraints on Teacher Professional Learning (TPL)

Constraints on TPL can be external or internal. Time constraints have been identified as one external factor that may affect TPL. Through their qualitative studies involving senior secondary school teachers, Widayati et al. (2021) found that Indonesian teachers may struggle to participate in PL activities due to their tight schedules and workloads. Moreover, limited access to resources, including funding, materials and technology, may hamper teachers' engagement in PL opportunities (Dalal et al., 2017; Rahman, 2019). Teachers also mentioned that a lack of institutional support, particularly from school principals or educational institutions, may hinder their efforts and motivation to engage in PL (Dalal et al., 2017; Widayati et al., 2021). While such challenges are external, there are also internal constraints such as teachers' resistance to change (Prestridge, 2019; Rahman, 2019).

Constraints may also come from the nature of the PL activities. Some educational authorities still prioritise formal learning (Shanks, 2023) or traditional, compliance-focused TPD (Prestridge, 2019; Rahman, 2019). As a result, the potential of informal learning and everyday interactions is undervalued (Shanks, 2023). Moreover, program content may be poorly designed or irrelevant to teachers' needs, interests, and contexts, leading to disengagement and limited impact (Prestridge, 2019; Rahman, 2019). In Indonesia, TPD programs set up by the Indonesian government (see below) aim for efficiency due to the large number of teachers and often use a cascade model, where teachers trained by experts return to their schools and disseminate the knowledge to their fellow teachers (Rahman, 2019). Despite its usefulness, this model has been criticised for being too general, and lacking relevance to varying teaching environments (Rahman, 2019). Although the cascade model is often used to reduce costs, maintaining the quality of content delivery can be a challenge (Oakley et al., 2023).

Teacher Professional Development (TPD) in Indonesia

In Indonesia, to be certified as a professional teacher and receive a professional allowance equivalent to the basic salary[2], teachers have to complete the *Pendidikan Profesi Guru* (PPG – Teacher Professional Education) qualification in addition to their initial teacher education program. Particularly for civil servants, their participation in TPD is closely linked to maintaining their certification, which is assessed through the *Penilaian Angka Kredit* (PAK - Performance Evaluation System) (Education, 2005). The result of this evaluation influences promotion and salary increases (Chang et al., 2014). A prominent framework that regulates TPD in Indonesia is the *Pengembangan Keprofesian Berkelanjutan* (PKB – Continuing Professional Development) initiative, introduced in 2017. Some of the activities in PKB include training and workshops, collaborative learning, classroom action research, and peer observation. Yet, it has been criticised for tending to adopt a one-size-fits-all approach and lacking follow-up activities post-training (Revina et al., 2020).

More localised forums that allow teachers to collaborate and conduct PL are *Kelompok Kerja*

[2] Additional financial support provided to certified teachers as recognition of their qualifications and professional status.

Guru (KKG - Teacher Working Groups) for primary school teachers and *Musyawarah Guru Mata Pelajaran* (MGMP - Subject Teachers Support Groups) for secondary school teachers. The teacher forums are typically formed at the regional level, within schools and districts, and offer regular meetings aiming at developing teachers' knowledge and competence (Chang et al., 2014). This increases the chance of local relevance to teachers. However, Rahman (2019) indicates that MGMP has been criticised since it has evolved to be a task distribution mechanism where teachers are assigned specific responsibilities and have little autonomy due to top-down control from the national government. In 2020, along with the introduction of the Merdeka Curriculum, the Indonesian government introduced a program called *Guru Penggerak* (Activator Teacher). The program aims to prepare teachers who can mentor fellow teachers at schools, foster open discussions with other stakeholders, and enhance each school's educational system (Kementerian Pendidikan, 2024).

Research Questions

To capture teachers' XK use and development by taking into account their varying contexts, this study aimed to answer the following questions:

1. How do secondary English teachers in Yogyakarta develop their XK?
2. What are the challenges they face in developing their XK?

Methods

Pedagogical Setting & Participants

In a study of contextual factors, a contextual description is imperative. This paper is focused on one site, Yogyakarta, a province located on Java Island. Yogyakarta, short for the Special Province of Yogyakarta, is the only region in Indonesia that still preserves its monarchy system and is ruled by a Sultan, who also serves as the Governor. It had a total population of 3.7 million in 2024 and is famous for being a student-populated province, home to over 100 higher education institutions (*Statistical Yearbook of Indonesia 2024*, 2024). Yogyakarta is the only province in Indonesia that administers the *Asesmen Standardisasi Pendidikan Daerah* (ASPD - Local Education Standardisation Assessment). Besides mapping students' levels of competence and knowledge, this collects data to help identify and improve education quality and find gaps in the education system across regencies[3]. Yogyakarta has also developed some technology initiatives to support teaching and learning, one of which is *Konsultasi Belajar Siswa* (KBS - Online Learning Consultation; see: kbs.jogjakota.go.id). The platform provides an opportunity for students to ask questions regarding any subject matter, which will then be answered by schoolteachers registered with the local Education Office.

Five EFL (English as a Foreign Language) teacher participants came from two schools, SMP[4]

[3] A regency or *kabupaten* in Bahasa Indonesia is an administrative division within a province. It has an equivalent status and function to a city or municipality.

[4] An acronym for *Sekolah Menengah Pertama* or, in English, junior secondary school.

Mandala and SMP Cita. Both schools are A-accredited[5] and are located in the same district, Ciptaharja (pseudonym). Table 1 summarises school and participant demographics. School and teacher names are pseudonyms.

Table 1.
Schools and participants' demographics

Name of school	Type of school	Name of teacher	Gender	Age	Years of teaching experience
SMP Mandala	Private; faith-based	Asteria	Female	Early 50s	> 20
		Janu	Male	Late 30s	10 – 20
SMP Cita	Public	Dewi	Female	Early 50s	> 20
		Candra	Female	Early 40s	> 20
		Bethari	Female	Early 40s	10 – 20

Design of the Study

This paper reports on a qualitative case study, defined as "an in-depth description and analysis of a bounded system" (Merriam & Tisdell, 2016, p. 37). It formed part of a set of case studies, also called multicase or multisite case studies (Merriam & Tisdell, 2016), investigating XK development and use among English teachers on three islands in Indonesia: Java, Kalimantan, and Sumatera. On each of the islands, there were participants from two junior secondary schools, one public and one private.

Data collection & analysis

The main instrument used was in-depth interviews. Before the interviews, participating teachers were asked to submit at least three sets of lesson plans and any digital artefacts, such as teaching media or tools, they had produced and used in their lessons. Since the interviews were Stimulated Recall Interviews (Smart, 2016), the lesson plans and digital artefacts were utilised to inform the interviews and help teachers recall their experiences. Therefore, they were not analysed separately. Each interview lasted for around 90 minutes and took place at the schools during September and October 2023. Below is a sample of interview questions and the prompts that addressed teacher XK (see Table 2). Before the data were collected, the research had received ethical approval from the Human Research Ethics Committee of The University of Western Australia.

The interviews, conducted in Bahasa Indonesia, were transcribed and translated into English. The transcript and translation were sent to each of the relevant participants for verification. Qualitative data analysis followed the phases of data reduction, data display, and conclusion drawing and verification (Miles et al., 2014). NVIVO was used to help the researchers organise and code the data. The first phase of coding was done through inductive and deductive approaches, in which some preset codes were determined before coding started based on the three contextual layers framework (Porras-Hernández & Salinas-Amescua, 2013) that guided

[5] Meets or exceeds the standards set by the *Badan Akreditasi Nasional Sekolah/Madrasah* (BAN-S/M - the National Accreditation Board for Schools/Madrasas).

the study. However, the codebook later expanded as the coding progressed.

Table 2.
Sample of interview questions

1. What strategies have you used to develop your Contextual Knowledge?* *Prompts: social media, reading news, reflection (on and/or in action), teaching journals, internet browsing, formal/casual conversation with students, parents and/or colleagues, workshops/seminars, school meetings, annual reports, professional learning networks (e.g. MGMP)?* *2. In developing your Contextual Knowledge, what challenges have you faced?* *a. How have you overcome the challenges?* b. *Are there any challenges that you have not been able to overcome?*	**Definition given to participants: Contextual Knowledge is knowledge about contexts where teaching and learning are situated. It incorporates knowledge about the learning environments at the micro level (classroom level), the meso level (school and community levels), and the macro level (national and global levels).*

In the second phase, similar codes were grouped into categories or subthemes, which then formed themes. For instance, as seen in Table 3, codes such as "learning community at school" and "regional teachers' association" were grouped into "meso level" and "formal professional development" categories. They were then clustered under the theme: Collegial collaboration and professional learning at the meso level". After reviewing and refining the categories, four themes were developed as seen in Figure 4.

Table 3.
Example of code, category and theme development

Interview excerpts	Code	Category	Theme
Asteria: We also have small and large groups of English teachers. The small one is only [the scope of] a city, while the big one, JETA (Jogja English Teachers Association) covers the province.	• Learning community at school • Regional teachers' association	• Meso level • Formal professional development	• Collegial collaboration and professional learning at the meso level

Below is the figure that illustrates the mapping of the research questions, methodology, and findings.

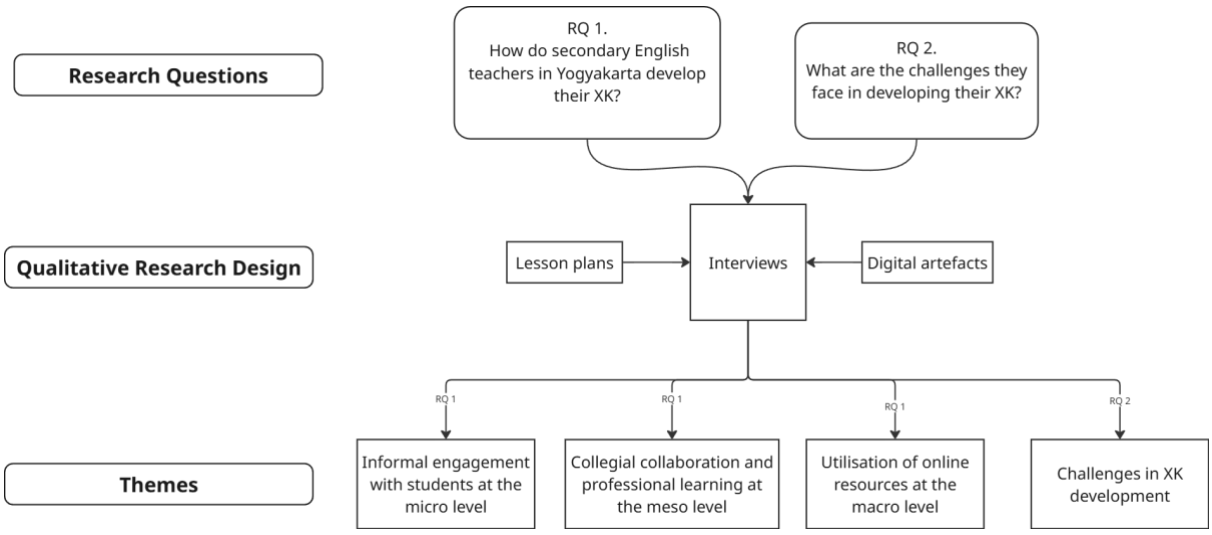

Figure 4. A visual mapping of the research questions, research design, and themes

Findings

Data analysis yielded themes regarding teachers' strategies for developing their XK. First, at the micro level, informal engagement with students helped teachers gain awareness of the students' backgrounds, interests, and abilities. Secondly, in addition to more formal PL, collegial collaboration with fellow English teachers at the school and district levels served as a commonly used strategy at the meso level. Thirdly, technology was prominent in facilitating teachers' XK development at the macro level. Finally, despite their efforts, participating teachers acknowledged various difficulties in developing their XK.

Informal engagement with students at the micro level

All of the teachers in both schools reported that they benefited from informal interactions with their students, occurring both within and outside the lessons. At the classroom level, in addition to students' work, most teachers used informal observations to help them gain more knowledge of students' abilities, interests and any issues the students might be encountering. For example, by examining students' writing, they could identify their individual English levels and differentiate instruction accordingly. While the national *Merdeka* curriculum requires teachers to conduct written diagnostic tests at the start of a new lesson unit, most teachers also relied on informal assessment of levels through classroom conversations and observations. For example, Asteria elucidated her understanding that her teenage students were interested in romance, which was seen as they performed a role play of "Snow White" when learning about *Narrative Text* in a unit of study. Likewise, Candra evaluated her experiments with varying teaching approaches by closely observing students' reactions.

Besides in-class interactions, the teachers highlighted their face-to-face interactions outside lessons. A common way to approach students was by expressing curiosity about the topics they were discussing. For instance, Candra mentioned how she was introduced to TikTok by her

students as she was walking past them during recess:

> That's why I'm close to the children because... For example, when they get together, sometimes I'm greeted [by the students]. "What are you doing?" I ask. I ask, "What's that called, why is it like that?" I ask questions. At the beginning of the TikTok hype, I was also intercepted by the children. "Come on, Ma'am, make TikTok together." How do you do that? "Just do this, Ms. Candra." (Candra)

The teachers' good rapport with their students appeared to foster meaningful teacher-student face-to-face interactions beyond the classroom. The teachers in this research called the students *anak-anak* or children. This is very common in Indonesia, where "students" and "children" are used interchangeably by teachers regardless of the age of the students. It may signify how teachers positioned themselves as parental figures to whom students could freely express their thoughts. Dewi noted that her established relationship with her students allowed them to confide in her about their feelings and family dynamics. Similarly, Asteria, who initially faced challenges due to her strict demeanour, worked to create a more approachable atmosphere by showcasing her humorous side. She believed that the shift in her approach helped students feel more comfortable discussing their experiences and encouraged them to engage more openly in class.

Candra's rapport with her students helped her learn not only about their use of TikTok, as seen above, but more generally about their internet habits and interests, including their involvement in online games. She described how a student introduced her to a popular roleplaying game and expressed concerns about its harmful effects. Candra sought advice from the guidance counselling teacher and her own daughter to better understand these online communities. Similarly, as a senior teacher, Asteria also exchanged some ideas with her own children, who happened to be teachers, too, in order to gain some insights into how to make her approaches relevant to the younger generation.

Additionally, the teachers' interactions with students extended beyond the physical environment to virtual spaces. For example, through his interactions with students outside class, Janu was able to identify and address instances of misconduct. He noted that during the pandemic, he learned the strategies students used, such as joining the online class and then leaving partway through. In Indonesia, there are no rigid guidelines for social media use between teachers and students, thus social media was used to inform teachers about students' interests. Asteria shared that by befriending her students on social media, she was able to recognise the conflicts they faced:

> Even though it can be said that they do it behind the curtains, it is still visible when they are rude. Some may even violate the rules, such as bullying and so on. It seemed like here [at school] the relationship was fine in class. There's nothing wrong with it. It turned out that on social media they were at war. (Asteria).

Asteria addressed the problem by involving several parties, including the homeroom teacher, the guidance and counselling teacher, and some parents. Most permanent teachers in Indonesia typically also serve as homeroom teachers, who are responsible for students' academic and personal progress and maintain close communication with parents.

Collegial collaboration and professional learning at the meso level

Teachers at both SMP Cita and SMP Mandala engaged in collegial collaboration at the meso level. Through informal discussions and daily interactions among teachers, teachers at both schools shared insights about their students, exchanged teaching strategies, and collaborated on problem-solving. Dewi, for example, sought advice from her colleagues whenever she felt that her teaching strategies did not work for particular classes. In both schools, the frequency and quality of interaction and communication among colleagues were heightened due to a local policy implemented by the school that required a grade to be taught by multiple teachers. For instance, Asteria and Janu jointly taught grades 8 and 9 at SMP Cita and, likewise, Candra and Bethari jointly taught grades 8 and 9. As Janu described:

> Yes. ... there is a syllabus as a reference, but in the daily dynamics, it is easier for us to communicate. Put simply, we check with each other... by asking "How is it going? What do you use for this material? Which material did you use?" or ... "What video did you use in the past? Which exercises did you use? What kind of question model? What test? Have you made it yet?" There is mutual communication there. (Janu)

In addition to regular school briefings in both schools, teachers' strategies in developing XK were mediated by a sense of community beyond formal settings. For instance, the three teachers at SMP Cita described that among the school staff, there was a sustained culture where every day they would meet and have lunch together. Teachers often brought food to school to share with other teachers, particularly on special occasions. This collegial relationship was also reinforced by interactions outside of school, such as outings organised by teachers. Through these informal gatherings, teachers could foster their personal connections and a sense of belonging. MGMP was also identified as a platform where the participants met and collaborated with fellow English teachers at other schools in the city. The forum helped inform teachers of any issues at the regional level, as Bethari mentioned:

> I participate in MGMP, too, to follow what information is related to developments about education in Jogja [Yogyakarta]. I follow like... workshops or something like that. (Bethari)

Yet the participants indicated that the regional forum meetings were not held regularly, possibly due to the post-pandemic situation. Candra stated that in 2023, there had been only three meetings. Although the forum members could still use WhatsApp to communicate, Bethari noted that it was mainly used for sharing information, such as promotional flyers for workshops or training, and was rarely utilised as a discussion forum. However, in both schools, *Kombel* (*Komunitas Belajar* – Learning Community), or school-based MGMP, was also regularly conducted. During the meetings, English teachers could share their good practices and seek solutions to issues they faced. Moreover, open communication and a supportive environment were not restricted to English teachers, but involved other colleagues.

Despite their similarities, particularly in collegial collaboration, SMP Cita and SMP Mandala exhibited notable differences in formal professional learning. As a public school, SMP Cita operated with a structured system of regular workshops and seminars based on needs assessment, including some focused on digital tools and inclusive education. Additionally, the school's status as an Activator School provided funding to organise workshops focusing on

implementing the Merdeka Curriculum. In contrast, teachers at SMP Mandala faced limitations in accessing external professional development opportunities due to their status as a private school. Thus, they relied more on the cascade model of workshops by learning from fellow teachers who had a chance to join workshops organised by the local Education Office.

Utilisation of online resources at the macro level

While face-to-face interactions at the macro level were limited, the teachers reported on the usefulness of technology-mediated learning. Only two teachers, Bethari and Candra, had an opportunity to join an online *Calon Guru Penggerak* (Activator Teacher Candidate) program organised by the national government. Accessing the *Platform Merdeka Mengajar* (PPM – Freedom to Teach Platform) was also mentioned by participants as an opportunity to stay informed about the national curriculum and seek guidance on applying it in their classrooms. When teachers sought more general information, they turned to Google. Furthermore, not only did teachers use social media to identify students' common interests, but they also employed social media to find inspiration regarding effective classroom approaches. Some applications mentioned included YouTube, WhatsApp, Twitter, and TikTok.

Through their self-directed learning – some of which was incidental – the teachers became aware of topics that would be relevant to teach. For instance, Janu mentioned how he became aware of the relevance of discussing ChatGPT as he was browsing YouTube. He then designed teaching content based on the topic. It demonstrates how the insights from the macro context, such as an awareness of global trends, could influence teaching strategies in the micro context.

Similarly, Dewi mentioned that she sometimes opened her phone when having difficulty sleeping and started to explore social media feeds. Often, she came across helpful content that she wished to try in her classes. To keep track, she sent the links to her WhatsApp account.

> I keep everything here [showing her WhatsApp account], *Mbak*[6]. This is English vocabulary related to food, daily expressions. Then this is the "Hokey Pokey" song. Then, this is description. Everything is from the feeds. If I need it, just click on it. Oh, this way. Instead of me searching again, I save everything. (Dewi)

Both Janu and Dewi exemplified how technology contributed to their knowledge development at the macro level by increasing their awareness of recent trends that aligned with students' interests and needs. Their practices also highlighted the role of technology in inspiring content development and refining teaching strategies at the micro level.

Challenges in XK development

In developing their contextual knowledge, the teachers encountered challenges. Most mentioned workload as a hindering factor. In addition to teaching, all the teachers had other roles, such as being a homeroom teacher, a vice principal, or a member of an ad hoc committee. Work demands impacted teachers in at least two ways. Firstly, they had very little energy left to undertake formal PL activities. Bethari and Dewi, at first, identified a lack of motivation as a challenging factor. However, when asked to elaborate, the reason turned out to be mental and

[6] An Indonesian (originally Javanese) term to address an older sister, a young woman, or a woman of similar age or slightly older, to show respect and politeness.

physical exhaustion due to workload. Dewi, one of the most senior teachers, expressed how she felt physically and psychologically drained:

> It's a lot of work, *Mbak*. O God, I haven't finished this, this, this. Clearly, I keep thinking, *Mbak*. Alas, alas. I'm not even looking at it. That's me. That's it, *Mbak*. But when people see, [they say] "Dewi never feels tired. She does this. She does that." But inside of me, maybe they don't know. So if I'm at home at night, if I don't want to open my laptop, I don't open my laptop. I'd rather play with my mobile phone. I do that. If not, I go to sleep. (Dewi)

What Dewi expressed in the above excerpt connects to her quote in the previous section. As she had difficulty sleeping, which may have resulted from exhaustion, she opened her mobile phone and found some resources and inspiration to teach. It demonstrates that even during their leisure time, teachers do not always fully disconnect from their role as teachers.

Relatedly, a heavy task load also meant teachers had limited time to take part in PL activities. Candra mentioned how her commitment to attending specific workshops sometimes clashed with other agendas. Janu faced a particularly challenging situation. Not only was he involved in many school activities, but he also lived a one-and-a-half hour drive from the school and had small children to look after. Significantly, he also mentioned tiredness:

> At a school with many non-curricular activities and numerous non-teaching tasks, one of the key challenges is time management. I believe this is where I face the biggest struggle. Up until now, I'm still trying to manage it. Dividing my time effectively, with teaching hours dedicated to marking, while also attending to committee responsibilities, is difficult. When I get home, the situation... especially with the distance and the exhaustion… makes it even harder. So, it really comes down to time management. (Janu)

While online professional learning may offer more flexibility in terms of time, Candra highlighted that she personally preferred and benefited more from in-person training or workshops. She cited being less tech-savvy as the reason underlying her preference, particularly if the workshops focused on teaching media and digital technologies.

Discussion

The four key themes that have been presented in the findings are: 1) informal engagement with students at the micro level, 2) collegial collaboration and professional learning at the meso level, 3) utilisation of online resources at the macro level, and 4) challenges in XK development. This section discusses these themes in light of the three contextual layers framework as well as the existing literature, and highlights implications for TPL practice and policy.

First, this study demonstrates that the strategies the teachers employed in one layer often informed their knowledge development in other layers. For instance, informal teacher-student conversations at the micro level helped teachers identify individual or classroom-specific challenges. These in turn drove them to collaborate with their colleagues at the meso level to seek solutions, such as modifying teaching strategies or utilising school resources. Likewise, teachers' engagement in national-level TPD programs at the macro level equipped them with strategies that they could later refine through experimenting with classroom practices (micro

context) and collaboration with fellow teachers (meso context).

Second, this study not only highlights the reciprocal relationships among the three layers in XK development but also suggests that XK is a domain of knowledge. This study offers qualitative insights to support Nguyen et al.'s (2024) quantitative study in the Global South context. Looking into XK among EFL teachers in Vietnam, they found that the XK construct was clearly identified and validated through its strong link to TPACK. However, as a domain of knowledge, XK is often intertwined with the other knowledge domains within the TPACK framework. This corroborates previous literature (Angeli & Valanides, 2008; Oakley, 2020), reflecting the fact that knowledge domain boundaries are often difficult to disentangle. When asked about the development of their XK, participants in this study mentioned strategies that were also useful in developing technological, pedagogical, and content knowledge. Although XK can be understood as a distinct form of knowledge, the findings demonstrate that the participants often developed their XK alongside other domains of knowledge. When XK was first introduced (Mishra, 2019), it was still represented by an outer dotted circle. Therefore, it suggested that XK was an external, overarching factor rather than an interacting domain. However, the latest update which positions XK inside the dotted circle seems to better represent the interactions between XK and other knowledge domains.

Third, the findings highlight the significance and potential of relationality, or the inter-relational dynamics between teachers and students (Riddle & Hickey, 2024), in teacher contextual knowledge development, particularly in the micro context. This resonates with Gozali and Chayono's (2022) study, which investigated Indonesian students' perspectives on EFL teachers' TPACK and XK. They found that the concept of XK, especially what they term Knowledge of Students, aligns closely with the principles of Pedagogy of Care, which emphasises the importance of building strong relationships with students (Gozali & Cahyono, 2022). Moreover, Dickerson et al. (2021) highlighted the role of students in teacher knowledge development. Teachers may not plan their interactions and conversations with students in the classroom in detail, yet they may serve as an effective way to connect more closely with the students' lives. Interactions and conversations with the students, and teachers' reflections on them, can provide a number of ways for teachers to be more informed of the students' backgrounds, characteristics, needs, and interests. Therefore, it is necessary for teachers to gain trust and build strong teacher-student relationships to better understand their students' backgrounds.

In addition, the findings may suggest a changing perspective in perceptions of teacher figures in Indonesian culture. The Javanese word for teacher is *guru*, which is a blend of *digugu* (to listen to) and *ditiru* (to be a role model). The words signify the authoritative attributes of a teacher. The participants in this study implicitly challenged this philosophy as they positioned the students as people they should listen to by delving into their worlds. This shift in teacher-student relationships may also be partly influenced by technology. Echoing Oakley and Pegrum (2015), this research reveals that teacher-student reciprocal relationships can help teachers gain more insights into new technologies that students are familiar with, simultaneously supporting teachers in developing TK and CK.

Fourth, this study showcases the value of informality in TPL at the meso level. Aligning with Kvam (2021), informal discussions may serve as a medium for sharing experiences and exchanging ideas. Teachers seem to engage in unstructured, spontaneous dialogues during morning or afternoon tea and lunch breaks, where they reflect on their practices and seek advice from colleagues. This denotes the prominent role that reflective practice plays in gathering and using XK (Heath & Moore, 2024). This type of strategy may help compensate for the limited relevance of some top-down formal professional development (Rahman, 2019; Widayati et al., 2021). It also highlights the importance of schools facilitating a culture of conversations among teachers, with one strategy being a joint-teaching policy. Therefore, the roles of leadership and policy are vital to promote a strong collegial culture.

At the macro level, informal PL through social media was also prominent among the participants in this study, echoing findings in international studies such as Prestridge (2019). However, while Prestridge (2019) found Twitter – now X – was the main platform used among teachers in Australia, Europe and the US, the participants in the current study emphasised more visually oriented platforms like TikTok, Instagram and YouTube, along with Facebook. The findings of this study also suggest that the participants seemed to merge personal and professional purposes in their social media use. Although the participants did not explicitly mention that they followed professional accounts, the fact that they found some content about teaching suggests they were actively searching for educational content during their leisure time. Yet, the blurred boundaries between personal and professional uses of social media may raise some concerns. For example, teachers often seem to use social media connections to facilitate their understanding of students' backgrounds. However, befriending students on social media, which is quite common in Indonesia, could pose privacy challenges by obscuring the distinction between professional and personal domains (Jarvie, 2019). Therefore, awareness of the implications and ethical concerns should also be embedded in contextual knowledge (Heath & Moore, 2024).

Finally, this study reveals the extent to which high workloads and heavy responsibilities – regardless of age, gender, and career stage – may hinder teachers' knowledge development, aligning with previous research in the Indonesian context (Revina et al., 2020; Widayati et al., 2021). The lack of motivation that the participants reported was likely a result of work pressure, resulting in physical and mental exhaustion. This suggests that external demands, rather than personal characteristics, may be the dominant hindering factor. It should be noted that the decentralised education system in Indonesia allows local governments to impose different expectations on teachers, which may result in inconsistencies in teacher workloads in different regions in Indonesia (Lim et al., 2020). Moreover, studies by Chang et al. (2014) and Rosser (2018) found that in Indonesia, teachers' burdens are often amplified by a lack of managerial autonomy and the prioritisation of political interests over educational goals. In the case of Yogyakarta, despite supporting local education quality, the implementation of ASPD may have added to the burden on teachers.

This study has a number of key implications. Teachers can benefit from a combination of different spaces and modes of professional learning in their XK development. For instance,

teachers may maximise the Indonesian government's initiative, *Komunitas Belajar,* at the school level, and MGMP at the regional level, which serve as formal professional learning activities. However, the formal structures of *Kombel* and MGMP still allow some space for informal learning. *Komunitas Belajar*, similar to a community of practice, can provide a platform where teachers evaluate, critique and reflect on what they have informally learned. As those forums are locally formed, the focus can be on local contextual issues that teachers and schools face. Especially with the growing recognition of differentiated instruction in Indonesian education, contextual knowledge could be one topic of discussion in forums. Furthermore, to address the high workloads that hinder teachers in developing XK, there should be policies that regulate administrative burdens. Technology could play a role in simplifying teachers' administrative tasks by, for example, equipping them to maximise the use of Generative AI in lesson planning. With reduced workload obligations, teachers might be able to engage more in activities that foster their XK, such as exploring student needs in-depth, interacting with colleagues, and participating in PL.

There were some limitations to this study. First, despite the extensive data derived from in-depth interviews, the study only involved a small number of participants. Since this research is closely connected to local contexts and employed a qualitative case study approach, the results may not be generalisable to other contexts. Also, the present study is part of a larger multisite case study, which is anticipated to reveal additional findings in due course. This study suggests that XK is still slippery and "wicked" (Heath & Moore, 2024, p. 8) due to its complex and multifaceted nature involving numerous interdependent factors. Therefore, more studies on XK, particularly on how it is enacted, are needed. Future studies could also employ methods like self-report surveys or reflective journals to gain deeper insights into teacher XK development.

Conclusion

This study sought to understand how contextual knowledge (XK) is developed among secondary school English teachers in Yogyakarta, Indonesia. The interviews revealed different strategies teachers employ at different layers of context. At the micro level, teachers often benefit from informal engagement with the students, inside and outside the lessons. Collegial collaboration and professional learning are prominent at the meso level, where teachers can consult, cross-check and evaluate their knowledge. The use of online resources also facilitates knowledge development at the macro level. However, the issue of teacher workload persists and may hamper teachers' XK development, and thus needs to be carefully addressed.

The findings suggest the potential of *Komunitas Belajar,* the government's initiative where teachers of the same subjects at school meet regularly to share knowledge. This localised program can serve as a follow-up to formal workshops, which are often not context-specific. In addition, despite their usefulness, informal interactions and incidental learning are often ill-documented and unrecognised as ongoing professional learning. Therefore, policies are needed to recognise these activities as part of professional learning. Such recognition could also help reduce teacher workload, which is often increased by participation in formal TPD programs.

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