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*Research Article*

# Navigating young children's online learning at home: A cross-case analysis of parental TPACK development during COVID-19

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The COVID-19 pandemic in early 2020 forced schools in China to shift abruptly to online learning, placing unexpected demands and responsibilities on parents who supported their children's online learning over a two-year period (2020-2022). Families and teachers were unprepared for this change, especially for families with young children. This study examines how parents as co-educators navigated these responsibilities and developed Technological Pedagogical Content Knowledge (TPACK) within international school contexts during the pandemic. A qualitative design was adopted, utilising semi-structured interviews with three parents of children aged 3-9 years enrolled in an International school that offers the International Baccalaureate Primary Years Programme in China. Participants were recruited through purposive and snowball sampling. The TPACK framework was used to analyse the data to determine how parents integrated technological, pedagogical, and content knowledge. Findings reveal that parents initially struggled with unfamiliar technologies and pedagogical strategies. However, they gained a sophisticated knowledge of supporting their children's learning online over the two-year period. Children's online learning was influenced by contextual factors, such as device access, parental workload, household composition, culture, and developmental level. Parental TPACK was developed through experiential experiences, which differed from those of teachers with formal training, thereby expanding the framework beyond teacher use. The study highlights the critical role of parents as co-educators, with implications that include strengthening parent-school partnership models, developing hybrid-readiness policies, and underscoring the need for policies that account for home-based learning in future educational planning, particularly during times of crisis.

Keywords: Co-educator; COVID-19; Online learning; Parents; Technology; TPACK

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## 1. Introduction

The COVID-19 pandemic led to an unprecedented shift by schools to online learning worldwide to ensure the continuity of education. The Ministry of Education in China swiftly implemented the 'Learning Continues' initiative in early 2020 (Ministry of Education [MoE], 2020), prompting an immediate shift to learning online. Schools alternated between in-person and online learning from the first online learning in 2020 (Rappa et al., 2025) until early 2023 due to intermittent lockdowns

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(World Health Organisation [WHO], 2023). This extended period of multiple shifts highlighted the opportunities and challenges of online learning, especially for young children in Early Childhood Education [ECE]. Traditionally, 'developmentally appropriate practice' in ECE relies heavily on face-to-face, hands-on, play-based, and socially interactive learning environments (Cade et al., 2022; Mengstie, 2023).

The sudden transition to online in early 2020, coupled with multiple immediate shifts to online learning over the following two years, required parents to engage with technologies and implement pedagogical strategies to support their children's learning and development. While some parents were IT savvy, many lacked formal training or prior knowledge of using technology for young children's learning. Little research has explored how parents, regardless of their technological proficiency, developed these competencies and adapted to new roles as co-educators during COVID-19.

## 2. Study Background

As learning moved to online at home, many parents were thrust into new and unfamiliar roles as co-educators, co-facilitating their children's online learning alongside their teachers (Ilmanto et al., 2021; Novianti et al., 2021). These shifts required parents to adapt to new ways of collaborating with teachers (Laxton et al., 2021). Parents play a critical role as children's first teachers, as early parental involvement and family support significantly influence children's learning experiences, well-being, socio-emotional development, and educational outcomes (Coelho, 2026; Fan & Chen, 2001; Kim et al., 2015; Kostov, 2026; Oladele & Komolafe, 2025; Rani et al., 2025). However, the terms 'parental involvement' and 'partnership' are often used interchangeably despite potential differences in meaning (Cottle & Alexander, 2013; Kambouri et al., 2022).

Epstein and Sheldon's Framework of Six Types of Parent Involvement emphasise parents' critical role in children's education. It ranges from basic responsibilities at home to active collaboration with schools, which refers to a parent-teacher partnership, where both are actively involved in the child's schooling (Epstein & Sheldon, 2023). This study employs the term 'partnership' to denote the shared responsibility, sustained dialogue, and reflection between parents and teachers that enhance learning outcomes and foster a supportive educational environment (IBO, 2018a, 2018b; Licardo & Leite, 2022; Lund, 2024). Parents and teachers can strengthen the bridge between home and school to enhance their children's learning by maintaining open communication with educators and participating in school activities (IBO, 2018b, 2018c; Kambouri et al., 2022; Levy & Peleg, 2022).

## 3. Literature Review

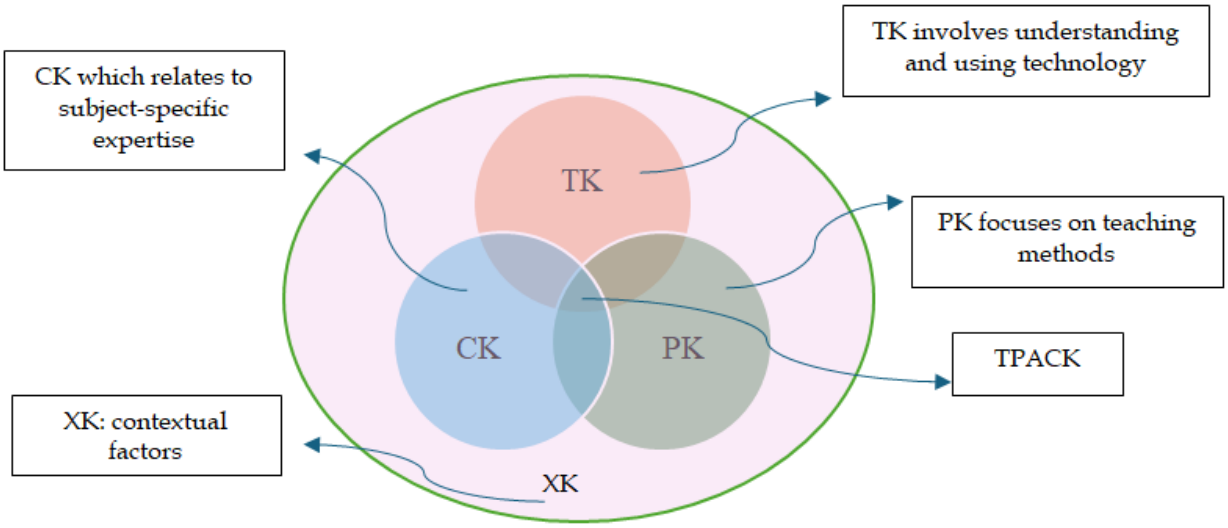
TPACK is a framework that describes the interconnected knowledge teachers need to effectively integrate technology into their teaching (Mishra & Koehler, 2006). It has three core components essential for effective teaching in technology-enhanced environments, including Technological Knowledge [TK] as knowledge of using technology for educational goals, Pedagogical Knowledge [PK] as knowledge of teaching and learning processes, and Content Knowledge [CK] as knowledge of subject matter (see Figure 1). The revised TPACK framework includes Contextual Knowledge [XK], acknowledging that teachers' ability to integrate technology is shaped by the specific contextual factors (Mishra, 2019).

TPACK has traditionally been applied to teachers' technology integration (Mishra, 2019), and substantial research has examined teachers' TPACK in ECE. For example, studies have explored how teachers integrated TK with PK in ECE (Luo et al., 2023; Muir et al., 2016; Yang & Hong, 2022). In addition, the research scope has included: teachers' ICT integration with play-based learning in ECE (Xie et al., 2026), teacher-level TPACK profiles (Li & Bai, 2025), teachers' TPACK within multi-layered ecological systems (Yang & Dong, 2024), teachers' TPACK efficacy (Chen et al., 2024), in mathematics (Muir et al., 2016), literacy development (Formen et al., 2023; Leung et al., 2024) and how play-based learning occurred online during COVID-19 pandemic with parents'

support as co-educators (Rappa et al., 2025).

Figure 1

*TPACK Framework with definitions*




*Note.* Adapted from Mishra (2019).

### 3.1. Research Gap and Importance of the Study

Despite the proliferation of TPACK research in education, a notable gap in understanding parental TPACK persists in empirical studies, as none have explicitly investigated parents' TPACK as an integrated knowledge construct. Existing research has predominantly focused on teachers' adaptations (Chen et al., 2024; Luo et al., 2023), with limited attention to the knowledge parents developed through this experience- though teacher-parent partnerships are crucial for young children's learning **(**Kambouri et al., 2022; Licardo & Leite, 2022; Lund, 2024). Rappa et al. (2025) found that during COVID-19, teachers relied heavily on parents to support children's access to technology and completion of online tasks. Yang and Dong (2024) also identified family and community contexts as important XK factors influencing teachers' ICT implementation. However, neither study examined how parents develop TPACK or how parent-teacher partnerships could be strengthened through a shared understanding of TPACK. The abrupt shift to online learning during COVID-19 and school closures provided an opportunity to explore how parents' TPACK developed as they were expected to adopt new roles as co-educators without formal training or resources (Rappa et al., 2025). Hence, exploring parents' unique challenges and investigating their TPACK development during this historic time can expand the TPACK framework beyond teachers, identifying gaps in education support systems.

This study is highly significant for three primary reasons. First, it extends TPACK beyond educators, offering theoretical insights into how parents develop integrated knowledge domains through their support of young children's online learning with technology. Second, it provides empirical evidence on parental experiences during the unprecedented COVID-19 pandemic, informing emergency preparedness planning for schools and policymakers. Third, the findings have practical implications for strengthening school-parent-parent partnerships in post-pandemic ECE contexts.

### 3.2. Aim and Research Question

This study aimed to investigate how three culturally diverse parents' TPACK developed through trial and error at home to support their young children's online learning during the COVID-19 lockdowns over a two-year period (February 2020- February 2022). Specifically, the study sought to: (a) trace parents' TPACK development across two phases of online learning; (b) compare support strategies for children of different ages (3-5 years vs. 7-9 years); (c) identify the timing

structures (fixed vs. parent-abrupt) parents employed; and (d) examine contextual factors (XK) that influenced parents' decision-making and children's online learning at home. A cross-case analysis of three families with six children was conducted to identify shared patterns and divergences in how parents mediated online learning at home for children aged 3-9 years enrolled in an IB PYP international school.

The research was guided by the research question: 'How did parents' TPACK develop through their experiences of supporting their young children's learning online at home across three phases of the COVID-19 lockdowns over a two-year period (2020–2022)?'

## 4. Methods

### 4.1. Research Design

This study employed a qualitative multiple-case study design to explore how parents developed TPACK while supporting their children's online learning during the COVID-19 pandemic at an international school in China that offers the International Baccalaureate Primary Years Programme [IB PYP]. As Creswell (2017) emphasises, qualitative research is particularly suited to uncovering context-rich, in-depth understandings of subjective experiences. A case study approach is appropriate when the researcher seeks to explore a bounded case within a real-life context and to gain an in-depth understanding of a contemporary phenomenon of young children's learning online (Creswell & Poth, 2018). The case boundaries were clearly defined by time (2020- 2022 during the COVID-19 pandemic), place (China), and participants (parents of young children aged 3-9 years). The intent of case study research is to provide a holistic, contextualised understanding of a particular case (Yin, 2018). Case study research can be intrinsic, where the case itself is of particular interest, or instrumental, where the case is studied to gain insight into a broader issue (Creswell & Poth, 2018). The research design was selected to develop a rich, contextual understanding of parents' experiences and to better understand the development of parens' TPACK knowledge over time. A multiple case study design was adopted because each case consisted of parent participants with two children across different grade level from this school, and the aim was to compare variations within the cases (Yin, 2018). Multiple case studies are particularly valuable when the researcher seeks to examine how an issue manifests in diverse contexts and to enhance the robustness of findings through replication logic (Yin, 2018). A multiple case study design was adopted as parents' experiences varied significantly across factors such as access to technology, parental roles and expectations, and family support structures. Additionally, their children's online learning experiences were at different developmental stages. Each parent represented a distinct case. Thus, this design enabled comparisons across families, revealing common challenges, such as balancing work with supporting children's online learning, as well as unique ways families fostered learning through play. Within each case, each child represents a sub-case, enabling cross-case analysis. This sequential multi-case study approach enabled a more comprehensive and multi-layered analysis of young children's online learning. This design allows for an in-depth exploration of the personal experiences and perceptions of parents and comparisons across participants' experiences, providing a comprehensive understanding of how parents' TPACK evolved while supporting their children's online learning and insight into shared patterns and unique variations in the development of parents' TPACK in these contexts.

### 4.2. Participants

Participants were purposively sampled for their relevant and insightful perspectives (Campbell et al., 2020). The participant school teachers provided a list of potential parent participants who supported their children (aged 3-9 years) during online learning from February 2020 to February 2022. (Note: The child aged 9 years was aged 7 at the start of the pandemic and was aged 9 years old at the end of the pandemic). Three culturally diverse parents (one German, one Chinese German and one Chinese American) volunteered. Each parent supported two children at different grade levels, offering varied perspectives on learning needs and contexts. Table 1 summarises

parents' demographic profiles, workplace contexts, and levels of involvement in their children's online learning.

Table 1
*Demographic Profile, Workplace Context, and Involvement of Parent Participants*

| *Parent* | *Cultural Background* | *Workplace Context* | *Time Involvement in Children's Online Learning* |
|---|---|---|---|
| Ava | German | Full-time employed (remote/hybrid work) | Moderate (evenings and weekends; limited availability during core work hours) |
| Becky | Chinese German | Stay-at-home parent | High (available throughout the school day; consistent real-time support) |
| Claire | Chinese American | Stay-at-home parent | High (available throughout the school day; consistent real-time support) |

### 4.3. Data Collection

Semi-structured interviews were used to gather data. Interviews were conducted individually via Microsoft Teams for safety during the COVID-19 pandemic. The interview questions were designed to include TPACK-relevant domains and adaptive probing, including key dimensions grounded in the study's conceptual framework: (a) Content Knowledge (CK); (b) Technological Knowledge (TK); (c) Pedagogical Knowledge (PK); and (d) Contextual Factor (XK). A total of seven open-ended questions with sub-questions were developed and distributed across the TPACK domains (see Table 2).

Table 2
*Mapping of Interview Questions to TPACK Domains*

| *Domains* | *Focus* | *Corresponding Question(s)* |
|---|---|---|
| CK | Knowledge of early childhood learning content, including academic and wellbeing | Q1, Q4 (partially) |
| TK | Knowledge of and attitudes toward technology use (hardware/software, digital tools) | Q2, Q3 (partially) |
| PK | Understanding of teaching/learning practices, parental roles, and teacher collaboration | Q4 (partially), Q7 |
| XK | Home environment, work commitments, household responsibilities, supports, and challenges | Q5, Q6 |

The foundation of this empirical study was strengthened by its rich and detailed accounts of parents' experiences. The interviews were designed to devote roughly equal time to two distinct phases of the online learning experience: Phase One (August 2019 - June 2020) and Phase Three (August 2021 - June 2022). None of the parent participants shared their experiences with online learning during Phase Two (August 2020 - June 2021), as their children did not engage with online learning during this time period. Each interview lasted approximately 60-75 minutes in total, with roughly 30-35 minutes dedicated to each of the two phases. All interviews were audio-recorded with participants' informed consent. Pseudonyms were used to ensure participant confidentiality.

The researcher, who speaks Chinese as a First Language, is also fluent in English as an additional language and conducted all interviews personally. Two interviews were in English and one in Mandarin, according to the participants' language preference. All interviews were audio-recorded, transcribed, and the Mandarin interview was translated into English by the researcher. Transcripts were subsequently returned to participants for member checking to verify interpretive accuracy. Transcripts were analysed using NVivo 14.

### 4.4. Data Analysis

The study employed a deductive thematic analysis using the TPACK framework (Mishra & Koehler, 2019) to examine how parents supported online learning across different grade levels by developing a priori codebooks derived directly from the four TPACK domains (TK, PK, CK, XK). The interview transcripts from both phases were categorised into parent response segments using the same codes. Any data that did not fit the existing code structure was reviewed to determine if it represented a subtheme within the TPACK framework; if not, it was set aside to maintain theoretical fidelity. Coding misalignments were resolved through consensus discussion, and themes were retained only if they appeared across at least two participants within the same phase. This systematic process enabled consistent identification of how parents' knowledge evolved and the development of parents' knowledge across TK, PK, CK and XK over time. Additionally, the analysis also explored how XK influenced parents' decision-making and children's online learning. Date analysis showed variations in family composition across the two phases of the study. Two participants had one child each, and one had two children engaged in online learning during Phase One. During Phase Three, each participant had two children in different grade levels, representing varied developmental stages. The differences in family composition and children's developmental stages were treated as contextual variables in the analysis, enabling within-case and cross-case comparisons of parental online learning support strategies.

## 5. Findings

### 5.1. Parental Experiences with Children's Online Learning (TPACK) during COVID-19 Lockdowns (2020-2022)

Three participant parents identified three phases of online learning based on the school year: Phase One (August 2019–June 2020), Phase Two (August 2020–June 2021), and Phase Three (August 2021–June 2022) (see Appendix 1). All had children enrolled in the same international school during Phases One and Three. Phase Two, being optional, did not impact their children. Initially, children were in early grades (e.g., Pre-K, K1, G1); by Phase 3, they had progressed to higher grades (e.g., K2, G1, G3), and one parent had a new baby.

#### *5.1.1. Ava's experience in Phase one: Online learning for Pre-K and G1 children*

Ava's children, Alice (G1) and Alaina (Pre-K), experienced online learning in Germany during Phase One. Alaina engaged primarily in asynchronous learning through teacher-provided videos featuring creative, hands-on activities. Ava appreciated its flexibility and non-compulsory nature, allowing Alaina to stay entertained and connected with her teacher through personalised feedback, such as "a little video commenting on her work". The activities were engaging and did not impose strict deadlines, providing a stress-free structure. Ava said that online learning posts on Seesaw (2025) gave them "a very nice idea and task to do during the lockdown." In contrast, Alice had a more structured mix of asynchronous and synchronous learning, including math, literacy, and the UOI, with deadlines that added pressure, especially with time zone differences. Ava reflected that parental involvement was essential for explaining tasks after "watching (the video) or getting instruction from the teacher" and assisting with "reading comprehension tasks". This shift in roles created what Ava described as a "relationship shift from mother-daughter to teacher-student…" which Ava found challenging and frustrating.

#### *5.1.2. Ava's experience in Phase three: Online learning for K2 and G3*

Ava's experience highlighted both the benefits and challenges of navigating online learning. By Phase Three, Ava's family had relocated to China. Alaina (G1) and Alice (G3) adjusted to online learning with a structured mix of asynchronous and synchronous learning. It has been a learning curve, "even for digitally savvy parents", as they navigated new tools and methods. Every family member had a device, as both Ava and her husband worked from home while their children followed different online learning schedules. Both children adapted better and gained confidence

and proficiency over time, as she said, "the more you experience it… more comfortable both the child and the parents…" Ava observed that her children became more comfortable with the technology and platforms, such as using Seesaw to get "links for synchronous meetings as well as activities and tasks for asynchronous learning" and seeking help in various ways, such as "write an email… you can call, you can voice record…" to replace the teacher's help in the classroom. For instance, Alice participated independently in her online classes and sought help only when needed. However, Alaina required more support with logging in and session reminders. Over time, Alice and Alaina developed stronger digital skills, such as using Google, YouTube, and cameras for assignments. They also learn to recognise their limits, ask for help, and overcome challenges, building resilience and digital literacy.

Balancing these demands can be challenging, as "everyone has a different schedule, and you need to make sure that it is somehow manoeuvred through the day", especially when both Ava and her husband had work commitments. Hence, managing household chores, preparing meals, and meeting everyone's needs added another layer of complexity. Ava noted that some days everything ran smoothly, while on other days, the experience felt chaotic and overwhelming. She believed many families were in similar situations to hers.

Ava highlighted the importance of balancing online learning with physical social interactions. She also acknowledged that technology cannot fully address all aspects of a child's development, as "they(children) still need physical, social interaction to play and to experience things in a different way than just digital…" However, online learning can be a good substitute in times of necessity, providing continuity in education when in-person interaction is not possible.

*5.1.3. Becky's Experience in Phase One: Online Learning for K1*

Becky's son, Ben (K1), participated in asynchronous learning alongside Alaina in a mixed-age group of children aged three to five while based in London. Becky admitted, "We didn't attend every class…" but she supported Ben's learning by leveraging asynchronous resources, such as videos and activity posts provided by Alaina's teacher on Seesaw. These resources allowed her to engage with the material at her convenience. Becky explained, "I could get an idea from the Seesaw, from posts of some videos or activities... When I had time, I could do them with my two children together." Online learning was challenging for Ben because of his short attention span and limited English proficiency, as Becky explained, "If I didn't sit with him, he would just make something or run away." Becky noticed that the presence of his younger sibling, Baxter, who was two years old, further complicated the situation. It was difficult for Becky to manage both children. Becky found the flexible nature of asynchronous learning beneficial. For example, when Baxter was asleep, she could focus on Ben's online learning. Making the most of the learning opportunities, Becky used the Seesaw posts to conduct activities with both children together sometimes. The non-compulsory nature of online learning suited her and her children's needs as it enabled her to engage with the content flexibly. However, balancing the demands of two young children remained a significant challenge.

*5.1.4. Becky's experience in Phase three: Online learning for Pre-K and G1*

Becky, based in China in Phase Three, faced new challenges supporting online learning for Ben (G1) and Baxter (Pre-K) while caring for a newborn. Online learning was a structured mix of asynchronous and synchronous learning for G1 and non-compulsory for Pre-K. Becky found multiple short classes scheduled throughout the day disruptive, as it felt like "the whole day was separated by short classes… Ben has two or three classes… in the morning and around lunchtime and afternoon. Baxter has two (online classes)". It was challenging for Becky to provide for the differing needs of three children. She had to supervise each child during their online sessions and provide additional homework support. Ben's better language skills and maturity made online learning more manageable. For example, he was more engaged and able to understand and respond to the teacher's instructions during online classes, while Baxter needed more support from Becky. She needed to "take them to their rooms and supervise them (during online classes) …"

and provided "support after the online classes…" such as "activities or homework…" which was compulsory for G1 students like Ben.

Becky acknowledged that while online classes provided valuable learning opportunities, she noted that a child's age and individual temperament played a significant role in how children responded to online learning. She observed that different age groups experienced varying outcomes, commenting, "age is one very important element to think about". Additionally, the child's personality and disposition were essential factors. Becky assessed Baxtor as being "much better than Ben when he was at that age because of the character" during the online learning. Recognising these individual differences is vital in tailoring the online learning experience to each child's unique needs. The need for parental support remained crucial, especially for younger children.

*5.1.5. Claire's experience in Phase one: Online learning for K1*

Claire, based in China, had her daughter, Cecilia (K1), participate in asynchronous learning for children aged three to five. Despite the teacher's efforts to provide interesting projects, Cecilia found engaging in asynchronous learning activities at home difficult:

> [her teacher] set up some interesting projects, and then we watched the teacher's videos at home: there were outdoor activities… and indoor activities such as spelling names or other interesting activities… the child watched it… but… she was not very willing to complete this project

Cecilia showed little enthusiasm and perceived the tasks as obligations rather than enjoyable learning opportunities. Even with parental support, Claire advised that "[Cecilia] still feels like she is completing a task and does not feel like she is doing something very interesting." Claire wondered if "it may also be a challenge for parents and families because it requires someone with such abilities to support, guide, and accompany children to complete this task". The child's lack of enthusiasm and the sense of obligation to complete tasks at home contrasted with the more engaging environment of a physical classroom. This led Claire to temporarily suspend online learning, as it was not compulsory and did not suit Cecilia's needs. Claire shared a similar challenge as Becky in managing one child's online learning and caring for a younger child.

*5.1.6. Claire's experience in Phase three: Online learning for Pre-K and G1*

In Phase Three, Claire was in China and had her daughter, Cecilia, in G1 and son, Charles, in Pre-K. Charles, who was in the same class as Baxter, was presented with options for asynchronous and synchronous learning. Claire explained that"online classes… are one-on-one videos… parents choose a suitable time… [teacher] give you (parent) a QR code…" Cecilia's experience of online learning evolved significantly over time from mostly passive and non-compulsory learning during Phase One to an improved online learning structure in G1, with more interactive elements, such as group classes where children were said to be "divided into groups … [Cecilia] was able to see the children in that group… they are still interested and motivated to attend…", which helped maintain her interest and enthusiasm. Claire shared that the short online classes (approximately 15-30 minutes) allowed children to connect with their peers and teachers, which was effective. Hence, Cecilia had a stronger motivation as she enjoyed the brief but meaningful social interaction. She was more engaged during these classes than in online classes delivered asynchronously because of the latter's isolating experience. Claire noted that the opportunity for children to interact with their classmates and share their interests online substantially improved Cecilia's participation and learning outcomes.

In summary, during Phase One, the parents had mixed experiences of asynchronous learning for younger children (Pre-K and K1). Asynchronous learning for younger children, such as Alaina, Ben and Cecilia, emphasised creative, hands-on tasks that were flexible but required significant parental involvement, reflecting the need for parents to adapt pedagogical strategies at home. For older children like Alice, the introduction of synchronous learning added complexity as parents took on the role of co-educators. Additionally, they had to navigate challenges such as time zone

differences and balancing work with supervising structured tasks while also catering to the needs of their younger children. By Phase Three, a more balanced approach with asynchronous and synchronous learning formats led to better engagement for both children and parents. The need for parental support remained critical, particularly for younger children like Alaina, Baxter and Charles, who required guidance to navigate tools and maintain schedules. Parents develop their pedagogical understanding (PK), technological fluency (TK), and content support (CK) through these different experiences, which are essential for supporting their children's online learning. This highlights the relevance of TPACK as parents adapt practices for online learning contexts.

### 5.2. Parents' Knowledge of Learning in PYP (CK)

The learning content for this participant's school, which followed the PYP, included Units of Inquiry (UOIs)[2] and various subjects, such as Mandarin, Performing Arts, Design, Physical Education, and Swimming. However, children (aged 3-6 years) in ECE enrol in four UOIs, while students (aged 6-11 years) in the PYP engage with six (IBO, 2018c, 2021). All three parents had sound knowledge about PYP before COVID-19.

### 5.3. Parents' Changing Knowledge of Pedagogy (PK)

The International Baccalaureate Primary Years Programme (IB PYP) is a concept-driven curriculum that promotes transdisciplinary connections, fostering holistic development, critical thinking, creativity, and global citizenship through inquiry-based learning (IBO, 2018c, 2021). Its Early Years Programme (which is part of the PYP) recognises play as a "holistic and authentic way in which children explore, grow and learn" and views it as a vehicle for inquiry (IBO, 2021). Teachers involved in this study were committed to adopting a 'play-based learning' approach - integrating play into the inquiry and learning process in ways that were meaningful and involved hands-on experiences (IBO, 2018a, 2018b).

While parents' knowledge of child development and learning was shaped by their personal experiences and cultural backgrounds, they had observed, first-hand, the play-based learning that occurred at their children's school. All three parents emphasised the value of inquiry and play-based learning. For example, Ava advocated for hands-on, inquiry-based play (see Appendix 2), "opportunity for trial and error… they can just try it out, they play, they experience firsthand… and it touches all their senses ideally." She believed it supported natural growth and individuality. Becky valued implicit learning through play: "The goal is to learn something, but the children don't know they are learning; they think they are having fun and playing." Claire supported multisensory, integrated learning, as "learning through play is a fundamental aspect of learning for young children… because they mainly focus on playing."

All highlighted the importance of social interaction, which was deeply missed during the lockdowns. Ava noted "they (children) still need physical social interaction to play and to experience things." Becky observed, "Social interaction is really different... It is so sad that they don't have a proper social life during lockdown time." Claire emphasised, "Face-to-face physical contact… may be more secure or attractive to them (children)."

The lockdown reinforced their belief in play-based learning and revealed the limitations of online environments. Their evolving understanding and knowledge of play-based learning influenced choices regarding their children's participation in online learning and the support they provided.

[2] UOIs is referred to six units of inquiry based on transdisciplinary themes of the PYP, which are: Who We Are, Where We Are in Place and Time, How We Express Ourselves, How the World Works, How We Organize Ourselves, and Sharing the Planet (IBO, 2021, 2018a).

### 5.4. Parents' Changing Views on Children's Use of Technologies at Home (TK)

Before the COVID-19 lockdown, parents carefully managed their children's technology use, emphasising limited and purposeful engagement. For instance, Ava limited weekday use, reserving it for educational games (such as "finding a square and putting it into the square hole shape") and connecting with family overseas. Becky and her husband were "not fans of technology for the children," preferring limited, controlled use and stated: "we give them very limited time to use technology such as the iPad or TV." Becky viewed it as "entertainment… but they are too small to control themselves." However, she trusted the school's approach to using technology in a controlled environment with selected age-appropriate educational apps closely monitored. Claire adopted an exploratory approach, viewing the use of technology as "a way to gain information" or "a reward," and "… didn't want my (her) children to see games as something negative or forbidden."

The lockdown significantly shifted their perspectives on the use of technologies. For example, Ava discovered beneficial educational apps and noted technology's role in social interaction and creativity. She shared that her children used"the Raz Kids or IXL for their classes, iMovie, or all the different applications they use in schools…" to document their learning process and their learning on Seesaw. They also play games like Minecraft and Farm Land and use Microsoft Paint for creative arts. Additionally, technology-facilitated social interaction enabled Ava's daughters to stay in touch with friends and teachers. Becky acknowledged the benefits as children grew older: "the positive side is that the children can really learn something…" though she recognised drawbacks for younger children as "it's also better than nothing. Claire developed a multi-layered perspective on technology as her daughter transitioned to online learning, expanding her children's online learning to include extracurricular classes like ballet and Go in the digital space, and she appreciated technology's accessibility.

The three parents emphasised that technology use should be guided and balanced. As Ava noted, addiction is not inevitable, and it depends on "the role of family environment… parental involvement." Despite parents' appreciation for its educational value, each parent continued to value hands-on, social, and play-based learning for young children.

### 5.5. Factors Influencing Children's Online Learning during COVID-19 (XK)

Three parents' experiences during the COVID-19 lockdown provided insight into the complex interplay of contextual factors that influenced their children's online learning. As parents, they acknowledged positive aspects of the school and teachers' efforts during this period, yet they also identified areas where additional support would have been beneficial.

#### *5.5.1. Lockdown measures and impact*

During Phase One of this research study (early 2020), all three families were in lockdown (in Germany, London and China, respectively), where restrictions were particularly stringent, forcing each family to stay indoors for extended periods. Prolonged indoor confinement increased household stress and made it harder for parents to direct their children to focus during online learning. By Phase Three, some schools were required to remain closed and online learning continued with restrictions that were eased off the school site. So, children were permitted to meet friends outside school, which helped reduce social isolation and supported their social and emotional development. Claire gave an example:

> …few good friends made an appointment to go to Zhongshan Mausoleum to play together. Then it was time for class... Then everyone was on the lawn, and some mothers even brought iPads, while serious mothers brought whiteboards… Some children scattered around the grass, taking online classes.

*5.5.2. Communication and personalised support*

One of the main challenges the three parents faced during Phase One was the lack of personalised face-to-face interaction between parents and teachers. Parents missed the informal daily conversations with teachers, such as brief chats at pick-up. Ava said that teachers' "personal interaction with a parent" was lost during lockdown. Communication with teachers, however, continued through email, Seesaw, and Teams. Both Ava and Claire felt that scheduled one-on-one meetings would have strengthened parent-teacher collaboration, particularly for younger children needing more tailored support.

*5.5.3. Technological resources*

The availability and management of ICT and learning resources were critical for online learning during Phase One. Everyone (teachers, children and parents) was new to Microsoft Teams for online meetings. Technical issues, such as registering for the wrong class or experiencing login problems, required intervention from parents. Becky explained, "In the beginning… because of technical issues, sometimes I just waited there … but he (the teacher) didn't come…" Claire had similar experiences when they joined the wrong online class. Ava said her daughter needed support with "dialling into her meetings."

During Phase Three, schools made online learning more accessible and efficient for children. Schools had developed better approaches to online learning provision, including implementing structured online schedules tailored to individual students, small groups, and whole-class settings, which ensures a more organised and engaging learning experience. Additionally, teachers, parents and children became more proficient with technology as they became more familiar with using the same platforms, enhancing the overall learning experience.

*5.5.4. Managing household dynamics and digital access*

Parents continued to face the challenges in meeting their children's diverse needs. For example, Ava's household had sufficient devices for each child. However, Becky and Claire's families experienced conflicts when their children needed to use devices simultaneously. All parents struggled to coordinate different schedules, balance online learning, work commitments, and household chores, leading to both successes and daily frustrations. Ava shared that she had additional challenges as her husband and she were both working.

> …at the same time, my husband is in an online meeting, or I have to…be in an online meeting as well. That's quite a challenge for our family in a lockdown situation… everyone needs to eat at some point. So…providing food, cooking, and doing the household chores… that is quite challenging.

*5.5.5. Diverse needs of children*

Children's online learning experiences varied due to differences in children's age, developmental stage, and individual temperament. This highlights the need for a sound knowledge of children and the necessity of tailored approaches for online learning. For example, the younger children in Pre-K and K1 benefited from flexible, asynchronous activities. Alaina's experience in Pre-K during the first lockdown in Germany exemplified this, as personalised videos from her teacher engaged her and allowed her to learn at her own pace, maintaining her engagement and connection. However, Ben's high energy and need for constant supervision made online learning challenging. The older children had more structured and time-sensitive learning tasks. Alice, who was in G1, struggled with a rigid schedule and time zone differences. Ava's parental involvement increased and shifted to more of a co-educator, which led to stress and tension due to the dual responsibilities of parenting and teaching. By Phase Three, depending on maturity and disposition, the older children had adapted well, showing increased independence and focus with minimal adult supervision.

This research study highlights that parents and children faced a range of challenges in online learning during the COVID-19 lockdowns. The type of online learning activities, parents'

knowledge of ECE, and adaptability to technology influenced children's online learning experiences. These experiences underscore the importance of tailoring online learning approaches to children's developmental needs and dispositions, as younger children generally require flexible, engaging, and supportive environments. Cecilia withdrew from the extracurricular classes, such as ballet and Go, due to technical issues and a lack of in-person interaction. Claire felt online learning couldn't match the social benefits of in-person schooling, especially for young children.

### 5.6. Cross-case Analysis of Parental and Child Experiences

A cross-case analysis of Ava, Becky, and Claire, along with their six children (Alaina, Alice, Ben, Baxter, Cecilia, and Charles), was utilised at the last stage of data analysis. The results reveal shared patterns and important divergences in how families navigated ECE online learning during the COVID-19 lockdowns over a two-year period. All three parents expanded their roles as co-educators, where online learning was heavily dependent on parental scaffolding. For example, when Alaina and Baxter were in Pre-K and Ben, Cecilia, and Charles were in K2, where online learning was primarily asynchronous, they required close supervision to engage with online learning tasks, manage their attention, and navigate digital tools. As for their children, overall, the older children (G1 and G3) adapted more effectively to structured combinations of synchronous and asynchronous online learning over time than the younger children (aged 3-6 years). The older children developed stronger digital literacy and self-regulation. These findings indicated age-related disparities in the benefits of online learning for young children in the early years.

Ava's experience illustrated a shift from intensive parental instruction as a co-educator in Phase One to greater child autonomy by Phase Three. However, Becky and Claire continued to face challenges with multiple young children, particularly with the additional duty of caring for the third child, an infant. Across cases, parents' diverse beliefs in play-based, inquiry-driven learning influenced their perspectives on online learning, particularly regarding the role of play and social interaction. They identified the need for guidance and training in ICT and skill development. Collectively, these cases demonstrate that successful online learning during lockdown was contingent upon children's age, temperament, family context, parents' ability to support, and contextual knowledge. It was less about the program design and learning content. To summarise, this highlights the importance of TPACK in understanding parental mediation of young children's online learning experiences.

#### *5.6.1. Timing of learning: Teachers fixed scheduling vs. parent-initiated flexible timing*

The findings indicate that both fixed scheduling and parent-initiated flexible timing occurred, depending on the pandemic phase of online learning and the child's age. Fixed timing with structured and scheduled learning online was evident among older children and during later phases. In Phase One, Alice (G1) experienced a more structured mix of asynchronous and synchronous learning" with deadlines set by teachers for children to complete the online learning tasks that added pressure. By Phase Three, online learning became "a structured mix of asynchronous and synchronous learning" across all families. Becky described multiple short classes scheduled throughout the day as disruptive, noting that "the whole day was separated by short classes… Ben has two or three classes… in the morning and around lunchtime and afternoon. Baxter has two online classes." Parent-initiated timing was more flexible, and parent-led scheduling characterised younger children's experiences in Phase One. Asynchronous learning was non-compulsory for young children aged 3-6 years, allowing parents to decide when to engage. Becky admitted, "We didn't attend every class…" and chose to engage "when I had time." Claire similarly suspended Cecilia's online learning temporarily when it did not suit her child's needs. Parents such as Becky strategically used nap times or quieter moments to complete learning activities.

*5.6.2. Negative impacts on learning*

Multiple negative impacts on children's online learning were documented across the three families. Cecilia (K1) demonstrated a lack of engagement and motivation, as she "was not very willing to complete this project" and ultimately withdrew from extracurricular classes such as ballet and Go due to technical issues and the absence of in-person interaction. Attention and focus difficulties were evident in Ben (K1), who had a "short attention span" and would "just make something or run away" without direct parental supervision. Older children were not immune to stress; Alice (G1) experienced "deadlines that added pressure, especially with time zone differences." All three parents highlighted the loss of social interaction as a profound negative impact. Becky noted, "It is so sad that they don't have a proper social life during lockdown time," while Claire stated that online learning "couldn't match the social benefits of in-person schooling." Relationship strain emerged as another significant concern, with Ava describing a "relationship shift from mother-daughter to teacher-student," a dynamic she found "challenging and frustrating." Becky further reported that short classes "separated the whole day," disrupting the family's daily rhythm and making it difficult to manage multiple children. Finally, withdrawal from learning occurred when Claire temporarily suspended Cecilia's online learning, acknowledging that the format "did not suit Cecilia's needs."

*5.6.3. Content covered by parents for different learner categories*

Parents addressed different content and support needs across three categories of learners: (a) younger children (Pre-K and K1, ages 3–5); (b) older children (G1 and G3, ages 6–9 years); and (c) children with individual temperament or attention needs (see Table 5).

Table 5
*Content Covered by Parents for Different Learner Categories*

| *Learner Category* | *Content Covered by Parents* | *Examples from Findings* |
|---|---|---|
| Pre-K, K1 children aged 3–5 years | Asynchronous activity facilitation; hands-on, creative task support; logging in and session reminders; supervision during short online classes; attention management | Becky used Seesaw posts to conduct activities with Ben and Baxter together. Ava helped Alaina with logging in and reminders. Becky had to "supervise them (during online classes)" and provide "support after the online classes… activities or homework." |
| G1, G3 children aged 6–9 years | Explaining task instructions; reading comprehension support; homework assistance (compulsory); email and communication guidance; technical troubleshooting | Ava assisted Alice with "reading comprehension tasks" and "dialling into her meetings." Alice learned to "write an email… you can call, you can voice record" to replace teacher help. Becky provided "additional homework support" for Ben. |
| Children with temperament/attention needs (e.g., Ben) | One-on-one sitting or constant supervision; behavior management; flexible scheduling around sibling naps | Becky stated, "If I didn't sit with him, he would just make something or run away." She used Baxter's nap time to focus on Ben's learning. |

## 6. Discussion

In the post-COVID-19 lockdown era, we discuss its impact on parents' advocacy of play-based learning, their perspectives on children's use of technology, their perceived roles in their child's education and the importance of TPACK development between parents and teachers.

### 6.1. Advocating for Play-Based Learning

Parents collectively emphasised the value of play and play-based learning, though their perspectives varied. They all discussed play-based learning as comprising two key aspects: the importance of play for meeting a range of needs and a learning programme that aligns with it (Allee-Herndon et al., 2019). When they discussed free play, they described children who are in charge of their play with minimal adult involvement, intended to meet their social and emotional needs, and play-based learning embedded in programmes such as the PYP. Ava emphasised the importance of play-based learning through direct experience, reflection, and active engagement, and aligned this type of learning with the experiential learning theory (Mainemelis et al., 2002). Becky illustrated how play seamlessly integrates with learning in mathematics (Zhang & Disney, 2024) and used Seesaw to bridge school and home learning, showcasing the role of technology in maintaining continuity. Ava and Claire echoed this view. Claire viewed play-based learning as learning experiences with teachers extending inquiry play (Allee-Herndon et al., 2019), where teachers support inquiry by sharing videos on Seesaw in response to children's interests, aligned with school curriculum standards, such as exploring sink and float. Becky's perspective aligned with playful learning (Allee-Herndon et al., 2019), illustrating how play integrated seamlessly with mathematics learning (Zhang & Disney, 2024). She noted that when targeted skills did not naturally emerge, teachers adopted more structured yet engaging approaches and used Seesaw to bridge home and school learning. Collectively, parents highlighted the importance of social interaction and the need for a holistic approach, including inquiry, play, and academic learning, during COVID-19 lockdowns, and underscored the influence of cultural capital on play-based learning practices (Yahya, 2016). The findings from these parental perspectives supported the growing shift towards play-based learning in ECE by recognising diverse and authentic ways to encourage play-based learning, making it more fun, engaging, and palatable at home. Home-school connections about play are influenced by parents' limited knowledge of play-based learning (Carolan et al., 2021). Therefore, schools should help parents understand its benefits, encouraging them to adopt this approach at home (Breathnach et al., 2016; Yahya, 2016) by integrating play-based learning into daily routines. Such as setting aside dedicated time for free play and hands-on activities that do not require screens.

### 6.2. Perspectives on Children's Use of Technologies after COVID-19 (TK)

Parents' perspectives on children's technology use before and during the COVID-19 lockdown revealed a nuanced understanding of its benefits and challenges. There were many studies on children's use of digital technology for home learning prior to the lockdown (Danby et al., 2018; Given et al., 2016; Marsh et al., 2017). During COVID-19, Farrugia and Busuttil (2021) demonstrated the complexity of parental attitudes toward digital engagement. Several factors influenced parents' responses to technology use, including the role of technology in education, social and cognitive development, and concerns about screen time (Green, 2020; Velicu et al., 2019). In addition to parents' beliefs, other cultural factors, such as the cultural expectations and parental influence, also influenced children's use of technologies (Cao et al., 2024). Parents regulated technology use with content and time restrictions (Dias et al., 2016), but lockdowns influenced parents to see the value of educational apps and digital resources in young children's learning (Baltzaki & Chlapana, 2023; Blum-Ross & Livingstone, 2020) and made learning engaging for their children (Asim et al., 2021). Parents' concerns about screen time and its impact on young children's physical health and mental well-being, such as digital fatigue, are well documented (Chaudron et al., 2018; Holloway et al., 2015; Park & Park, 2021). Ava adopted a balanced approach that advocates for integrating physical activities alongside digital engagement to optimise children's holistic development (García et al., 2022).

Becky remained cautious before and during the lockdown, mirroring research identifying parental concerns over young children's ability to self-regulate screen time (Fitzpatrick et al., 2022). However, Becky trusted the school's standards for the use of educational technology in formal

learning environments (Dong & Newman, 2016; Hesterman, 2013; Muir et al., 2016). She set a limit for her children's technology exposure at home. Becky's approach emphasises the importance of ensuring that technology serves an educational purpose by striking a balance between digital and non-digital activities. Her viewpoint resonated with contemporary discussions on healthy technology use among young learners (Aslan et al., 2022; Fletcher et al., 2024).

Claire's adaptive approach to technology reflects the importance of parental mediation (Harrison & McTavish, 2018; Kostyrka-Allchorne et al., 2017). She integrated technology into her children's learning before the lockdown and during COVID-19 online learning. She balanced children's screen time with hands-on activities, social engagement and emphasising digital safety (Edwards et al., 2018; Lazarinis et al., 2020). Claire's approach aimed to accommodate the necessity of learning with technology while striving to address its potential drawbacks (Shorty & Jikpamu, 2021), demonstrating a flexible approach to the evolution of educational technology (Brito et al., 2018).

Technology in ECE offers benefits for learning and development, such as fostering creativity, communication, and multiliteracies (Harrison & McTavish, 2018; Hesterman, 2011; Kim et al., 2023), yet it is often perceived as less impactful for physical or social activities (Hatzigianni & Margetts, 2014). This study found that parents recognised online learning as a bridge between home and school, and that it offered peer socialisation for children during the COVID-19 pandemic. Limited participation in online learning was not solely due to parental reluctance (Ford et al., 2021; Munastiwi, 2020), but was influenced by many factors, including children's temperament, attention span, beliefs about play, optional sessions, and family logistics.

### 6.3. The Role of Parents and TPACK

Parental involvement is crucial to children's development, school readiness, and enhancing their learning in literacy, numeracy, and motivation (Kambona, 2025; OECD, 2011, 2018). Maintaining positive partnerships with parents (Kwambaza & Basela, 2024; Rouse & O'Brien, 2017) improve children's outcomes (Fenech et al., 2019). The IBO (2018c) states that the partnerships "provide the foundation to support students' learning, growth, health and well-being and agency" (p.3). Platforms like Seesaw and Microsoft Teams, used before and during the pandemic, enabled parents to access learning materials, support instruction flexibly, and sustain learning continuity (IBO, 2020; Ilmanto et al., 2021; Novianti et al., 2021). Active parental engagement through co-teaching and real-time assistance necessitated parents integrating knowledge of technology and pedagogy to support their children's learning during the COVID-19 lockdown.

### 6.4. TPACK Development in Teachers and Parents

During the COVID-19 pandemic, parents developed TPACK through informal, hands-on, co-teaching with teachers, adopting a trial-and-error approach as they supported their children's learning online. They focused on managing home learning environments, supporting emotional well-being, and integrating technology under constraints, such as ensuring learning continuity and availability of time, resources, digital skills, and emotional capacity (Belfanti, 2017; Buettner et al., 2016). Unlike teachers' TPACK development, which is primarily centred on instructional practices (Çakır & Güner, 2026; Saubern et al., 2020; Yang & Dong, 2024), parents' TPACK development was shaped by the practical demands of supporting young children's learning at home, balancing pedagogical support, technological mediation, and children's emotional needs within the family context. This collaboration strengthened the teacher-parent partnership and highlighted the potential of technology in the ECE context post-COVID-19.

## 7. Conclusion: Implications and Recommendations for Future Research

This study expands the application of the TPACK framework to parents in the home settings as they integrate technology and pedagogy to support their children's online learning content over time. It shows that parents' TPACK evolved through practical engagement with online learning platforms and direct involvement in their children's education. The findings demonstrate that

TPACK is not confined to qualified teachers but can be developed by anyone interested and involved in the educational process, particularly in crises such as the COVID-19 lockdown. Schools support parents in developing their TPACK by offering resources and training that address both technical and pedagogical skills over time.

This study has three key implications for parents, policymakers, and professional development. For parents, the findings highlight the need to balance online play-based learning online with in-person, hands-on play-based learning activities and to tailor support to each child's age and temperament. Parents managing multiple children should establish clear routines, coordinate schedules, and maintain open communication with teachers to avoid the relational strain of shifting from parent to co-educator. For policymakers, this study implies the need to develop age-appropriate online learning guidelines by age band (e.g., 3–5 years versus 6–9 years) to differentiate online learning designs that offer flexible asynchronous options for younger children and more structured ones for older children. Policymakers should support families by ensuring they have access to a parent help line, adequate devices, reliable internet connectivity, and technical support, particularly for households with multiple children or working parents. Furthermore, social-emotional learning should be integrated into online learning policies. For professional development, the findings call for training teachers to scaffold parents' TPACK, provide tiered resources, and recognise early warning signs of disengagement or relational strain. PD programs must also offer strategies for translating play-based learning into online learning and responding to families' unique household and cultural contexts.

The insights into parents' strategies, challenges, and required support can inform schools and policymakers about the resources that strengthen parent-teacher collaboration and online learning. This underscores the importance of contextual influences on children's online learning, which inform future research on the role of XK in TPACK development. Future research should examine how household dynamics (e.g., number of children, parental work arrangements, availability of extended family support) shape the effectiveness of online learning. Additionally, the framework has potential for broader applications across various educational contexts, such as home-based learning, and researchers should explore the mutual influence of parent-child to teacher-student relationships observed in this study across cultures and family structures.

## 8. Limitations

This study is limited by its small sample size of three parent participants with their six children and by its specific cultural-linguistic contexts (German, Chinese German, Chinese American) during the COVID-19 pandemic, which may limit the generalisability of the findings to other populations. Future research should explore larger, more diverse samples and examine whether the observed patterns hold across different cultural and family structures (Slot et al., 2025).

**AI Usage and Assistance:** The AI tool (DeepSeek) was used as a proofreading tool for grammar and language use. It was also used to check the accuracy of the translation of the interview transcript.

**Conflict of Interest:** The authors declare that there is no conflict of interest regarding the publication of this paper.

**Data Availability:** The data supporting the findings of this study are available from the corresponding author upon reasonable request. To protect participant confidentiality, full transcripts are not publicly available.

**Ethics Declaration:** This study has been approved by the Murdoch University Human Ethics Committee (Project ID: 2021/167) on the condition that it complies with the National Statement of Ethical Conduct in Human Research (2007), the Australian Code for the Responsible Conduct of Research (2007), Murdoch University policies and the Human Research Ethics Committee's standard conditions of approval to safeguard participants' interests and privacy. The anonymised

dataset is available from the authors upon request, subject to the conditions of approval by the Murdoch University Human Ethics Committee.

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**Appendix 1.** The description of multiple cases

| *Parents* | *Children* | *Phase One* | *Phase Two* | *Phase Three* |
|---|---|---|---|---|
| | | 2019 -2020 | 2020-2021 | 2021-2022 |
| | | 2020 Feb- June 1 (after the Winter Holiday) | 2020 August- 2021 June: the whole school year | 2021 August - September 20: at beginning of the school year |
| | | Emergency online learning | Optional online learning | Planned online learning |
| | | Asynchronous learning & Introducing Synchronous learning for K2 up | Asynchronous & Synchronous learning | Asynchronous & Synchronous learning |
| Ava | Alice & Alaina | G1 & Pre-K | G2 & K1 | G3 & K2 |
| Becky | Ben & Baxter | K1 & Home | K2 & Home | G1 & Pre-K |
| Claire | Cecilia & Charles | K1 & Home | K2 & Day care-bilingual kindergarten | G1 & Pre-K |

*Note.* Pre-Kindergarten (Pre-K): aged 3-4; Kindergarten1 (K1): aged 4-5; Kindergarten2 (K2): aged 5-6; Grade1 (G1): aged 6-7; Grade2 (G2): aged 7-8; Grade3 (G3): aged 8-9. The academic year lasts from mid-August to the end of June of the following year.

**Appendix 2.** The description of parents' knowledge of children's technology usage, learning pedagogies, and content

| *TK* | *PK* | *CK* |
|---|---|---|
| A set of shared iPads for children aged 3-6 | Play-based learning | Units of Inquiry |
| Children aged 7-9 have individual iPad | Inquiry-based learning | Mandarin |
| | | Performing Art |
| | | Design |
| | | Physical Education |
| | | Swimming |