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Digital funds of identity: understanding a young child's multilingual development through mediagrams

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Abstract

Purpose

The study explored how Feifei, a 3-year-old trilingual girl living in England, uses touchscreens across her multiple languages (English, Mandarin, and Bahasa Indonesia), exploring how her languages and social interactions interact with her touchscreen use.

Design/methodology/approach

The research adopts a case study approach, using mediagrams, supported by family interviews and parent-recorded interviews, and taking into account conceptualisations of funds of identity in the analysis.

Findings

The mediagrams and supporting interviews relate how Feifei's multilingual touchscreen use relies on parental interest and support, but also highlights innovative ways for multilingual families to use technology, and opportunities for schools and nurseries to use technology to explore children's funds of knowledge and identity.

Originality/value

The study makes an important contribution to the concept of digital funds of identity in multilingual children, highlighting the usefulness of mediagrams as a methodological tool within this sphere.

Introduction

Growing up multilingual is a complex personal experience that is influenced by sociocultural context and needs (Surrain and Luk 2019; Wilson 2020). For heritage language speakers, home languages are often minority languages in the society they live in (Schalley, Eisenclas, and Guillemin 2016); developed through daily communications and family literacy activities from a young age (Kupisch and Rothman 2018).

In England, nearly one in three nursery-aged children (29.1%) are registered as having English as an Additional Language (Department for Education, 2022), making their lives and experiences a much-necessary focus for research. To do justice to their individuality, case studies are a vital tool in helping us understand the complex sociolinguistic and sociocultural entanglements leading to a child's identity development. While there is a growing body of research focusing on multilingual children, they are less well represented in research focusing on children's digital experiences, a gap this study seeks to address. In this paper, the multilingual funds of identity of Feifei, a three-year-old trilingual girl living in England and

exposed to two heritage languages (Mandarin and Bahasa Indonesia) are discussed through the lens of touchscreen use. The research questions are as follows:

1. What is the general pattern of a young trilingual's (Feifei's) home language use?
2. How does Feifei develop her languages through touchscreen activities?
3. What is the parents' role in facilitating Feifei's language development through touchscreen activities?

The study draws on funds of identity (FoI) research (Esteban-Guitart 2012), contributing to the emerging concept of digital funds of identity (DFoI) (Poole 2017). Through the creation of mediagrams (Lexander and Androutsopoulos 2021), parent-recorded videos, and family interviews, we explore how Feifei navigates her technological world via touchscreens, and the role her languages, and the adults surrounding her, play within this.

Multilingual Development in the Early Years

The home environment is essential for young heritage language speakers to develop their emergent literacy and multilingual identities (Eisenclas, Schalley, and Guillemin 2015). Many heritage families facilitate their children's heritage language to tighten family bonds and help form a cultural identity (Cho 2000). Parents and other family members play a vital role in managing children's heritage language development through varied activities, such as communicating with children in their home languages, visiting their home countries, and using apps or other technology to support heritage language development (Little 2019). Through these various inputs, children develop a linguistic repertoire that enables them to communicate across multiple languages and social contexts (Blackledge, Creese and Kaur Takhi 2014, Gumperz 1964).

Young children's multilingual development is impacted by the start of formal education, and the introduction of school literacy in the majority language (Wagner 2022). Since the learning goals from school are to be achieved in the societal language, the focus may shift from home literacy to school literacy (Little 2021), failing to acknowledge and incorporate children's FoI.

Multilingualism through technology

Several studies indicate the increased impact and use of technology in young children's home lives (see e.g. Marsh et al. 2018; Plowman 2015), although the link between mobile technology and children's multilingual development is a relatively new area of study (Little 2020). In this study, instead of investigating Feifei's home technology use in general, her use of touchscreens (i.e. tablet and mobile phone) and multilingual development are specifically studied, expanding the existing body of research.

Many apps are designed to offer learning experiences to children (Livingstone et al. 2019). However, young children's app choices can be complex, since the standards and functions of apps vary. For example, some apps are designed to meet commercial aims instead of considering the children's needs (Kucirkova 2017). Some language-learning apps merely translate content across multiple languages instead of localising cultural content (Little 2020).

More case studies with specific multilingual family groups are needed to understand how and in what ways apps facilitate children's multilingual development (Little 2019).

Parents as gatekeepers and enablers

Children's home technology use is tightly linked to parental screen habits, choices, and attitudes (Plowman 2015; Stephen, Stevenson, and Adey 2013). For example, parents who are more positive about technology may let their children use screens more freely (Kotrla Topić, Perić Pavišić, and Merkaš 2023).

For multilingual young children, parents act as gatekeepers and enablers to provide support for children's technology activities in their home languages (Little 2020), with technology use commonly supervised and monitored by parents and caregivers (Livingstone et al. 2019). When children grow older, direct parental monitoring on their digital use tends to reduce and greater reliance may be on their self-disclosure (Kotrla Topić, Perić Pavišić, and Merkaš 2023).

Using multimodal apps may offer opportunities for the parents and the children to share their thoughts and stories (Kucirkova et al. 2013). With parental assistance, children can create multimodal contents in apps, such as recording family videos, writing or painting things with narrations (Little 2020). However, children's and parents' digital preferences may differ (Little 2019), and children's agency (Sairanen, Kumpulainen, and Kajamaa 2022) and opinions will be considered when exploring Feifei's app and language choices in the study.

Funds of Knowledge and Identity

Traditionally, funds of knowledge (FoK) are identified as accumulated knowledge and skills that embody historical and cultural understanding (Moll et al. 1992), with a focus on how children's home FoK are acknowledged and furthered - or not - within formal education contexts. This highlights discrepancies regarding how children from socioculturally dominant linguistic and cultural backgrounds experience education, versus those whose home cultures and languages differ from dominant discourses (Conteh and Riasat 2014).

Since the original conceptualisation of FoK, concerns have been raised regarding the focus on families and the family home, often based on adults' interpretations (Esteban-Guitart 2012; Esteban-Guitart and Moll 2014). The Funds of Identity (FoI) approach pivots the attention to the child, their views, and their identity development, offering five separate but linked FoI for exploration and analysis, namely the geographical (cultural or physical spaces and places), social (connections with other people), cultural (culture-specific and/or psychological tools or beliefs), institutional (school or a belief-related institution) and practical (hobbies or activities) FoI linked to the child (Esteban-Guitart 2016). In other words, FoI relates to how the child interprets, lives and embodies the family's FoK. By focusing on the specific child, FoI avoids generalising or stereotyping according to cultural or other markers, taking a wholly individualistic approach (Hogg and Vollman 2020), making it highly appropriate for case study research.

In their comprehensive literature review, Hogg and Vollman (2020) found FoI referred to as “an approach, a theory, and a teaching strategy or method” (p. 868), concluding that FoI and related research is multi-layered, and particularly suited to supporting multilingual children in the early years context (Miller Marsh et al 2022; D’warte and Woodrow, 2023). In our study, FoI functions as a theoretical lens through which to view the lived experiences of one particular child (Feifei). Hogg and Vollman (2020) explicitly situate FoI as a way to counter ‘deficit theorising’, the still-common view that any gaps in educational attainment are due to students’ own shortcomings (Valencia 2010), rather than looking for societal reasons.

Specifically in the early years context working with multilingual children, D’warte and Woodrow (2023) explore arts-based methods of making FoI visible. One of their approaches, equipping the children with technology to document their day, is highly relevant to this study.

Digital Funds of Identity

Poole (2017) highlights that traditional research on FoK/I appears to focus on what he calls analogue social interaction, and that, in contrast, the impact of digital social interaction, via social media and/or other technology, has received little attention. The concept of digital FoI (DFoI) is particularly relevant to heritage language families, where technology is vital in facilitating and maintaining contact with family members abroad (Little 2020). However, technology is more than a medium, and thus interactions that contribute to a child’s identity development may frame technology in the role of entertainment provider or information giver (e.g. through playing games or watching a video), a companion to analogue social interaction (e.g. using technology to facilitate discussion, or playing together), or as a mediating tool for communication (e.g. for communication with family members abroad). The complexities of technology use in the heritage language family context, especially in understanding how different attitudes and identities shape this use and engagement, have been hitherto unexplored, a gap this study seeks to address.

The lack of understanding of home digital practices also impacts on the development of creative pedagogies in formal education contexts (Hutchison, Paatsch, and Cloonan 2020), with teachers struggling to bring pupils’ home digital practices meaningfully into formal education contexts. Poole (2022) explores the utility of multimodal methods for identifying learners’ FoI in a study focusing on avatars with 10th grade learners. Feifei, in our study, is significantly younger, and so our study offers a meaningful extension of the work on multimodal practices, making recommendations for those working with young children and enabling them to share their FoI, bridging home and nursery/school.

Methods and Methodology

The study of three-year-old Feifei’s touchscreen use and her multilingual language development follows a case study approach, helpful in collecting in-depth information of people’s life experiences (Tight 2010), and exploring the connections between these experiences and the related context (Gray 2018). The uniqueness of each case can be regarded as not only a limitation, but also a potential strength, since detailed life experiences can be studied in more depth, suitable for FoI research (Hogg and Vollman 2020). In this case study,

three family interviews, spaced 4-6 weeks apart, were held with the family, conducted online through Google Meet, as per the family's preferences due to Covid (Foley 2021). Family interviews favour young children since a parent can provide familiarity (Farrugia and Busuttil 2021). Family members may remind each other of pertinent memories, sharing thoughts, and expressing feelings.

To link interviews to family practices (Little 2021), the parents sent a total of four self-recorded videos of Feifei's engagement with touchscreens at home (Wilkinson et al. 2020). Parent-recorded videos in early years research offer a lens to look at children's real-life experiences without the researcher's presence (Stephen, Stevenson, and Adey 2013). They are beneficial in investigating actual experiences, ideas and identities (Knoblauch and Schnettler 2012). Parent-recorded videos are not without limitations, since the content may be influenced by parental actions and intervention, and only form a partial story (Wilkinson et al. 2020). By triangulating data collection across three methods (Gray 2018), we maximise opportunities to understand Feifei's experiences as well as home practices, in line with a FoI approach. Following each interview and discussion of parent-recorded videos, a mediagram (Lexander and Androutsopoulos 2021) was first created, then revised with the emergence of new or additional information, leading to a total of three evolving mediagrams available for discussion.

Mediagrams

The mediagrams in this study are inspired by the work of Lexander and Androutsopoulos (2021), investigating multilingual families' 'mediational repertoires'; highlighting media and language preferences with different people through their daily communications (Lexander and Androutsopoulos 2021). In their mediagrams, the choices of multiple languages are represented by lines of different styles and colours, connecting the core participant and different interlocutors around them (Lexander and Androutsopoulos 2021). In working with Feifei and her family, we adapted the concept of mediagrams, focusing on Feifei and her relationship with various forms of touchscreen technology, apps and games, through her multilingual experiences. Mediagrams are particularly suitable for a FoI approach (Esteban-Guitart and Moll 2014; Poole 2017), since they place the child at the centre of the investigation. Esteban-Guitart (2016; 2021) highlights that, in Funds of Identity work, the learner creates "identity artefacts". While Feifei is too young to create a mediagram herself, it does function as a digital artefact focused on her DFoI - the way she interacts with technology to play, socialise, and learn. The mediagrams are presented along with data from family interviews and parent-recorded videos.

Introducing Feifei and her parents

Feifei is a three-year-old girl born in England, her father is Chinese and her mother is Indonesian. The family lives in the southern part of England. Before the age of three, Feifei only spoke two languages, English and Mandarin Chinese, because her parents found it difficult to support three languages simultaneously. By the time of our first interview, she had just returned from Indonesia, visiting her grandmother, and had started nursery school. Her mother introduced Bahasa Indonesia to Feifei during the visit, and maintained it afterwards. The family was recruited via snowball sampling, a suitable method especially for reaching specific

populations (Noy, 2008). Following their expression of interest, the full information letter was sent to the parents and further questions were answered before they participated. Both parents gave informed consent, and Feifei's assent was gained each time before and during the interview.

Approaches to data analysis

Before beginning data analysis, the recorded family interviews and parent-recorded videos were transcribed. For the family interviews, the transcription focuses on the dialogues, since the main data in these interviews are intensive conversations with the family. For parent-recorded videos, the family interactions including verbal and non-verbal expressions on the touchscreen were kept as detailed as possible, because these data indicate the natural ways of parent-child interactions and the child's tablet use activity. Data not originally in English were translated and member-checked by the family.

The methods of data transcription are closely associated with the following data analysis (Nascimento and Steinbruch 2019). Thematic analysis (Braun and Clarke 2006) was applied for the family interviews, while multimodal discourse analysis (Alba Juez 2009) was used for analysing the parent-recorded videos. For the family interview data, transcripts were coded based on the research questions, with codes including: patterns of tablet use, the use/development of Mandarin/English/Bahasa Indonesia, parental attitudes, other family activities, parent-child interactions, and parental mediation. The mediagrams were discussed in the interviews and were amended collaboratively with the family. In the findings section of this paper, the analysis of data that combines mediagrams, parent-recorded videos and family interviews will be discussed in detail, explicitly linking them to the five linked FoI highlighted in the literature review (geographical, social, practical, institutional, and cultural).

Ethics

Doing research with young children requires specific ethical considerations, as children will explain their experiences through verbal and non-verbal expressions (Sairanen, Kumpulainen, and Kajamaa 2022). In this study, not only the parents' consent was gained before conducting the fieldwork, but also Feifei's oral assent (Dockett and Perry 2011) was gained every time before holding a family interview. Feifei's assent and parental consent were viewed as a fluid and ongoing process (Ericsson and Boyd 2017), knowing they had the right to opt out of the study at any time. During the study, Feifei was encouraged to share her views through accessible questions, and her choice to engage or not engage with activities was respected. In respecting children's rights and agency, we need to acknowledge that children are physically and psychologically vulnerable (Christensen 2000), and attention was paid to Feifei's non-verbal expressions during the study.

To improve the data integrity and trustworthiness, data were triangulated across interviews, mediagrams, and parent-recorded activities (Gray 2018). All data collected through the three methods were complementary to each other and should not be analysed separately. This kind

of data triangulation increases the data trustworthiness across case study research (Little and Little 2022).

Findings

Mediagrams

The three mediagrams below centre around Feifei, with her varied touchscreen activities illustrated in text boxes around her. The specific apps for different touchscreen activities are labelled next to the text boxes, with the languages used represented by different line styles and colours. Dotted lines are used to represent oral language use, while the continuous lines are for written language use. The colour purple represents Mandarin, yellow stands for English, and green is for Bahasa Indonesia. In each case, the data leading up to the creation or amendment of the mediagram are presented as precursors, followed by the mediagram itself as a resulting artefact.

First mediagram

The first mediagram was created based on the data collected from the first interview with Feifei and her mother, the researchers' interpretation of first three parent-recorded videos, and her father's notes sent via online chat afterwards. As shown below, Feifei can distinguish the three languages she can speak and clearly knows about switching languages when talking to different people:

M (Feifei's mother): How many languages can you speak? What language do you speak with baba?

F (Feifei): Mandarin.

M: Umeh datuk [(With) grandma grandpa]? Bahasa Indonesia.

F: Iya. [Yes.] Bahasa Indonesia.

M: Bahasa Indonesia. And with mama?

R (researcher): Bahasa Indonesia?

F: English.

M: English, well. Uh-huh. So you can speak Mandarin, and...

F: Bahasa Indonesia.

M: And then?

F: And then English.

M: So how many languages are there?

F: One, two, three.

M: Three, well done.

Feifei's understanding of her three languages as distinct from each other show that they are part of her FoI, and included in the mediagram as illustration of her DFoI. In the first mediagram, oral Mandarin is used in all Feifei's touchscreen activities, almost all the apps that Feifei played on the iPad were in Mandarin, and Feifei's exposure to written Mandarin is found in several activities in the first mediagram. For the English use, oral English was used during some activities with her mother, the exposure to written English only appeared when she played the music app and watched cartoons. Bahasa Indonesia is only used orally in two activities.

When talking about the child's adoption of iPad apps, the mother said:

"Oh it's just Mandarin. Because I don't like her to play games actually. So my husband has video games for her, it's Mandarin and the instructions are Mandarin."

Although the mother was not keen on Feifei playing games, data from the interview and parent-recorded videos show that she played iPad games with her daughter when Feifei wanted to teach her how to play, and she let Feifei play on the iPad when she was occupied, or as a reward for good behaviour. As shown in the mediagram, English is used in almost every digital activity and Bahasa Indonesia was only seen in two activities, because Feifei's mother spoke mostly English with her and had only recently introduced Bahasa Indonesia. This highlights how Feifei's *practical* and *social* (Esteban-Guitart, 2016) DFoI, and specifically, the language used to engage with them, are influenced by parental preferences.

While the father accompanied Feifei in most of her touchscreen activities through Mandarin, two digital activities in the first mediagram involved all family members, and the use of all three languages. The family would take photos/videos and create stories from the recorded materials later on, recounting activities for each other, and for family members not present. As Feifei's mother explained in the first interview:

"...She (Feifei) just likes to browse, usually we do storytelling with the mobile phone. We did this like, yesterday we went to the fish shop, we saw the fish, we shot a video, and we tell a story about the video, what's on the video. And then usually at the night-time when we were all together, we tell the story of what did we do yesterday or today when we went out. Because my husband is at home, he didn't go there."

The family often told bedtime stories via real-life experiences, browsing pictures/videos taken with mobile phones. This activity enabled Feifei to decide what pictures to take, and what to share with her parents, giving her agency (Sairanen, Kumpulainen, and Kajamaa 2022) through digital play. Recording Feifei's *geographical* FoI digitally provides a tool for her *social* FoI, making connections and recounting stories. As the parents could not speak each other's heritage language, they used English to communicate. Since they speak different languages with Feifei, storytelling time offers an opportunity for her to practise and switch among all three languages. The photo and album function of the mobile phone is used as a tool to facilitate high-quality parent-child interactions and family bonds. Crucially, the activity supports Feifei in creating FoI artefacts (Esteban-Guitart 2016, 2021), which in her case are digital, and could, theoretically, cross the divide between home and nursery, highlighting important opportunities for DFoI to contribute to FoI research.

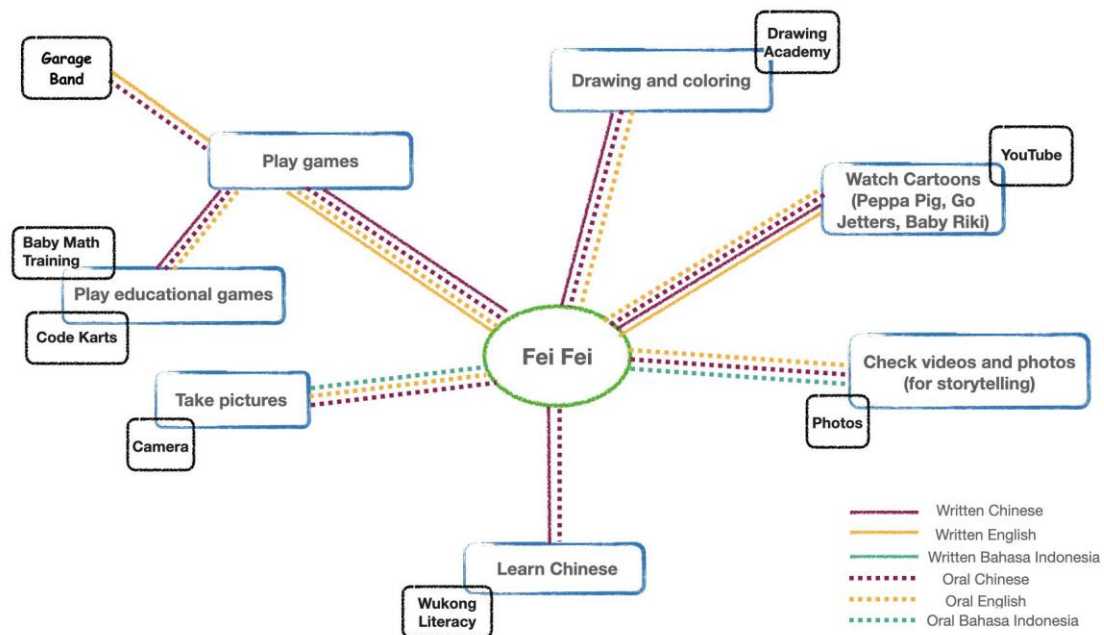
Feifei's code-switching and use of multiple languages (Sczepurek et al. 2022) can be found in other touchscreen activities, as the following extract of one parent-recorded video that involved both the parents and Feifei playing Code Karts illustrates:

D (Dad): 先直走 [Go straight first]。

M (Mum touches Feifei): Hey what are you doing?

F: (Feifei points at the car) 直走 [Go straight]. I'm playing this game, I'm just, because this car...like this.

In this example, Feifei responded to both parents with different languages. She first repeated her father's instructions in Mandarin, then switched to English answering her mother's question. Studies indicate that 2-3 years old bilinguals possess a certain level of meta-linguistic awareness and perspective-taking abilities, as they can adapt their language choices to suit the intended recipient's language preference (Sczepurek et al. 2022).



Feifei's first mediagram

Second mediagram

The second family interview provided the opportunity to discuss the first mediagram, as well as the first three parent-recorded interviews. The second mediagram was collaboratively adapted during this interview, functioning as an DFoI artefact which the family could use to reflect on, highlighting additions and changes. Compared to the first mediagram, most of the touchscreen activities and language use remained the same, only the use of a musical app called Garage band was removed since Feifei was not interested in playing it any more. Linked to Feifei's *practical* FoI, this shows how mediagrams can be used to track and explore changes in preferences and behaviours over time. An activity linked to using her mother's phone to make video-calls with family members in Indonesia was added, both English and Bahasa Indonesia were used during this activity. Similar to the story-telling activity, video-calls with Feifei's grandmother also indicate intensive communication, highlighting Feifei's *social* DFoI. Her mother explained, "*She (Feifei) is more excited if she can express in Bahasa, she is proud of herself if she can explain*", showing how communication in the heritage language can be

linked to enhanced family ties and recognising one's culture and identity (Little 2019; Cho 2000). Her grandmother's encouragement motivated Feifei to practise Bahasa Indonesia, and show pride if she could communicate in the heritage language during the video-calls. Since, for Feifei, authentic communication in Bahasa-Indonesia beyond with her mother requires the use of technology, exploring DFoI is vital to understand her *social* FoI, and speaks to the importance of the inclusion of mediagrams in FoI research.

One of Feifei's tablet activities that was frequently mentioned in the interview and parent-recorded videos is learning Mandarin, with the use of an app called Wukong Chinese, an example of *cultural* FoI. In the second interview, her father expressed his worries about the limited Mandarin resources that Feifei could access and how to help her maintain the language, saying that “如果我不教的话，可能过几年她也会忘。 [If I did not teach (her), maybe she would forget after a few years.]”. He insisted on speaking Mandarin with Feifei most of the time, and using language learning apps in Mandarin together was one of the ways for him to help her learn Mandarin, as the example extracted from the parent-recorded videos shows:

T (Tablet): (with sound and animation effect) 今天是个什么日子? [What day is today?]

F: (Feifei looks at the screen and says) 三月三十日。 [30th March.]

T: (the recording inside the app plays what Feifei just said with animation) 三月三十日。 [30th March.]

(The screen shows animations with some smiling faces jumping on top of the Chinese characters.)

F: (looks at her father and says) 看都在笑。 [Look, (they are) all smiling.]

D: 嘿嘿嘿，对都在笑，是的。 [Hahaha, yes, all smiling, yes.]

F: (smiles and says) 我说的是对的。 [What I said is correct.]

In this example, Feifei's answer to the questions was recorded and a smiling face animation appeared every time she spoke sentences correctly, which made her proud and happy to continue to engage in Mandarin. Well-designed sound effects and animations in learning apps may provide responsive interactions with the child (Kucirkova 2019), encouraging the child to continue playing and learning language, although the interaction between Feifei and her father obviously led to additional motivation.

Besides the language learning app, Feifei's father also selected other games to help her develop Mandarin. During these co-use touchscreen activities, intensive parent-child interactions and parent scaffolding are again clearly demonstrated, as the below example from one parent-recorded video shows:

(The parents and Feifei were playing a car-racing game.)

F: (Feifei points at the left column and asks) 还有哪个，爸爸? [Which one, dad?]

D: 往上走到哪里了? [Where did you go if you went upwards?] (her father points at a green spot on the screen and asks) 走到这里了是不是? [Went to here, right?]

M: Turn left or right?

D: 走到这里了应该是往右边走。 [Should turn right when (the car) arrived here.]

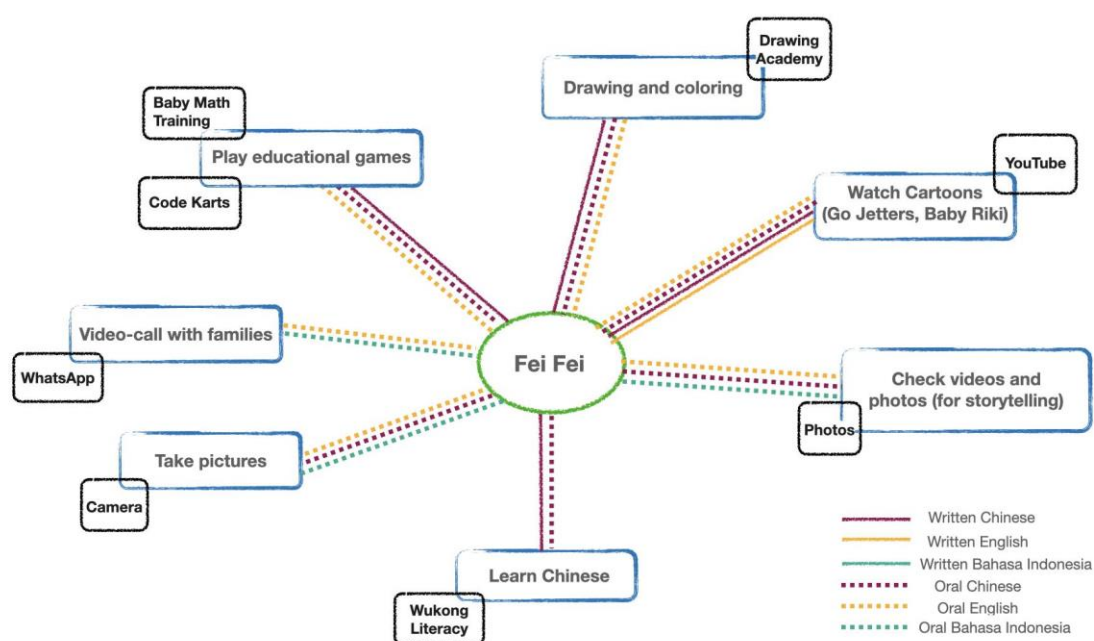
F: (Feifei listens carefully and points at an orange button on the left column and asks) 这个吗? [This one?]

D: 右边是在哪里? 右边的箭头。 [Where is turning right? The button for turning right.]

F: (Feifei points at the same button and says) 这个。 [This one.]

D: 对。 [Correct.]

In this example, Feifei could not find the correct button to move the car, she asked for her father's help and found the correct button by following her father's instructions, illustrating how high-quality parent-child interactions during touchscreen activities may facilitate language development (Sheehan et al. 2019). Playing a Chinese game with her parents links Feifei's *cultural* and *social* FoI through digital tools, even though they are in the same room, highlighting the important mediating power technology might have in children's FoI development. Combining Feifei's other touchscreen activities discussed above, her trilingual language abilities continue to improve through communications and parental support.



Feifei's second mediagram

Third mediagram

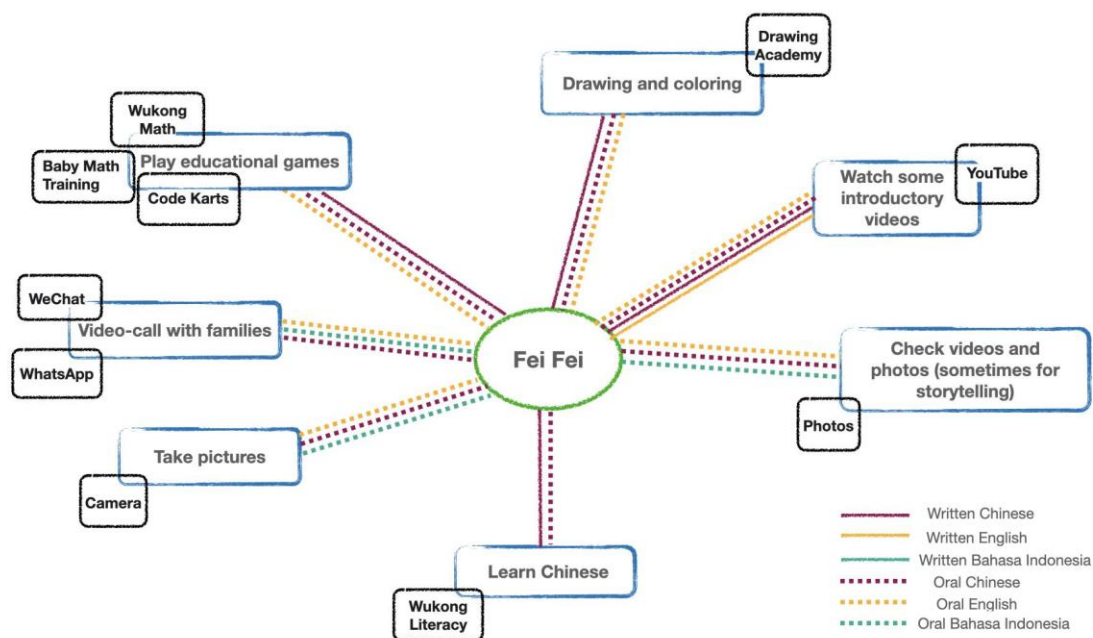
The third mediagram was formed after conducting the third interview and discussing the final (fourth) parent-recorded video. Compared with the second mediagram, the categories of Feifei's touchscreen activities do not change, but two new apps are added, one for making video-calls with family members in China via WeChat. Feifei speaks only Mandarin with her grandmother in China, so oral Mandarin is added to the video-calling activity, again highlighting the importance of technology for Feifei's *social* FoI.

The other new app is an educational app called Wukong Math. Similar to apps introduced previously, Wukong Math is an educational app, helping Feifei learn simple mathematical concepts through touchscreen games. Her father explained,

“比如说，一个7字它会让上面涂涂完泥巴，涂完泥巴之后你把它洗干净，照着把泥巴洗掉，这样呢你就得到了一个没有泥巴的7字。[For example, there is a number 7, and it asks you to put mud on it, after putting mud on you wash it clean, follow (the arrow) and wash the mud off, when you can get a 7 without mud.]”

By using her fingers to draw and interact with the screen, Feifei got to know how to pronounce number 7 in Mandarin. Touchscreen devices and apps may offer responsive and entertaining experiences for children (Kucirkova 2017); however, when playing these gaming apps, the lines between actual entertainment and the aim of language learning may not be clear (Little 2020). Studies show that parental preferences to apps may be ‘edutainment’ with clear language learning goals (Little 2019). Feifei’s choice of apps was strictly limited to her parents’ selection (Livingstone et al. 2019) and some of the choices are with educational aims. The FoI links of this particular activity are therefore blurred - although Feifei does not go to school yet, it could be said to be *institutional*, arguably speaking to parental desires for their child to not fall behind in school (Little 2023), thus supporting educational apps. Equally, though, from Feifei’s perspective, it could be a *practical* FoI, an activity or game Feifei engages with, without necessarily focusing on the educational content from her perspective. This blurred genre seems particularly relevant in Digital FoI research, where parents regularly hope to utilise the motivational impact of technology to further educational aims (Little 2020), and long-term research will be needed to understand how children navigate parental choices as they grow older (Kotrla Topić, Perić Pavišić, and Merkaš 2023).

The changing content of Feifei’s screen-watching activity with YouTube in the three mediagrams also indicates parental supervision (Livingstone et al 2019). In the first two mediagrams, Feifei mainly watches cartoons on YouTube, with parental mediation. Her father removes Peppa Pig from the programmes Feifei has access to, explaining that, “里面有些东西，有些行为不是特别好 [some content in (Peppa Pig), some behaviours are not very good]”. By the time of the third mediagram, Feifei only watches introductory education videos on YouTube with her touchscreen devices, highlighting the same tension between institutional and practical FoI as above.



Feifei's third mediagram

Discussion

Focusing on one individual child in detail, over an extended period of time, speaks to the FoI approach of centering the child (Hogg and Vollman 2020, Esteban-Guitart 2016). When looking at the three mediagrams collectively, Feifei's tablet use is varied: playing gaming apps (mostly educational ones), taking photos, browsing photo albums, drawing pictures, and making video calls to remote family members. The apps she uses for her activities were mainly designed with specific functions in mind, and some are designed especially for young children (e.g. Wukong Math, Wukong Chinese). Furthermore, Feifei's tablet use activities and language choices were rather fixed, despite some of her changing interests, with parental influence on app and language choices evident (Little 2020). Parental supervision and the intensive parent-child interactions are key features of her home technology use, influencing her FoI development.

Feifei's trilingual language practices are also diverse, as is typical of pre-schoolers in multilingual families (D'warte and Woodrow 2023, Miller Marsh et al 2022). When checking the lines that represent different languages that connect Feifei with her varied touchscreen activities, the dotted lines (representing spoken language use) of all three colours appear most frequently than the continuous lines (representing written language use). This makes sense, given her young age. Among the use of all the three languages, the recently introduced language, Bahasa Indonesia, was used least, only oral Bahasa Indonesia was found in three activities: taking pictures, checking albums for storytelling and making video calls. The prevalence of spoken language speaks of a high level of *social* FoI - in order to use spoken language, Feifei requires speaking partners, and multiple tools and apps in her mediagrams attest to this, though, interestingly, no tools or apps explicitly designed for spoken language development (e.g. listen-and-repeat apps or reading-aloud apps). Instead, Feifei's *social* DFoI

involve technology as a vehicle or tool to support connections with real people - whether via social media to communicate with her grandmother, or photographs to recount her day to her father. This distinction highlights the importance of co-developing mediagrams with families, drawing out not just what technology is used, but also how and why, to understand FoI development. The family practice of documenting the day and recounting it in the evening is reminiscent of D'warte and Woodrow's (2023) approach of bringing young children's FoI into the early years education context, and suggests an important opportunity for family digital practices to facilitate an understanding of children's FoIs in educational settings.

The most frequently used language while engaging with tablets was Mandarin. Both written and oral Mandarin were used in several activities, such as playing games, drawing, watching cartoons or videos, and learning Mandarin. The varied frequency of the three languages in Feifei's tablet adoption may be influenced by parental attitudes towards language and touchscreen activities (Plowman 2015).

Parental preferences about language choices and parental meditations linked to the child's touchscreen activities can influence the child's DFoI. The family language policy (Wilson 2020) in Feifei's case focuses on the development of the two heritage languages. Both parents mentioned their willingness to speak more heritage languages with their daughter. In England, Feifei has limited resources to develop her Mandarin, and her father was worried that if he did not teach her Mandarin, she may forget the language. Similarly, after the mother and Feifei returned from their vacation to Indonesia and Feifei began to go to nursery, the mother said that *"So, I try to decrease the amount of English I speak to her, into Bahasa."* Feifei's parents value their heritage language maintenance, and their links to the heritage language influence their language choices for Feifei (Ivanova 2019, Kupisch and Rothman 2018). Feifei's three languages are clearly part of her FoI, and development of all three languages is supported through tablet use. While different parental attitudes influence Feifei's language use while using touchscreens (Plowman 2015), high-quality interactions take place between Feifei and family members in both the heritage languages and English with the help of touchscreen activities, such as storytelling with photos/videos and facetimeing (D'warte and Woodrow 2023). Feifei can securely identify the three languages and she is clear about her trilingual identity, through the home digital practices and daily communication. Her multilingualism is most certainly not a deficit (Valencia 2012), and mediagrams are one potential way of alerting her future educational contexts to the rich linguistic tapestry Feifei's FoI represent.

Regarding the five aspects of FoI (Esteban-Guitart and Moll 2014, Esteban-Guitart 2016), Feifei's digital practices clearly incorporate the following:

- *Geographical* - both through the family habit of documenting their experiences throughout the day, and the use of technology to span geographical distance
- *Social* - there is strong evidence of using technology to connect Feifei to family members, both inside and outside the immediate home environment
- *Cultural* - through the use of play and supporting cultural family experience through documentation

- *Practical* - documenting the day is a practical way to share information with family members, and Feifei is learning life skills, such as directions from driving games.

The one aspect of FoI that is only debatably represented in the data is the *institutional* FoI, arguably linked to educational content apps Feifei is encouraged to use by her parents. Their desire to drive educational content speaks to ideals such as future school success (Little 2019), but this desire, to us, seems more linked to the family's FoK, whereas how Feifei experiences this same content may not be as institutional, but as social (co-playing or co-viewing with parents), or practical (as activities to engage in) or even cultural. This distinction highlights the important delineation between FoK and FoI, and Feifei is too young, as yet, to examine and reflect on her experiences in detail so as to enable us to assign them to a specific FoI/DFoI. More research is needed to understand how children's DFoI change as they enter the formal school system, and parental control on digital choices gradually reduces (Kotrla Topić, Perić Pavišić, and Merkaš 2023).

The study highlights the methodological value of mediagrams (Lexander and Androutsopoulos 2021) to examine DFoI at family level - producing an artefact through interviews and parent-recorded affords both parents and child the opportunity to drive the research and co-create meaningful results. At the same time, mediagrams themselves make a vital contribution to DFoI research, not only as the artefact forms an important centre for discussion and development, but also because it provides a chance for these mediagrams to be shared between home and school, giving institutional establishments an insight into not only digital practices, but also how these practices link to the child's FoI.

Conclusion

Mediagrams form an important tool for capturing children's digital lives for FoI/DFoI researchers, and offer a significant opportunity in researching multilingual families. Since mediagrams are not created in isolation, but through triangulation of various methods and in collaboration with families, they are a useful research method that give families the opportunity to reflect repeatedly on data gathered from observations (here the parent-recorded videos) and interviews, thus enabling the tracking of DFoI development. Mediagrams can and should be continually adapted to illustrate a child's changing language environment, as they illustrate language use both through the lens of technology itself, as well as through parent-child interactions. Taking the research field beyond the study at hand, mediagrams have the potential to become artefacts that can be shared with, or created with the support of, formal education contexts. Specifically, mediagrams can be introduced as a once-a-term activity in nursery or school, giving insights into family FoK, home language use, and the child's DFoI. For multilingual children in particular, mediagrams facilitate the artefact-based approach often adopted in FoI research (Esteban-Guitart 2016, 2021, Miller Marsh et al 2022), while incorporating clear opportunities to explore and acknowledge home language use, and how this develops over time, making it a vital tool for education contexts to understand home language practices. Even more specifically, mediagrams offer the opportunity to problematise and understand the ubiquitous term 'screen time' by analysing DFoI according to Esteban-Guitart's (2016) FoI classifications, overcoming stereotypes around technology use and offer a more

fine-grained understanding of how technology contributes to FoI and multilingual development (Little 2020). The approach further provides opportunities to identify key activities (such as Feifei's retelling of the day through photographs and videos) which may be used to bridge home and school. The research field of DFoI is still relatively new, and this study makes a methodological contribution to the field of FoI research, by offering a meaningful tool to drive DFoI research forward, and to enable practitioners to understand multilingual children's DFoI in the home context.

Feifei's DFoI are fluid and change according to new apps and games identified by her parents, as well as her growing language confidence. As Feifei grows older and more independent, mediagrams offer an important opportunity to highlight the shift from parent-dependent to more independent technology use, and how this reflects across the child's multiple languages.

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