What's it like to learn with an iPad?

A postphenomenological study.

Abstract

This dissertation is a qualitative study on children's experience in using an iPad at the researcher's UK primary school and seeks to answer the question: *what is like to learn with iPad?* It draws on Wellner and Levin's framework for considering digital technology, which combines Papert's Mindstorms and Idhe's Technic and Praxis into the four postphenomenological relations of embodiment, hermeneutics, alterity and background for understanding how technology mediates children's learning experiences. This dissertation uses a Mosaic-inspired method to research children's experiences, conducting interviews with six children as well as gathering 'digital tours' and 'digital maps' from children. It found that children were positive in affect towards the iPad, with key parts of their experience and usage of the device involving the learning platform, coding apps, educational spelling and number fact games, a digital library and e-reader app, the camera and a digital book creation app. These were then analysed in terms of embodiment (camera and onscreen typing), hermeneutics (e-books and coding apps), alterity (learning platform and educational game) and background (problems using iPad and one-to-one deployment). The four implications of the research are about the benefits providing of one-to-one devices in an education setting, the importance of providing an effective learning platforms, the ongoing the positive impact of teaching coding to children, and the need for experiential learning.

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1. Introduction

The iPad, Apple's then latest incarnation of the "bicycle for our minds" (Jobs, as cited in Couch, 2021, p. 11) in the form of an easy-to-use yet technologically capable tablet computer, saw rapid adoption in education after its launch in 2010: by 2012, 1.5 million were in use in educational settings globally and over 1,000 schools worldwide had adopted a one-to-one deployment for students with the device (Apple Inc., 2012). Initial pilot studies were very positive, with Burden et al. finding that "many teachers and students…are convinced [the iPad] has changed learning for the better" (2012, p. 11). Over time, however, it became clear that the evidence for the educational benefits of iPads in schools was more mixed: Boon et al., after undertaking a systematic review of 43 studies published between 2010 and 2019 examining academic outcomes for students aged 9-14 years using mobile technology, summarised that "it is not clear whether iPad-based learning is as effective in practice as it is in theory" (2021, p. 526). Despite this, and perhaps as an "educational utopian" (Papert 1980, p. 17) teacher and ICT Coordinator, in 2016 I led the introduction of a one-to-one iPad deployment for Key Stage 2 (7- to 11-year-olds) in my school, followed by Key Stage 1 (5- to 7-year-olds) in 2018. We have arguably seen success with the programme, with positive comments from Ofsted in their 'outstanding' visits to my school in 2019 and 2022 about the use of technology that they saw and it's impact on learning. During the most recent inspection, children brought their iPads with them to group interviews with inspectors and could talk animatedly about their learning, opening up apps, documents and created digital artefacts as they shared enthusiastically about their work. This dissertation attempts to sidestep the skepticism and malaise surrounding the iPad in education and instead tries

to unpack children's lived experience using it as a learning tool: *what is it like to learn with an iPad (RQ1)?*

At it's heart, this dissertation is a phenomenological study concerned with exploring the lived experience of how learners directly perceive things in their lifeworld (Aagaard, 2017, p. 519). Conceptually, it sits at an intersection of multiple streams of thought that all converge as we consider the iPad in the classroom, with three corresponding subquestions that unpack my main research question. First, *how might we conceptualise the iPad as a learning tool (RQ1-1)?* To answer this, I will draw on the pioneering work of Papert (1980) in exploring and advocating the use of computers with children as part of learning, and in particular as a learning tool. Willard's (1995) understanding of the philosophy of phenomenology offers an understanding of the nature of knowledge itself, particularly how perception/experience can be a sufficient basis for knowledge. Idhe (1979) argues that technology mediates our experience of reality through embodiment, hermenutic, alterity and background relations in his development of the field with postphenomenology. Wellner and Levin (2023) then link these four relations back to Papert (1980) to form a postphenomenological-constructionist framework for understanding technology in education.

My second subquestion is: *what is like for a child at my school to learn with an iPad (RQ1-2)?* I will use a Mosaic-inspired approach (Clark, 2017), building up a picture of their experience through interviews, 'digital tours' (where I screen-record a child demonstrating and talking about how they use their iPad) and 'digital maps' (where a child creates a digital artefact to represent their experience of using their iPad for learning). Whilst not a classical phenomenological approach, I believe it is in that same spirit of

seeking to understand the experience of consciousness. And my third subquestion is: *what does an postphenomenological-constructionist analysis tell us about the experience of learning with an iPad (RQ1-3)?* Here I take Wellner and Levin's (2023) framework, through the relations of embodiment, hermeneutics, alterity and background, to analyse children's accounts of their experiences of learning with iPad. These multiple lenses and subquestions will then allow me to answer my main research question.

At this point I need to make my bias clear: I believe that one day giving a computer to a child for learning will be as ordinary as giving them a pencil and paper is today. I am fully aware that the iPad is no 'magic bullet' and can be used poorly and carelessly in the classroom, hindered by a lack of vision, scant professional learning provision for educators and a failure to invest in necessary infrastructure. At the same time, I would like the success I have personally seen with the one-to-one programme in my school replicated in many other schools. According to Rogers' Diffusion of Innovation (2023), one of the attributes of a new idea that affects how it spreads through a population is 'observability': "the degree to which the results of an innovation are visible to others" (p. 698). My hope is that this research will make the experience of learning with an iPad a little more 'visible', which will then in turn make the benefits and challenges easier to articulate to schools who are interested in the idea of assigning a computer to every child.

I will begin with a literature review, examining what Ofsted had to say about my school as well as the research showing the impact iPad can have on engagement and collaboration. I will then explore the thinking of Papert, Willard, Idhe, and Wellner and Levin, as outlined above. In my methodology I will defend my use of a Mosaic-inspired method of interviews, digital maps and

digital tours, as well as how I undertook my thematic analysis. I will also discuss ethical consideration and the limitations of my study. In my results and analysis chapters, I will draw out the main themes from my study and then analyse the data from the four postphenomenological relations of embodiment, hermeneutics, alterity and background. In my discussion, I will summarise my findings, make connections back to theory and then consider implications for practice as well as possible directions for future research.

2. Literature Review

An assumption behind my main research question is that the iPad can indeed be used for learning. In this literature review I will attempt to answer RQ1-1: *how might we conceptualise the iPad as a learning tool?* I will do this by looking firstly at my own school and then at wider research that has examined iPad in a school setting. I will then turn to the thinking of Papert and how iPad fulfils some of the predictions made in the early 1980s. Following this, I will draw on Willard's understanding of Husserl's phenomenology as a philosophical approach and how this offers an integrated understanding of the nature of knowledge. Utilising Wellner and Levin, I will evaluate the links between Idhe's postphenomenology and Papert's constructionism and how it provides a way to understand the creation of knowledge — the representation of the thing 'as it is' — via the relations of embodiment, hermeneutics, alterity and background.

Learning with an iPad

The use of technology was highlighted by Ofsted following their inspection visits to my school in 2019 and 2022. The 2019 monitoring visit noted how every child has a tablet computer to use in all curriculum areas, with this used with particular success in reading as "pupils are able to download texts which have been selected for them by their teachers, and work collaboratively with their peers to engage with and learn from the text" (Ofsted, 2019, p. 3). A result of this was that "even the most reluctant readers are highly motivated and inspired by the use of the tablets." They also stated that "all pupils' learning is supported by the personalised use of technology" (p. 5). The 2022 inspection commented how pupils "particularly enjoy using technology to create images

and making short films to capture what they have learned" (Ofsted, 2022, p. 2). Regarding how teachers help pupils retain knowledge, Ofsted noted how "pupils like how they get to use a range of technology to record and connect knowledge between different subjects and topics." In both reports, the iPad is highlighted as contributing to learning through encouraging collaboration, motivating engagement as well as providing a mechanism for accessing classroom resources. It also is suggested as a tool for 'capturing', 'recording' and 'connecting' knowledge, via photography and video but perhaps in other ways as well.

There certainly are affordances of the design and form of the iPad that can — potentially — lend themselves to learning. Henderson and Yeow (2012) argue that the unique features of the iPad are "the streamlined design, the lack of peripheral attachment, the connectivity, the large multi-touch screen and the variety of different applications available to the consumer" (p. 78). In their case study of one of the world's first iPad deployments in education, it was this combination of features that "makes it a very portable device for children to hold, operate and use it where they choose, whether at their own desk, collectively around a table, on their lap or possibly out of class" (p. 80). It was this mobility that excited Melhuish and Falloon (2010), writing prospectively about the iPad after it was released but before they had been able to try it. For them, "the iPad offers all the aforementioned portability of mobile devices, but with the increased power of a computer" (p. 6). They thought that the intuitive interface would be something that even young children would be able to access (p. 7), something echoed by Flewett et al. (2015), who found from research in early years settings that "children…relished the responsive nature of iPad activities and the immediacy of the results they produced" (p. 299). Not

all were convinced about the potential about the iPad, with Murray and Olcese boldly predicting that they “do not think the iPad will ignite a revolution in schools” (2011, p. 48), arguing that the types of software available for the iPad are either ‘drill and practice’ or simple content consumption, rather than offering meaningful collaboration opportunities.

Subsequent research, however, has found that using iPads in schools can indeed increase opportunities for collaboration as part of learning. Fisher et al. (2013) found that the design of the iPad facilitated collaboration between students, noting that “the size and portability of the iPad allowed students to share their screens as part of their dialogue” (p. 166). When compared to using laptops, the iPad was more readily used as part of mathematic discussion when working collaboratively. Falloon and Khoo (2014) built on this to study the kind of talk used by 5-year-olds when using certain iPad apps to create content in pairs as part of literacy or maths learning. They found a high level of on-task cumulative student talk, which they suggested was both due to the more open-ended nature of the apps used and the increased ‘public space’ afforded by the iPad’s design. They concluded that the iPad “at least potentially could provide students with powerful environments supportive of critical but collaborative content development, as gauged by increased exploratory talk” (p. 27). In a much wider study of over 100 elementary schools in New Zealand, Falloon (2015) found that students valued the iPad’s portability, screen viewing angle, screen rotation function and quality sound as affordances that enabled collaboration in their learning. Apps like Google Docs were also key for enabling collaboration, particularly in how it allowed synchronous and asynchronous working together on a document. Falloon cautions that having access to iPads doesn’t guarantee collaboration, noting

that “iPad use in these classes was embedded in curricula purposely designed to foster learner collaboration and higher order and critical thinking skills” (p. 75).

Another benefit for learning with an iPad is that of engagement. In early research on the iPad in classrooms, Gasparini (2011) expected the initial enthusiasm for newly introduced iPads to wane but instead “no change in children's behavior [sic] or interest was observed” (p. 24). In a three-year longitudinal study of a secondary girls school with a one-to-one iPad programme, Tay (2016) found that “students consistently reported that they found lessons using the iPad more engaging” (p. 16). These results came from surveys across the student body as well as in group interviews, with students making links between engagement, easy access to online resources and the ability to more conveniently continue learning outside of school. Tay compared results from the ‘pioneer’ groups of students with access to one-to-one iPads to the rest of the cohort who didn’t have one-to-one devices and found that the younger year groups and those of lower ability saw a greater impact on academic scores. Tay suggested that perhaps this could have been due to the examination pressures in older years reducing the use of iPads in lessons, as well as teachers with the younger students having had more experience with the iPad and making better use of them in the classroom. Diemer et al. (2012) also found an impact on reported student engagement when an iPad was provided and used as part of active and collaborative learning tasks across a range of undergraduate courses. They also found a moderate positive correlation between reported levels of engagement and reported levels of learning (p. 20).

Papert and learning with technology

I would argue that engagement and collaboration, whilst being helpful or even vital aids or aspects of the learning process, they are no learning itself. Does the iPad offer anything beyond this in the classroom, perhaps touching into the very process of learning itself? Papert (1980) certainly had high hopes for computers in education, writing before the advent of graphical user interfaces and touchscreen tablets and believing that computers could be "objects-to-think-with" (p. 11) for children. He frames this by a retelling of his childhood obsession with gears, which he says "did more for my mathematical development than anything I was taught in elementary school" (p. vi). The gears became a mental model that then enabled Papert to grasp a range of mathematical ideas and relationships as he went through his schooling. But because he so loved using and playing with gears, this positively coloured his contact with mathematics as he grew up.

Papert takes a Piagetian view of learning, that children are "builders of their own intellectual structures" (p. 7). In comparing Papert and Piaget's approaches, Ackermann argues that for both "knowledge is not merely a commodity to be transmitted, encoded, retained, and re-applied, but a personal experience to be constructed" (2001, p. 7). Whereas Piaget offers key insights into the stages of cognitive development of children as they grow, Papert always emphasised that learning needs to be hands-on and not just in the mind, "that concrete thinking is no less important than figuring out things 'in the head'" (Ackermann, 2001, p. 7). In light of this, Papert suggests that computers offer a richer set of models that children can build their knowledge and understanding from, particularly if children are immersed in the world of computers, perhaps similar to how a child quickly learns a foreign language if

they live in that country. The main conceptual model that Papert explores is with geometry through the LOGO programming language and corresponding real-world or on-screen floor programmable robot 'turtles'. However, he also suggests that systematic thinking, possibility modelling and even drafting/ writing could be areas that a computer could help. He summarises his thinking as arguing that "children can learn to use computers in a masterful way, and that learning to use computers can change the way they learn everything else" (1980, p.8). The role of the teacher is one to support the learning process, but it is the learner who must do the learning: "the actual job of getting to know an idea…cannot be done by a third party" (p. 137). Although how a teacher structures activities using technology is vital for how they are used for learning, my dissertation focuses on the experience of the learner rather than the teacher.

Some of Papert's (1980) predictions are surprisingly prescient, particularly when considering the iPad and its use in education generally, but also specifically in my school. It seems quite likely some of his ideas have gone on to shape the approach of educationalists, but also technology companies themselves in terms of the sorts of products that are made and promoted. Papert predicted that by the 21st century, computers in children's toys would have more power than a late 1970's IBM supercomputer (p. 24) and that there would be a "massive penetration of powerful computers into people's lives" (p. 23-24). Despite freely identifying as being 'utopian' is his thinking, Papert was aware of the potential dangers that computers could have on the development of the human mind. But for Papert, this was also a benefit: he claimed to "have invented ways to take educational advantage of the opportunities to master the art of *deliberately* thinking like a computer" (p.27). In all of this, Papert knew

that there needed to be a vastly greater investment in and provision of computers for children. As he states, “My vision of a new kind of learning environment demands free contact between children and computers” (p. 16). The proliferation of one-to-one device programmes in schools and colleges suggests that his ideas have some merit. Papert even envisioned a sort of computer perhaps like an iPad:

> This is a television screen that can display moving pictures in color [sic]. You can also “draw” on it, giving it instructions, perhaps by typing, perhaps by speaking, or perhaps by pointing with a wand. (p. 12-13)

Given that this device now exists and potentially is in use in schools in a way that Papert himself suggested, how can we best investigate and understand this use and experience?

Studying learning itself

I believe that a phenomenological approach would be insightful for trying to understand more about this kind of technology-rich learning. Moustakas (1994) defines the phenomenological approach as “a return to experience in order to obtain comprehensive descriptions that provide the basis for a reflective structural analysis that portrays the essences of the experience” (p. 12). If we accept Papert’s idea that the use of computers — in our case, the iPad — in learning help structure children’s knowledge, we must look more closely at this experience for children to understand it better. Whilst there certainly has been phenomenological research in education, such as child-led phenomenological investigation in a rural school (Kinash & Hoffman, 2009), an examination

intercultural sensitivity of international secondary school students (Westrick, 2005), and a study on teachers' interaction with the imaginative lifeworld of students in a primary school (Trotman, 2005), there has been very little phenomenological research done on the iPad as a learning tool. Sedaghatjou and Campbell (2017), in investigating the use of a specific iPad maths app in an early years setting, found that it "appears to have supported [the child's] developing understanding of cardinality with tactile, visual and vocal feedback" (p.1236). Their research focused in on one specific child and one very specific element of learning, but certainly were able to trace out how the iPad contributed to a child's formation of the concept and skills with counting.

Now phenomenology is both a methodology *and* a philosophical position and approach, based on the works of Edmund Husserl (1859–1938). Willard (1995) argues that "clarification of the nature of knowledge…is the primary aim of Husserl's philosophical work" and that for Husserl, "knowing… is fundamentally a matter of finding something to be as it is thought to be" (p. 138). Willard elsewhere describes knowledge as "the capacity to represent a respective subject matter as it is, on an appropriate basis of thought and/or experience" (2000, p. 31). This derives from Husserl's "Principle of All Principles" (Hopp, 2020, p. 217), simply put, that experience can be a sufficient/foundational basis of knowledge. In phenomenology, the direction of our consciousness is called its 'intention'. An 'unfulfilled' or 'empty' intention is one that is not verified by 'intuition' or our perception of the object, whereas a 'fulfilled' intention is one that is verified by our intuition: for example, "I think my pen is in the desk drawer, and opening the drawer I find it to be so" (Willard, 1995, p. 145). Representation is how we think about a concept, which can be quite far removed from fulfilment via perception, such as most mathematical

concepts which cannot be checked by counting objects directly in front of you. However, Willard argues that "we 'have' knowledge, are knowledgeable, when we are in a position or are qualified to actualize the path toward the re-cognitive union of concept and object through perception when we choose" (p. 152). I believe this realist understanding or description of what knowledge is has many echoes with the constructivist view of learning from Papert.

Postphenomenology and the iPad

Ihde argues that one thing that is missing from Husserl's phenomenology is the use of technology, proposing that "it is unlikely that Husserl gave attention, whether ordinary or phenomenological, to ordinary use-technologies" (2016, p. 14). Idhe's work to examine how technology mediates and shapes our perception and experience of the world became part of the field of 'postphenomenology'. Wellner and Levin (2023) have drawn interesting parallels between Idhe's postphenomenology in *Technics and praxis* (1979) and Papert's constructivism in *Mindstorms: Children, Computers and Powerful Ideas* (1980), arguing that they interact to form a helpful framework for analysing educational technology. Idhe's four postphenomenological relations of embodiment, hermenutics, alterity and background (1979, 1990) map onto Papert's ideas of 'body knowledge', 'object-to-think-with', the 'micro-world' as well as 'the natural landscape' (1979) as follows:

- **Embodiment: (I – technology) —> world.** Idhe gives the example of driving a car, where an expert driver "'feels' the very extension of himself through the car as the car becomes a symbiotic extension of his own embodiedness" (1979, p. 8). Papert's programmable floor turtle, "is a way to understand space and relations between geometrical objects through a

bodily experience that is mediated by the LOGO software environment" (Wellner & Levin, 2023, p. 5). Reflecting on the iPad in the classroom, the camera and the touchscreen pinch gesture could be understood to offer an embodied and mediated encounter with the world, as might the use of a 'slo-mo' camera to capture and slow down the action of objects in front of the learner.

- **Hermenutics: I —> (technology – world).** When we have to interpret the technology as a way of understanding the world, such as reading the dial on a car, "the machine is something like a text" (Idhe, 1979, p. 12). We can see this in the writing and debugging of command's in Papert's LOGO, and no doubt in the use of coding apps on the iPad, such as ScratchJr (Scratch Foundation, Inc., 2023) and Swift Playgrounds (Apple, 2024). Wellner and Levin argue that "the book, and especially the textbook, exemplifies the hermeneutic relations in education" (2023, p. 7) so the iPad as e-reader and web browser could be understood in this way.
- **Alterity: I —> technology (–world).** This is what Idhe calls "technology-as-other" (1990, p. 98), where the relationship is with the technology itself and not necessarily also with the world as well. Computers can often feel like they have a life of their own, and Idhe recognises that the computer is a "stronger example of a technology which may be positioned within alterity relations" (p. 106). This can be seen in Papert's concept of LOGO as a 'microworld', that computers can offer a digital space where more complex ideas can be playfully explored within a computer simulation. Papert gives the example of learning Newtonian physics through a modified version of LOGO, but this idea can be seen with programmable LEGO WeDo 2.0 (LEGO Education, 2022) models, controlled via an iPad app, or even

experimenting with animation in Keynote (Apple, 2024) to explain or understand a concept.

- **Background: I —> (technology–) world.** Here, technology has become part of the background to a point where it is not really noticed, even though its presence may be vital or sorely missed, perhaps like when the internet or WiFi stops working for an iPad in a classroom. An and Oliver (2021) argue that "technology should be ready-to-hand for students' learning" (p. 13) so that its fluent usage allow for the focus on the task that is being accomplished. A successful iPad deployment in schools, where devices are available and 'just work', could be an expression of this background relation.

The iPad for learning

How then can we conceptualise the iPad as learning device? Whilst engagement and collaboration are important aspects of the learning process, Wellner and Levin's framework, combining Idhe's postphenomenology and Papert's constructionism, provides an insight into how a learner can construct knowledge, the representation of the thing 'as it is'. Through embodiment, the iPad amplifies or extends a learner's experience and therefore grasp of the world; via hermeneutics, the iPad becomes a multimedia text that can be 'read' to better understand the world, or even of creating 'texts' to represent their understanding; in alterity, the iPad allows the exploration by students of simulated environments to develop their thinking; as a background relation, the ubiquity of access with a one-to-one iPad programme allows for this tool to be readily available.

3. Methodology

I will now discuss my methodology, justifying my qualitative research design, which used a Mosaic-inspired phenomenological approach to answer RQ1-2: *what is it like for a child at my school to learn with an iPad?* I will explain in more detail the different data collection methods I used, including paired interviews with children, child-led 'digital tours' of their iPads and creative 'digital maps' of how learning happens using an iPad. I will then outline about my approach to thematic analysis of the transcribed research data to draw out the emergent themes. I finally will discuss the ethical concerns and the limitations of my study.

Research design

My research was qualitative, taking "full advantage of the not inconsiderable power of the human-as-instrument" (Guba & Lincoln, 1982, p. 235). However, I did not take the usual relativist ontology or subjectivist epistemology for such a study, but rather a realist one. According to Willard (1984), Husserl

> believed the world which is known in the full range of possible cognitive acts also to *exist in itself,* and that its existence is not relative to particular minds which may know it—or even to the nature of *the human mind* in general. (p. 237)

I take the real world to include the iPad, the children in my school and the learning that happens (or otherwise) using the device. Whilst the methods I used involved talking to children about their subjective experience of the learning process, my aim is that the knowledge thus generated can be treated

as objective, to the degree that it corresponds with reality. Knowledge can never be exhaustive or complete, but my intention throughout has been to attempt to answer honestly as possible my research question.

One particular challenge posed by RQ1 is the desire to find out what it is like *as a child* to learn with an iPad: Shi (2011) notes that "there seems to be little phenomenological research that has been conducted with children" (p. 6). Adams and Turville summarise the phenomenological method as involving two parts: first, gathering or generating reflexive materials or anecdotes regarding the phenomena in question; and second, reflecting on these materials phenomenologically (2018, p. 4). I imagine that there are great challenges with involving children with both of these steps as I would argue that children are not always immediately able to articulate their experiences, nor reflect on the meaning of them to others. A study by Porto and Kroeger (2020) implemented a solution to this problem by using methods adapted from the Mosaic approach (Clark, 2017) to undertake their phenomenological research into children's preflective and reflective experiences of nature. Clark defines the Mosaic approach as "a multi-method, polyvocal approach that brings together different perspectives in order to create *with* children an image of their worlds" (p. 17). Through a range of methods and approaches, a picture is built up of how children see and understand their lived experiences. Though not a traditional phenomenological approach, I have chosen this as a way to engage with children and how they articulate their experiences of learning with the iPad.

Clarke (2017) outlines six tools that can be used in the Mosaic approach but, due to the time constraints of a dissertation, I was only able to select three: this would still allow me to capture children's perspectives from a variety

of angles, but is clearly a limitation to this study from the outset. ‘Child interviews’ was the primary tool I selected as it would elicit children’s anecdotes and accounts of their experiences in using the iPad for learning. Second, I modified ‘child-led tours’ to instead use the screen-recording function on the iPad to capture a video feed of the iPad’s display along with the audio of the corresponding conversation as a child ‘showed me around’ the learning environment that was their iPad, as this would allow children to demonstrate as well as talk about their experiences. Third, I digitised ‘map making’ with children using a digital whiteboard app to show in visual form what it is like to learn with an iPad, with the aim that this would capture something of children’s representation of the learning experience with an iPad. ‘Observation’ of children using the iPad in the learning would have been fruitful no doubt, but I felt that the digital tours would give me an element of this tool. ‘Children’s photographs and book making’ also would have been insightful, but again the digital maps involved an aspect of this creativity. Finally, ‘interviews’ with teachers and parents might have widened the scope of my study beyond focusing on the experience of the child.

Technically, the kind of phenomenology I have undertaken is postphenomenology as it concern understanding the experience of consciousness mediated via technology. Aagaard et al. note that “no distinctly postphenomenological methodology exists” (2018, p. xi), which is both a challenge and an opportunity! Adams and Turville identify case study “as a popular way to frame postphenomenological studies” (2018, p. 7), and in many ways my research could be understood in this way: I am taking the example of my school as the ‘case’ in question and seek to understand it as fully as possible. The phenomenon of ‘learning with an iPad’ is still relatively new and

arguably varies greatly depending on the school setting. From the outset, I was aware that some of the experiences of children at my school would be quite unique to us and cannot easily be replicated elsewhere. Whilst I knew that a Mosaic-inspired approach would highlight the peculiarities of my setting, I still felt that it would allow for a useful study on the lived experience of using the devices.

Data collection methods

Before I could begin undertaking my study, I needed to locate and select some learners from my school who are willing to participate the in the research. Moustakas (1994) identifies five essential criteria for selecting research participants: an experience of the phenomenon, an interest in understanding its nature, willingness to participate in a potentially lengthy interview, consent to conversations being recorded and permission for the data to be published in a dissertation. I chose to speak to six children in total, which partly was due to the time constraints on conducting interviews and then transcribing and analysing the results. Guest et al., in discussing how many interviews would be considered ‘enough' in a qualitative study, i.e. when data ‘saturation’ had been reached and no new themes or data could be observed in the data, noted that Morse (1994, as cited in Guest et al., 2006, p. 61) “recommended at least six participants for phenomenological studies.” Guest et al.’s study, using data from 36 interviews with women in two African countries, found that 73% of all thematic codes emerged in the first six interviews, with 92% of the total codes by the twelfth transcript. I felt that interviewing six children was the minimum amount necessary for meaningful results, with the Mosaic-inspired approach augmenting this data with additional information from the digital tours and

digital maps; because this also increased the time demands for transcribing and analysing the results, doubling the number of participants to twelve would not have been feasible.

I initially considered just speaking to children from one class because they would have had a shared experience of learning with an iPad in a similar way as each other as they moved through the school. However, in the end I decided against this because it would limit the chances of finding appropriate participants from just within one class. It would also turn the research into more of a case study of that one particular class, rather than opening it up wider to the whole school to find the unifying essence in the experience. Because of this, I instead chose to work with pairs of children from Year 1 (5 and 6-year-olds), Year 3 (7 and 8-year-olds) and Year 5 (9 and 10-year-olds), not wanting to interrupt the studies of children in Year 2 and 6 who had statutory assessments during the time of my research.

I liaised with class teachers from classes in the selected year groups to help identify children who would be articulate in their descriptions and discussions in an interview, as well as likely to want to talk about their experiences of learning with an iPad. I initially met with the selected children to explain my project and determine if they wanted to participate in the research: they all agreed. I then contacted parents to explain the project in more detail and to gather their consent, which they all gave. One parent had quite poor English, so I used an online translation tool to translate the information sheet into their own language (Somali). Of the 6 participants, four were boys and two were girls: I deliberately did not ask teachers to select on the basis of sex (i.e. ‘pick one boy and one girl’) as I did not consider this as a relevant criteria for participation. In terms of ethnic background, none of the children were from a

White British background, which reflects the ethnically diverse makeup of the school and area. At the same time, I did not actively select on the basis of ethnicity for inclusion or exclusion in the study.

In considering the nature of interviews with young learners, I tried to heed van Manen's advice (2016) that "the interview process needs to be disciplined by the fundamental question that prompted the need for the interview in the first place" (p. 66) in order for an open-ended interview to produce data that is useful for a phenenological study. He emphasises the importance of gathering personal life stories, with enough concrete stories, anecdotes and examples of experiences (p. 67). Because of this, I designed a sequence of questions that aimed to encourage children to reflect and describe times when they've used an iPad as part of their learning process (see Appendix 1). As well as asking children to recount their experiences using an iPad for learning and their feelings about that, I also prompted children to talk about use-cases with iPads that could correspond with Idhe's postphenomenological relations of embodiment, hermeneutics, alterity and background. I decided to record the interviews with children in pairs from their class and year group to help them feel more comfortable to talk and to allow the possibility of children building on each other's answers due to their shared experiences. Each paired interview lasted for around 25 minutes. I used the Voice Memos app on an iPad to record the interviews.

In terms of the other elements to my Mosaic-inspired approach, I invited all children to create a digital map. I asked them to use the Freeform app for the iPad, which allows the user to add text, images, photos, drawings and more onto a large digital 'free-form' canvas. One other advantage of this app was that I could also invite the children to digitally collaborate on their iPad

with the Freeform ‘map’ for more convenient capture of their work. I gave them the prompt: ‘What’s it like to learn with an iPad?’ and then asked them to create a collage to show a visitor the most important things about using an iPad in a learning setting. I then exported these as PDFs from the Freeform app for analysis. With the child-led digital tours, I worked with each child individually and set up and triggered the screen recording function on their iPad. I then gave the child the prompt: ‘show me some of your learning on your iPad’, asking them to talk as they 'showed me around’ the iPad and opened apps and resources as they saw fit. The digital tours were of around 5 minutes each and were captured concurrently with the digital maps: those not recording their digital tours with me world on their digital maps until everyone had completed it. This process lasted around 45 minutes.

Data analysis methods

To transcribe the interviews and the digital tours, I used the transcription feature within Microsoft Word on the web (Microsoft, 2024) via my UCL Microsoft account and licence. This tool uses artificial intelligence to attempt to transcribe the audio, including separating out the different speakers. The process was not perfect and so required careful checking of the transcription for accuracy, particularly given children’s developing speaking skills. The Microsoft Word transcription service automatically removes ‘filler’ words like ‘um’ and ‘er’, which was not ideal but was acceptable to me as I was not wanting to do in-depth linguistic analysis on how children spoke. I did seek to keep the sometimes repetitive and round-about nature of children’s talk in my transcription, indicating any ellipsis in my findings with ‘…’. With the digital tours, the microphone on the child’s iPad captured the sound of every single

tap and interaction with the screen, which I initially was concerned would make transcription difficult. However, once I had extracted the audio from the video file, Microsoft Word was able to transcribe the audio without too much difficulty. I added brief descriptions in square brackets to describe what children were doing on screen in their tours as they spoke.

I then undertook a thematic analysis of the interviews, the digital tours and digital maps. van Manen (2016) defines phenomenological themes as the "structures of experience" (p. 79), noting that "a so-called thematic phrase does not do justice to the fullness of the life of a phenomenon" (p. 92). Despite this, themes can help make sense of the wealth of data that qualitative research generates. I came to the research data with some themes already in mind, due to the direction of the questions I asked children in the interviews. However, I did seek to code the transcripts with as open a mind as possible, identifying emergent themes across the various transcripts as I worked through them. van Manen is quite disparaging about a more mechanised approach to theme analysis via coding, including the use of "computer programs available that claim to do the theme analysis for the researcher" (p. 78-79). Despite this, I decided to use the qualitative research coding software Taguette (Rampin & Rampin, 2021) to help me with tagging as it was an efficient way to process and revisit the data from different angles. In my coding, I ended up with three broad categories of tags: the general topic of the conversation (indicated with a lowercase tag, e.g. 'handwriting' or 'resource availability'); the names of software mentioned (indicated with a capitalised tag, e.g. 'Showbie' or 'Tynker'); and any National Curriculum subject mentioned or covered (indicated with an underscore, e.g. '_Computing' or '_French'). The software enabled me to tag parts of the transcript with multiple tags, which could then be viewed

accordingly, as well giving frequency counts for each tag to help with theme analysis.

Ethics and limitations

My completed ethics form from UCL was approved by two members of staff and in it I agreed to the BERA (2024) ethical guidelines for academic research. One key part of this is gathering consent from all those involved in my research: I gathered verbal consent from the child participants before then asking for written consent from their parents, gathered via Microsoft Forms (Microsoft, 2024). Throughout the process I ensured children knew that they didn't have to answer any questions at any point nor did they have to participate in any activities. Involvement in the research project was not related to any assed work for children. To inform both child and parent consent, I created a summary document that explained what the project is and what they were agreeing to. As I work in the school in a senior position, there is a possibility that children might have felt that they 'had' to take part in the research so I did my best to ensure that they knew they were free to join in or not.

The most significant limitation of my study was due to the truncated 'mosaic' of children's experiences with the iPad, as I only worked with six children and gathered data using three tools. Working with a wider number of children would have confirmed or otherwise the emergent themes as well as no doubt suggesting further ones. Adopting additional tools would have also given higher resolution to the picture, such as interviewing both teachers and parents to find out their thoughts on learning with an iPad, observing children in the

lessons themselves, or co-creating digital books with children to capture their experiences over time.

Another limitation of my study was that I did not review the data I had gathered with the students I worked with. Clark (2017) argues that “revisiting material constructed with children and adults provides opportunities for participants to ‘think what they think’” (p. 156). This was partly due to time pressures and that when I was writing up my research it was already in the summer holidays so children would not be available to speak with. In hindsight, I should have included opportunity for children to review the transcripts and the conclusions I was drawing from them as part of my research method. It would have also allowed me to to ask follow-up questions and explored themes further

Finally, because my research happened in my own institution and examined the use of one-to-one iPads for learning in a programme I had helped establish, I had a vested interest in presenting this in as positive way as possible. To mitigate this, I sought to be objective as possible, involving and listening to children as part of the research process to garner their honest thoughts. The exploratory nature of the study also meant that I really wanted to know what children would say. My knowledge of how the technology is set up and used in the school also means that I might presume and extrapolate beyond what children actually said or shared, so in my analysis I always sought to ensure that there was corresponding evidence in the data collected.

4. Findings

I will now describe the key themes that emerged from my research data, i.e. from the transcripts of the interviews, the digital tours and the digital maps. The themes overlap in all sorts of ways but my aim is give an insight into overarching topics that the children tried to communicate.

Affect

Perhaps unsurprisingly, following Papert's (1980) description of the affective component of his love and enjoyment of using gears as a young child, all of the children articulated positive emotions about using an iPad in their learning. One Year 1 child described how using an iPad made him feel "happy", because he wanted to use it for his work. Another Year 1 child said, "I feel like a teacher," when using an iPad: for her, this was a positive experience as "I've always wanted to be one". Sometimes children weren't always able to articulate clearly a specific feeling but could describe their thoughts surrounding their use.

> Year 3 child: "It just feels like..you know where it is and you know how to use it like because we…know how to use it. Because if you had something else that wasn't an iPad, we wouldn't know how to use it. And we had to get experience to use it."
>
> Interviewer: "So you kind of feel quite confident. Is that a good word?"

This was echoed by a Year 5 child who said that the iPad made him feel more confident in his learning because of the benefits that typing and using an iPad has over more traditional paper-based tasks: "I'll feel more confident because

then…most of my spellings will be correct and then I won't have rough handwriting.” Another Year 5 child said using an iPad made her feel “relaxed” because “the iPad helps you like spell stuff when you use the keyboard.” A Year 3 child has a similar sentiment, saying that, “it kind of makes me feel calm” when using an iPad because “I don't have to use my hand…and the people might not understand your…handwriting.” Children had a positive emotional response to the iPad because it helped them accomplish tasks in the classroom that could otherwise be difficult or uncomfortable.

Showbie

Perhaps one of the most repeatedly mentioned app across the interviews, digital tours and digital maps was the learning platform Showbie (Showbie Inc., 2024). When asked to show me some of their learning on their iPads, two

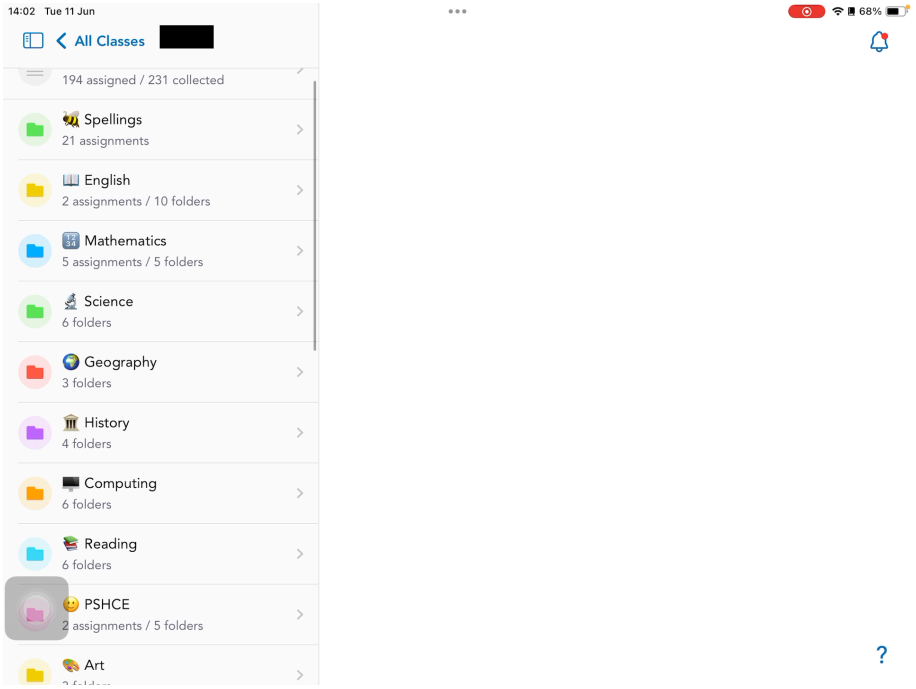

Figure 1: Showbie interface, showing Year 5 folder structure by subjects.

thirds of the children immediately opened the Showbie app. They were then

able to show me various pieces of work that had been uploaded to Showbie across multiple subjects. Each child was part of their ‘class’ on Showbie, with folders for each subject (Figure 1). Within these were subfolders for each half term and then ‘assignments’ for each lesson that had been taught using an iPad. Children could confidently navigate in and out of these different assignments and folders, as well as tap to open up screenshots, images, videos or documents of work that had been uploaded (Figure 2). From the

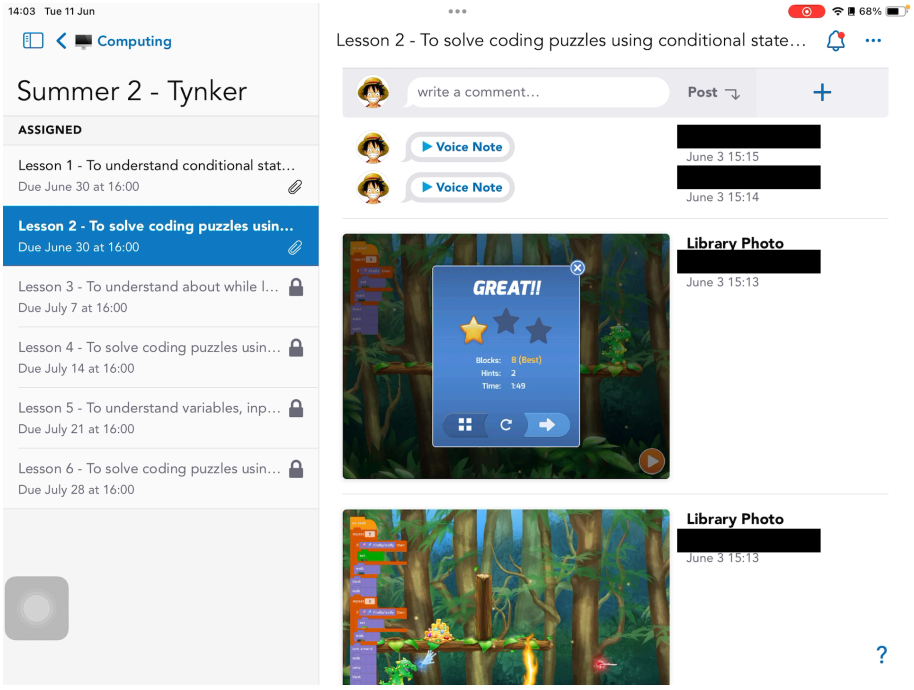

Figure 2: Showbie assignment, showing Year 5 student’s uploaded work.

interviews, Showbie was often referenced as a place that children had to ‘upload’ their work to, or ‘go’ to in order to access resources or even complete learning tasks. When asked why children had to upload things to Showbie, a Year 1 child commented that, “if [the teacher] doesn’t have time to, like, look at it, she could look at it on Showbie.” Children understood that Showbie was a way for teachers to see their work and give feedback on it, as well as check whether children had completed and uploaded their work. One child even drew

a diagram to try and explain how Showbie worked in their learning process (Figure 3).

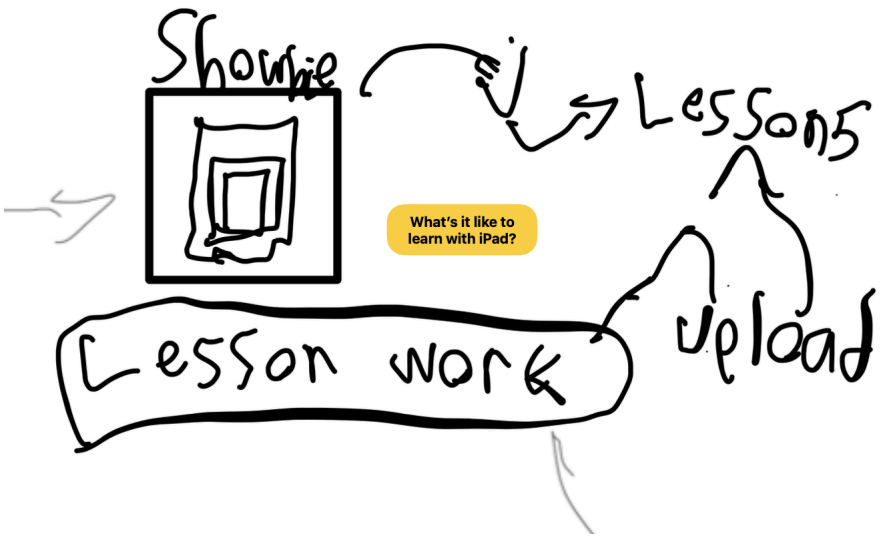

Figure 3: Year 3 child's diagram about how Showbie works.

Coding apps

The use of coding apps, as part of the subject of 'Computing', was another key theme that emerged. One question in the interviews specifically elicited a response around 'coding', but children also volunteered anecdotes around the use of coding apps when asked to describe a typical day using an iPad in class: a Year 3 child talked about how they had been making sprites in ScratchJr, and a Year 5 mentioned about a coding app called Tynker (Tynker, 2024), where "we have to use our brain". The two Year 5 children and one Year 3 child included coding apps in their creative digital 'maps' (Figure 4) and then proceeded to show and explain screenshots or open and demonstrate these apps in the digital 'guided tours' as well as talk about them in the paired interview. Children could talk in some detail about how they were able to solve the challenges in the coding apps: some of which were 'gamified' puzzles like

Tynker where children had to combine code blocks in the correct order so that the character to achieve their goal; whereas others, like ScratchJr, were a more open-ended coding environment where children were able to get on-screen characters to perform certain actions, such as bouncing a ball up and down on a basketball court, by combining code blocks in a desired pattern. Year 1 children talked about codeSpark (codeSpark, 2024), although its nature as a 'game' is what most stood out to them, with one child showing how it's possible to collect coins/rewards in the game and customise the character as well as "code games".

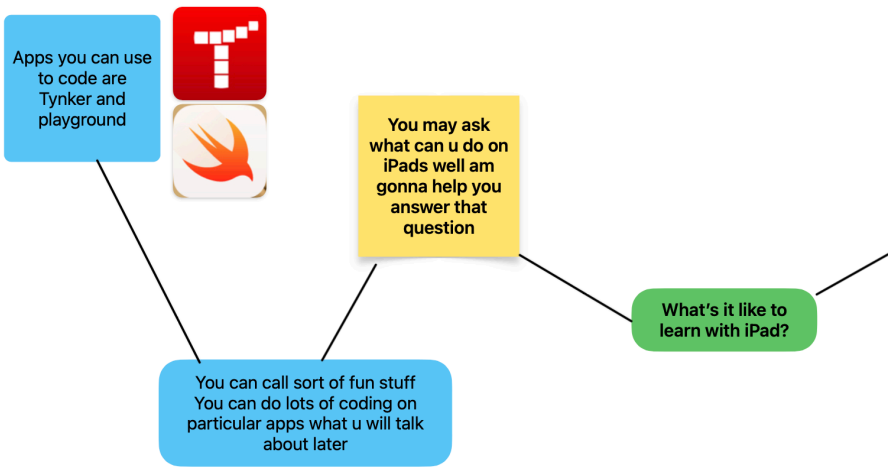

Figure 4: A Year 5's 'digital map' showing coding apps.

Educational games

The use of standalone educational game apps also featured prominently in all interviews and many digital tours and maps. The spelling app Spelling Shed (Education Shed Ltd., 2024) allows children to practice their spellings, which the Year 5 children could clearly see had a benefit on learning, with one commenting:

> If I do Spelling Shed, I can memorise the spelling, when I keep on doing them. And when I do that, when I get to, like, King Queen Bee it means I basically already memorised all of it and and then I can use that to my advantage too in the spelling tests.

Times Tables Rock Stars (Maths Circle Ltd., 2024b) helps children practice their multiplication tables. One Year 3 child articulated the advantage of the immediate feedback that the app could give:

> I think they help because if you didn't own a piece of paper, you might, you might not know [if you had it right]. But if on times table rockstars it tells you after and you can just keep trying to improve and improve.

NumBots (Maths Circle Ltd., 2024a) is a maths app aimed at younger learners with a focus on simple mathematical operations. One Year 1 child was particularly taken with this app, talking about it at multiple points in the paired interview and also showing me around the app in his digital ‘tour’. He was proud to show me all of the stars he had earned through completing various levels and challenges, and liked how he could see the scores across the school as well as make his own robot character.

Reading

One of my prompt questions was about whether children read on their iPads. All children then started talking about Sora (OverDrive, Inc., 2024), which is a school digital lending library with built-in ebook reader and audiobook player. One Year 1 child particularly liked how “it reads it to you”, describing the

audiobook function of the app and a Year 3 child commented on how “it has loads of books”. Children described the mechanics of how the digital library worked, how books had to be ‘borrowed’ or placed ‘on hold’ if another child was already borrowing it. One Year 5 child was able to articulate some of the differences between a digital book on Sora and a ‘normal’ paper book:

> If we have the book for a long time, it will disappear because someone else had maybe was on ‘place on hold’ and then someone else would get the book. … When you're reading on a physical book. You can usually just get it easily, but when you're reading on Sora you have to wait for a long time.

For one Year 3 child, the advantages of reading on an iPad with Sora were clear:

> And you can just tap it and you can start reading it. And also you can have multiple books at a time. But…if you didn't have an iPad you have to bring all those books everywhere, but if you have an iPad, it's just on your iPad and…it’s not that heavy to carry.

Another Year 3 child commented on how with the iPad “you could just zoom in, but on books you have to look closely” (Year 3 child) expresses something about the lightness and fluidity of reading on an iPad compared to the physicality of paper.

Camera

The iPad camera, which is able to capture both photo and video, was another theme that emerged strongly. One way that the camera was used was as a way of capturing work for the teacher to see, either by a direct upload to Showbie or inserting a photo in some sort of document first. Children understood that teachers wanted to 'mark' work and that taking a photo of a piece of work allowed teachers to view it whenever they wanted to on Showbie, particularly, as a Year 1 child noted, "if the teacher is not available to see it on paper." Taking a photo seemed much more efficient and accurate to children, compared with attempting to draw it. As one Year 5 child explained:

> Let's say I draw a a protein bar. They will think…they could think it's anything. They could say, "Oh, look, it's a chocolate bar." But…if I took a picture, they can clearly see why it was a protein bar.

Sometimes this process was also about wanting to retain a copy of something for future reference (see Figure 5). Children understood the advantages of

Figure 5: Year 3's 'digital map' describing how the camera is used.

video too, with one Year 3 child advising me that I could have recorded video on on my iPad instead of the audio recording app for the interviews “because [video] has audio”. A Year 5 child talked about the use of Timelapse video, (where frames of video are taken at a much slower rate by the iPad in order to speed up time in the final video) in a Design Technology lesson to capture a bridge-building project:

> It helps you learn because when you're using Timelapse…when people do it slow it kind of looks boring and when they use their Timelapse it can know how you built it.

The camera here captures the learning process, both for the teacher but also for the learner as well.

Book Creator

One app that was frequently mentioned in terms of children producing ‘work’ for any given subject was Book Creator (Tools for Schools Limited, 2023). This app allows for the creation of digital ‘books’ on an iPad using the ePub format, which can include images, text, sound, video and drawings. Three of the children showed me some of their work in the app as part of their digital ‘tours’, although only one mentioned it in their digital ‘map’. Across all interviews, it was mentioned as an app used in the national curriculum subjects of design technology (DT), science and religious education (RE). A Year 1 child had been using the app as part of a science unit on ‘animals, including humans’ and could show me how she could bring up the Showbie app as a Slideover window (where a smaller lozenge-shaped app window can float over

an app underneath) to allow her to take information from a fact file on ‘fish facts’ in Showbie and type it into Book Creator. A Year 3 child could show me a book they had been making in RE about Sikhism and could talk to me about what he had learned in the lesson. A Year 5 child could talk in some detail about different topics they had covered in RE whilst flicking through a Book Creator book that she had completed. These books are part of how children are being their own representations of the world ‘as it is’.

Technical issues

When asked about any issues that children faced when using iPads in their learning, there was quite a range of answers. One Year 1 child described her difficulties in using app Bee-Bot (TTS Group, 2024) — a modern-day descendant of Papert’s LOGO floor robots —because the robots would turn to the left rather than move left: “when I thought that side [was] to turn left, to like go left or right, but actually [it was] to turn.” Other children shared their frustrations when logins for certain apps would stop working or kept on “kicking people out”, as one Year 5 child put it. There was relief expressed that the technician would come and sort the problem, but children did articulate that not being able to access an app would affect learning. Three children mentioned that there are sometimes issues with batteries on the iPads, either because someone has forgotten to charge it or the charger wasn’t working, but this did not come across as a big problem. The autocorrect feature on the iPad was also something children noticed, where “if you text (type) something and it's wrong, it might show a different word and not this not the same as your word”, as a Year 3 child explained. This child also commented on how his

name would autocorrect to the capital city of a certain country, although the problem has stopped now.

One-to-one iPads

Finally, when thinking about how they felt about having access to an iPad each, this was mostly conceptualised in terms of resource availability. As one Year 1 child put it, “if we all had one iPad and we have to share, it will be difficult because everyone have to upload their learning, so it will be crowded.” A Year 3 child understood about the challenges that sharing an iPad would pose:

> Because you can just go on the iPad and you have your own, so you can just do do what you need to do… Because somebody else might need to do something else so they can do a different stuff and and you can do your stuff and other people can do their stuff.

Both Year 3 children were concerned that sharing a device might mean that another child might put in the wrong answer when they had put in the correct answer, particularly in maths. One Year 5 child could see that sharing an iPad would result in lessons taking much longer because “we would have to wait for the other person to finish”, giving the example of a computing lesson using Tynker and imagining that it might take twice as long as normal. Children all very quickly could see the challenges of sharing resources, no doubt because taking turns is a feature of children’s lives and something that they do not particularly enjoy.

5. Analysis

I will now attempt to analyse my findings through the lens of the four postphenomenological relations of embodiment, hermeneutics, alterity and background, understood as mapping onto Papert's thought as well. This addresses RQ1-3: *what does an postphenomenological-constructionist analysis tell us about the experience of learning with an iPad?* These all overlap in many ways, and any particular iPad feature or finding from my research could be understood with a combination of several or even all of these. After all, Papert's *Mindstorms* (1980) focuses on the use of the LOGO language and programmable on-screen and floor 'turtle' robots and can be understood using all four of Idhe's relations (1979 & 1990).

Embodiment

Embodiment is where the the individual experiences the world through the technology, where "the better the machine the more 'transparency' there is" (Idhe, 1979, p. 8). The camera on the iPad the prime example of this, where literally the screen of the iPad displays what can be seen immediately in front of children via the camera. Whilst one child did mention augmented reality via the app AR Makr (Line Break LLC, 2023), where they were able to add objects into the displayed 3D space on the screen, the children generally weren't using the camera to somehow access reality via the technology that they couldn't do via their normal visual perception. Rather, the embodiment allowed children to capture that perception and time-shift it so that it could be 'kept' and viewed by the child at a future time or shared with others. There were many examples of children capturing 'work' with the camera for the teacher to see at a later time: the teacher could have seen that work in actuality if they were standing

next to the child when they took the photo, but instead the captured digital image stands in for that direct perception. Children seemed happy to accept the photo as sufficient ‘evidence’ of their direct perception, as presumably the teachers did because they often required students to do this as part of lessons. One Year 3 showed me a video clip of himself from an English lesson where children were acting out part of a book. He commented about the experience of seeing himself that “it just feels like there's two of me”, which I would argue shows the extent that he is satisfied that this technologically mediated capturing of himself is equivalent to direct perception.

Children’s comments about typing and handwriting can perhaps also be understood through the embodiment relation. Writing using a pencil or pen is a technologically mediated embodied experience, where a writer’s thoughts emerge through physically scribed letters on the page (which clearly also involves hermeneutic relations). But for children, handwriting can be a very non-transparent experience: it hurts to hold and use a pen for extended time, and involves intense concentration to physically form the correct letters and in the right order, in the hope that others will be able to read and understand it. This is, arguably, a crucial skill for children to learn. But with typing on an iPad, a Year 3 child commented:

> You don't have to focus on your hand writing more than you have to focus on write[ing] and also if you spelt something wrong it shows that it's wrong.

Typing becomes a much more ‘transparent’ form of technology, as a child just has tap on the key they want and the words just appear. As one Year 5 child put it,

> It feels like I'm just like…touching the screen and it feels like I'm not even texting [typing] but I am texting and…sometimes I even forget I'm texting and I'm actually texting.

Once the skill of typing on an iPad screen has been mastered, this embodied mediated relation recedes as the iPad becomes an extension of the child in what they can create and produce with words.

Hermeneutic

Idhe’s second postphenomenological relation is hermeneutic, which moves “from experiencing through machines to experiences of machines” (1979, p. 11). Instead of transparency, technology becomes opaque because it has to be interpreted, or ‘read’ to understand and perceive the world. The clearest example of this from my research is to do with children’s experience of reading on the iPad, in particular using the Sora digital library and e-reader app. For young children, reading text from a page, via decoding the phonic information, is a process they are still learning, which can make accessing the meaning a challenge. For this reason, adults will read stories to children so they can still access the rich cultural and mythic information that narratives tell us about the world. The Year 1 children appreciated that the Sora app could do this for them through audiobooks that they could playback and enjoy. Rosenberger (2017), in analysing whether e-readers encourage or prevent immersion in the reading

process, argues that “the material design of reading devices entirely *determine* our relationship to reading content” (p. 159). The design of the Sora app appears to try and recreate the reading experience of a physical book and library albeit in digital form, through design decisions such as swiping the pages to turn them, the mechanism of ‘borrowing’ books from the library and how they are books that children would be able to find in a normal library. A Year 5 child’s comment that “if we come back from lunch or break our teacher might say, ’Oh just go 15 minutes on Sora’” indicates that Sora has been widely accepted by teachers as a good enough digital equivalent to a physical book.

The hermeneutic relation is not just about interpreting texts that then tell us about the world but also includes interpreting technology itself, which increasingly includes computer programmes. Wellner and Levin (2023) argue that “computational thinking is a prominent manifestation of…and the extension of textual interpretation” (p. 8). The LEGO WeDo 2.0 app provides an example of where the interaction with the technology results in the actions of real-world objects: as a Year 3 child said, “you build it and then you start coding it like Scratch.” With the range of coding apps that children mentioned, such as CodeSpark, ScratchJr, Tynker and Swift Playgrounds, children are learning how to read and interpret the coding challenges and environments of these apps. Of all the different experiences children described with the iPad, coding was the area that involved the most challenging thinking for children. When showing me what they had created or solved in these apps, children could sequence together commands via a block-based interface with a high level of understanding and sophistication. Thinking in terms of the postphenomenological relations, it could be argued that computational thinking

is too ‘opaque’, where the child is purely interacting with the technology and the ‘world’ completely recedes into the background. However, with the world around us increasingly structured and organised by computers, there is great value in children learning to think computationally and be able to put that thinking into practice.

Alterity

Idhe’s initial conception of postphenomenological relations (1979) incorporated ‘otherness’ as part of hermeneutic relations, but he later expanded it to include the distinct category of alterity, which is where “humans relate to technologies as relationships *to* or with technologies, to technology-as-other” (1990, p. 98). Here the world recedes into the background with the technology taking on a life of its own. I would argue that the use of the educational games, such as Spelling Shed and Times Tables Rock Stars, can be understood in this way. Whilst these games ultimately aim to improve children’s spelling abilities and recall of multiplication facts, both of which have real-world usefulness, they also engage children on their own basis. The Year 1 child who wanted to show me in some detail their progress within the NumBots app was clearly motivated by the game in itself, not for how he could interpret or experience the world through it. Part of the ‘life’ in the app was that there was a leaderboard showing comparative scores across the school, which encouraged the child to keep playing the game to get a better score than his peers. Wellner and Levin argue that “alterity relations highlight the interaction with ed-tech that functions as a quasi-other and thus may explain the emotional attachment on the part of the learner” (2023, p. 12). This can be seen in the positive attitude towards

these games from children, with a Year 1 child saying he was “excited” to play NumBots and a Year 5 child describing Times Tables Rock Stars as “really fun”.

Another aspect of the learning with an iPad that can be understood with the alterity relation is with the learning platform Showbie. Papert introduced the idea of the ‘microworld’ (1980), which Wellner and Levin link to the alterity relation and define as follows: “it functions as a model of reality; it is isolated from reality; and it enables a reflection of reality” (2023, p. 8). Showbie has been structured with folders for each subject, with assignments for each lesson within this, which in many ways this reflects a more ‘traditional’ primary classroom with its exercise books for each subject. Into this space, children are able to upload documents, videos, images, text and even audio ‘voice notes’, either just to keep a record or ‘trace’ of their learning, or for their teacher to see and mark. Showbie allows for the interaction with the digital media, whether that’s playing content back, zooming in on a photo, previewing the slides on a document, or even annotating over the top of an image or a text. However, all of this is not ‘real’: it’s just digital content saved on cloud storage. The ‘life’ in Showbie in part comes from the teacher who is structuring, populating and providing feedback/marking to students. The design of Showbie also lends itself to this dialogue, where the child and the teacher’s contribution and displayed in a ‘chat’ style interface, complete with speech bubbles around any comments (Figure 6). Whilst Showbie doesn’t offer the immediate feedback and modelling that Papert was thinking of with the LOGO turtles, I believe it still offers something helpful for structuring children’s thinking.

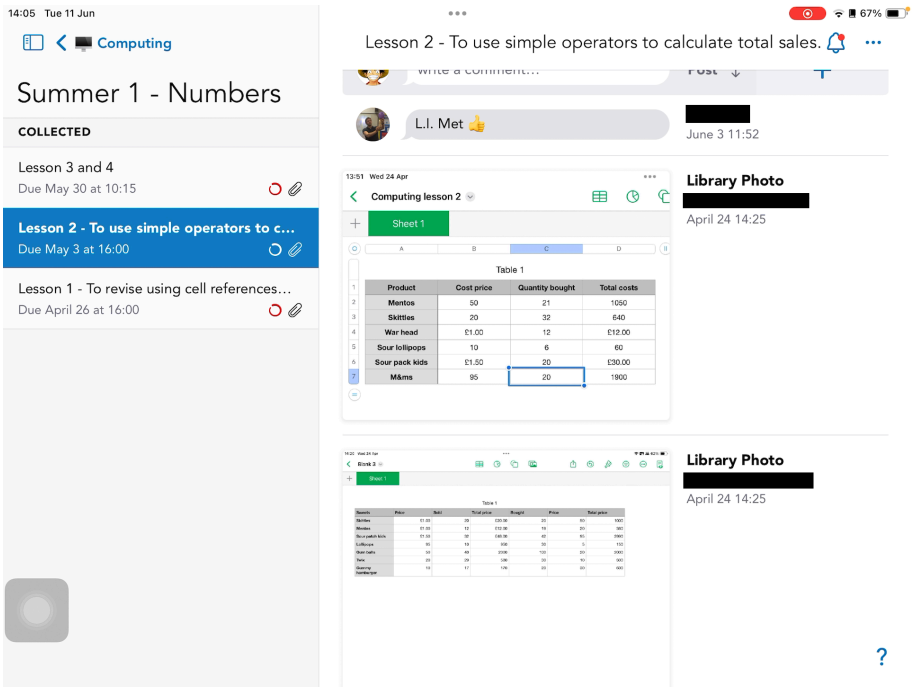

Figure 6: Showbie interface showing dialogue between teacher and child.

Background

The fourth postphenomenological relation is of background, where technology is all around us yet is not something that our attention is focused on. As Idhe writes:

> I neither relate through these machines, nor explicitly, except momentarily, to them. Yet at the same time I live in their midst, often not noticing their surrounding presence. (1979, p. 14)

It is quite difficult to try and study the things that nobody notices, except by a process of deduction and examining the elements that are only fleetingly touched upon. Given that children were describing their experiences of using computers in densely populated classroom, Wi-Fi was not directly mentioned at all. There was one Year 1 child who commented, “I'm gonna show you a

picture, but it's just uploading [loading]," as she tried to show me something on her iPad from Showbie on the patchy Wi-Fi connection in my office. In this was implied that the iPad experience in the classroom did, at times, involve an element of waiting for the network. Forgotten usernames or passwords was also something barely mentioned, apart from a few comments around Spelling Shed having difficulty with logging in. Part of this could be down to the fact that each child has their own device and so once an app has been logged in with certain credentials, it would stay authenticated. General software management issues were also not mentioned, apart from a Year 3 child commenting that "sometimes iPads suddenly starts updating," alluding to the iPad operating system update process which can sometimes be triggered at an inconvenient time. Battery and charge issues were also mentioned, but with assurances from children that it wasn't often a problem. All of these ideally should be as unobtrusive when using technology in the learning process.

At a surface level, children having an iPad assigned each perhaps in some ways made them more aware of the technology rather than less. Children certainly expressed concerns about what it would be like if they ever had to share an iPad and the impact on access to resources that this would have. Despite this awareness of the technology, its ubiquitousness allows for it to permeate throughout the learning experience. One example of this is how Sora was used by teachers as a 'go-to' option to fill 15 minutes after break or lunch: the fact that these devices are immediately to hand means that they can slot into the 'spare' moments in a classroom day. The organisation of the subject folders in Showbie as seen in the 'digital tours' seemed to indicate that every National Curriculum subject was included. Looking through all of the transcripts, 10 subjects were mentioned (computing, DT, English, French,

geography, history, maths, music, RE and science) with only PSHE, PE and art unrepresented. All of this indicates that the iPad as a learning tool has permeated throughout children's experience of the curriculum, becoming a true technological background. Perhaps like with air conditioning in a room on a hot day, with its impact eventually receding from conscious awareness as it becomes 'normal' and a stepping outside into the hot summer atmosphere bringing its benefits back to the forefront of perception, so reflecting on the background of technology in the school makes children notice and appreciate it. As a year 5 child expressed it:

> We're actually lucky to have our own iPads, because in other schools they maybe they do have iPads, but they all have to like share it instead of them all getting their own iPads. …So I, I can enjoy it 'cause we're actually lucky to have it.

6. Discussion

I will now discuss my research, summarising my findings and analysis and reflecting on how this intersects with theory: Idhe's postphenomenology, Willard's description of knowledge itself, Wellner and Levin's framework and finally Papert's prophetic vision of computers for children. I will explore some possible implications, such as the significance of one-to-one computing, the benefits of having a learning platform, the potential of children learning coding and the ongoing importance of experiential learning. I will then highlight the limitations of my study and possible future directions.

Summary of findings

What, then, is it like to learn with an iPad — at least at my school with the children involved in the study?

- It is something that children feel positive about, giving them a sense of confidence as they grow in mastery over the device and a more relaxed feeling because it reduces some of the anxieties that come with writing everything by hand.
- The Showbie learning platform is a key part of the experience, structuring how they access learning resources, providing a place for children to complete and store work, as well a conduit for getting their work to teachers for them to see and mark.
- Coding apps are a memorable part of learning, giving children challenging problems to solve but also the developing skills needed to put together instructions in a programme for a computer to follow.

- The gamified experience of practicing spellings and number facts with educational games like Spelling Shed and Times Tables Rock Stars is enjoyable to children with a reported impact on those specific skills.
- Children enjoy reading via the digital library and e-reader app Sora, with the convenience and immediacy of the digital format enjoyed, although children would like to not have to wait for certain titles to become available.
- The use of the built-in camera is a core part of the iPad experience, allowing children to capture their learning outcomes or process via video or photos for their teacher to see.
- The Book Creator app is used regularly as a way of structuring learning activities and allowing children to construct their own representation of their knowledge.
- Problems with the technology were not particularly prominent, with the issues that were raised surrounding: charging and battery life; accessing accounts on various educational platforms; typing autocorrection; and the difficulty of some coding apps.
- Having an iPad each was an experience by children as the feeling of avoiding resource scarcity, with sharing seen as a barrier to efficient use of learning time.

From a postphenomenological perspective, the camera and the iPad keyboard experience can be understood via the embodiment relation. The camera allowed for the capturing and time-shifting of children's perception by allowing an image of what they see to be shared with others. Typing on a screen, once mastered, becomes transparent to the child, extending the child's thinking via typed language onto a screen. Reading via the Sora app and developing computational thinking in various coding apps can be understood

via the hermeneutic relation. The design of the reading experience on an iPad offers many similarities to that of using a paper book, leading to seeming widespread adoption by teachers. Through the use of coding apps, children are learning to read, interpret and ultimately create solutions using computational thinking. The use of the educational spelling and number fluency games, as well as the learning platform Showbie, can be understood via the alterity relation. Apps like Spelling Shed and Times Tables Rock Stars have a life of their own which engages, motivates and gives immediate feedback to children as they practice the core skills. Showbie becomes its own ‘microworld', where children can engage with learning resources and through that participate in a pedagogical dialogue with their teachers. Finally, the fleetingly mentioned problems and the benefits of a one-to-one deployment can be understood via the background relation. The technology surrounding the iPad was sufficiently successful that issues like Wi-Fi, charging, account management and software updates were only mentioned indirectly. Children had an awareness of the benefits of the one-to-one iPad deployment, but didn’t find remarkable the extent to which it had permeated to nearly every corner of the curriculum.

Reflections on theory

How useful has Idhe’s postphenomenological relations been? In trying on each of the four lenses to look at the children’s experience of technology, there really was a lot of overlap, with the distinctions I drew being somewhat artificial. The Book Creator app could be understood in this way, with the ability to add photos and videos into digital texts, even captured within the app, bringing an embodied transparency to the user; the process of reading and writing the text

itself reflects the hermeneutic relation; in completing digital tasks to show their understanding, children are entering the alterity of a microworld of the subject domain; and in its widespread use, it becomes a tool that disappears into the background. Perhaps what the iPad offers the classroom is that it can become whatever it needs to be, as Apple claims, a “magical piece of glass” (Apple Inc., 2014) that transforms via software into a multitude of things. Idhe offers a way to tease this apart and think about how it is enabling the user to interface with the world mediated through the technology. Having used Idhe's four relations, I feel they comprehensively cover all of the options of understanding technology’s place within perception and actions, but do leave two questions remaining: is the mode of relation any ‘good’? And does it help with learning? I suppose that each of the four can be poorly or successfully executed: the transparency of the embodied iPad camera should offer clear images and a responsive interface, otherwise it becomes a tool that just isn’t useful. A postphenomenological analysis might help with hardware, software and even deployment design in order to get it working as well as possible.

In terms of learning however, I think it would be useful now to turn to Willard and his description of knowledge: “the capacity to represent a respective subject matter as it is, on an appropriate basis of thought and/or experience” (2000, p. 31). I would argue that learning must — at some level — involve the building of knowledge by the learner. If we take Idhe’s four postphenomenological relations, I suggest that they might be mapped onto Willard’s understanding of knowledge itself. First, ‘embodiment’ with the iPad allows the potential for facilitating an experiential interaction with the subject of knowledge and the child, albeit this was not always seen very strongly. Second, ‘hermeneutic’ concerns thought and thinking, where understanding is

coded and decoding through reading and writing using technology. Thirdly, ‘alterity’ can correspond with the capacity of representation, where another world is made in the learner’s understanding and where technology can facilitate its exploration. Fourthly, ‘background’ concerns technology disappearing out of view, ideally allowing for the learner to access the reality of the subject matter ‘as it is’, and adjusting their representation in light of thought and/or experience accordingly. Learning with an iPad can perhaps be said to be working best when it includes all of these aspects working together. Using an iPad camera by itself doesn’t necessary impact on learning particularly, but if it includes thought and representation, then this results in a richer effect.

I have found particularly helpful Wellner and Levin’s framework, which seeks to combine Papert’s constructionism and Idhe’s postphenomonology. I believe that its particular usefulness is in how it allows both theorist’s ideas to work together, perhaps like the two blades of a pair of scissors working in opposite directions to effectively cut a piece of paper: Papert can be used to supply the pedagogical and educational edge to Idhe, and Idhe provides a more structured and philosophical approach to structure and organise Papert. One example of this is with typing on an iPad. Papert writes that he has “seen a child move from total rejection of writing to an intense involvement (accompanied by rapid improvement of quality) within a few weeks of beginning to write with a computer” (1980, p. 30), citing the advantages of being able to enter and edit text more cleanly and conveniently than the “slow and laborious” act of physical writing. My research found that children appreciated the benefits of autocorrect when typing, as well as not having to focus on or worry about physical handwriting. Idhe’s embodiment relation can be used to unpack this phenomena further, suggesting that it is the

augmentation of a child's physical actions through on-screen typing that is what is enabling this educational benefit. This then opens up further lines of enquiry: what other ways does the iPad augment a child's powers through their embodied experience? And how could this contribute to learning gains in the classroom?

At the same time, Papert also pulls against this more systematic approach. In writing about the art of learning, for which he coined the word "mathetic", Papert (1996) described a time when he wrestled with his inability to learn the names of different flowers. In the end, it was only when he discovered an interest in the etymology of flower names and could then make and keep those connections in his mind. This messy process of learning isn't something that can be easily codified, except perhaps with the suggestion of "a strategy to facilitate learning by improving the connectivity in the learning environment by actions on cultures rather than on individuals" (p. 24). For Papert, the affective component of computers is part of their potential for learning in the classroom: his childhood obsession with gears included "feeling, love" (1980, p. viii) that meant he could more easily assimilate learning using that model. My research also found that children had a deeply positive relationship with their school iPad as a learning tool. Idhe's postphenomenological relations do not include this affective component, although it could conceivably be considered with each of them: a device that is a pleasure to use enhances the embodiment possibilities and is more likely to recede into the background as well.

Implications

The first implication from this study would be about the significance of one-to-one technology and its impact on the device being useful for learning. Whilst providing a device to every child is not a panacea to solve all educational ills, children in the study could articulate the benefit that could see in terms access to resources as well as saving time with not having to log into services or the device itself. Because they were able to use the iPad on a regular basis, this meant that they were confident with completing tasks and using them in their learning. The fact that the devices were just 'to hand' meant that they could be used for reading and for practising number facts and spellings as time wouldn't be wasted in getting the devices out. My study didn't look at the practicalities of how the one-one iPad programme was established at my school, in terms device procurement, financing, staff development, curriculum design or even device choice. The fact that children reported few technical issues with the devices implies that the implementation was working well, so this would need to be carefully considered. But I do believe that there are good reasons to make this work for children.

A second implication is about the importance of having a robust learning platform with a one-to-one device programme, which in this case was Showbie. Showbie became this 'microworld' that organised children's experience using an iPad in the classroom. If there was no learning platform in use in the school, children's responses perhaps might have been similar: they could have opened their Photos app to show me how they used the camera, or just gone straight to various apps that they had used to show me their work. However, I do wonder about the extent to which the learning platform encouraged the increased use of the iPad in lessons because it offers a viable

way for distributing resources and taking work back in from children. There are multiple learning platforms available, which all take different approaches and solve for particular use cases (i.e. Higher Education with Moodle or Chromebook deployment with Google Classroom). It would be interesting to study how these shape the experience for learners, particularly in a one-to-one situation. But I would argue that having some sort of organising system and platform is essential for the success of a one-to-one programme and children's experience of learning with it.

Third, I believe that Papert was correct in his vision that children should learn to code, that instead of the computer "being used to program the child… the child programs the computer" (1980, p. 5). This idea has germinated and taken root in education systems, to the point where in 2012 the then UK Education Secretary disapplied the existing 'ICT' curriculum in favour of 'Computing', stating:

> Instead of children bored out of their minds being taught how to use Word and Excel by bored teachers, we could have 11 year-olds able to write simple 2D computer animations using an MIT tool called Scratch. (Gove, 2012)

My research found a high level of engagement and interest in creating computer programs on the iPad, often using block-based coding approaches pioneered by Papert himself. I was surprised by the extent of children's fascination with the computing curriculum, but I really shouldn't have been as it gives children

> a sense of mastery over a piece of the most modern and powerful technology and establishes an intimate contact with some of the deepest ideas from science, from mathematics, and from the art of intellectual model building. (Papert, 1980, p. 5)

I believe that computers can be that cognitive tool to support learning across multiple subject domains, but that must go hand-in-hand with learning to be fluent in the language of computers themselves.

Finally, I believe a fourth implication is a reinforcement of the importance of experience in learning. Part of this comes from the phenomenological understanding of knowledge, which is built upon perception, “an experience in which something is presented rather than merely represented” (Hopp, 2020, p. 11). Knowledge involves the representation of reality, but this best happens, particularly with younger learners, once the individual has had direct perception of the object first. What I believe that the iPad offers, particularly through the use of the camera, is a bridge between the ‘presentation’ of the child’s experience and the ‘representation’ of the knowledge that is produced. One example in my research was of a Year 5 child talking about protein bars in a DT project: the photo of it would make it clear to the teacher what the child was looking at and talking about. Knowledge must pass through direct perception into representation but this grounding in experience is essential. The camera, and how it is able to be tied into all sorts of apps and workflows, offers something unique here I believe.

Limitations and future directions

My study is inherently limited because of the small sample size, captured over a narrow period of time in a very specific setting. A larger sample size, gathered over a longer period of time, indeed with using the full range of Mosaic tools, would give a more robust study, but would still only tell us about the experience of learning with an iPad in one school setting: running the same investigation across multiple schools would no doubt provide a range of different answers. Technology is also a moving target, with operating systems, software and even hardware changing on a regular and ongoing basis. This limits any ongoing transferability of my findings. And finally, eliciting postphenomenological reflections from children was challenging to undertake, and I am certain that, perhaps with a more refined questioning approach, this could have been more effectively undertaken.

In terms of future directions, there are multiple paths further study could take. One of them could be to undertake a more participatory study, in the true spirit of the 'mosaic' method, where children's thoughts and feelings about how the iPad programme might be improved could be investigated. There are also some threads that could be examined in much more detail, such as about how the use of learning platforms with an iPad shapes and structures the learning experience, or perhaps the impact of computational thinking and learning coding has on children's general approach to learning. I would also be interested to look at a variety of schools who have deployed the iPad as a learning tool (perhaps some less successfully than others) and if there were common threads about the important elements of how to make it work. Another element that hasn't been looked at in this study is about what it's like

for teachers to teach using an iPad, both in terms of an instructional tool but also in guiding learners through tasks on devices and so on.

7. Conclusion

I now am perhaps able to articulate a postphenomenological-constructionist account of what it is like to learn with an iPad. It is something that involves the embodied experience of the child: the camera transforms the iPad into a window on the world, allowing the child to capture their perception of the world that can then be stored, shared and reviewed; the immediacy of the touchscreen interface, particularly that of the keyboard with it's computer-assisted spellcheck and autocomplete, means that a child's thoughts are more readily expressed without the friction of handwriting and letter formation. It is something that involves the child's interpretation: reading on an iPad gives the child access to the wider symbolic and literary world through engaging with texts, with the lightness and immediacy of a digital library, not to mention the option of getting an adult to read to younger readers via audiobooks; all interactions with an iPad are, in a sense, learning to 'speak computer', but coding apps, with their corresponding demands of more rigorous computational thinking, invite learners into an engaging and satisfying interactive interpretative world. It is something that involves an interactive dialogue: through a learning platform, there is the to-and-fro relationship with the teacher, through distribution of resources and submission of work with the surrounding conversations; spelling and number-fact apps also offer an interaction with the 'life' of the technology, through immediate feedback and competition with peers. It is something that involves a hidden backbone, mostly unseen by the child: login frustrations, app crashes and internet speeds are sometimes felt and noticed by the child, but the behind-the-scenes technological infrastructure and support are mostly notable for their absence; the ubiquitous access to a computer that a one-to-one programme offers is

appreciated and noticed by the child when they stop to reflect and its presence greatly reduces anxiety about resource availability. In all of this, learning with an iPad is something that is experienced positively in the child's affection, due to both the individual aspects of the experience and the sum of the parts.

I am indebted to Wellner and Levin for their interpolation of the postphenomenology of Idhe and constructionism of Papert. I believe that Papert is still relevant to today, with his pioneering work on developing programming tools for children still making an impact as seen even with the intellectual engagement of children in this study when using coding apps. My Mosaic-inspired research method was fruitful even on a very small scale and I feel that a longer and more detailed study using a greater number of Mosaic-inspired research tools would be beneficial for understanding better the use of technology in the classroom. I also would argue that a phenomenological basis for understanding the nature of knowledge, as articulated by Willard, makes sense of how an iPad can be used for learning: through a combination of thought and experience, the representation of the world that is knowledge, corresponding to how reality 'actually is', can be generated. This stands against postmodern insistence that "knowledge cannot be represented as a 'map' of territory to be explored and finally to be fully understood" (Guba & Lincoln, 1982, p. 239), which ultimately calls into question the very purpose of education itself. This is obviously a topic for much wider discussion and debate, but I hope I have been able to contribute to this issue.

Finally, I hope that I have been able to provide some more 'observability' (Rogers, 2003) to the diffusion of the innovation of providing a computer for learning to every child. Taking each postphenomenological relation by themselves is not necessarily particularly compelling: the iPad-as-camera or

the iPad-as-e-reader might be diverting or helpful at times, but seemingly not much more, nor necessarily worth investing the time and money in. But if it becomes the iPad-as-positively-regarded-tool, the iPad-as-always-available-resource, the iPad-as-computational-thinking-device and the iPad-as-writing-assistant, this becomes a much stronger case to make. Rogers argues that 'trialability' – "the degree to which an innovation may be experimented with on a limited bases" (p. 696) — is another key attribute of a successful innovation as "new ideas that can be tried on the instalment plan are generally adopted more rapidly than innovations that are not divisible." Though not explored in depth in this study, the iPads children used and talked about in this study were surrounded by technical infrastructure for managing and supporting the devices, professional development for teachers to know how to use them, a learning platform that needed selecting and implementing, as well as apps to buy or subscribe as well as the financial implications of procuring an iPad for each child. It's hard to know how these things can be 'tried out' without a full implementation: it's not like you can 'borrow' a one-to-one programme for a week to try it out! Maybe Papert was just a dreamer in his vision of technologically mediated education and this is still not easily replicated elsewhere. At the same time, I do hope that this study has demonstrated that it is still worth trying.

15,617 words

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Appendix 1

Prompt questions used during interview.

1. Imagine of a ‘typical’ school day. Can you tell me all the ways you might use an iPad in your learning?
2. Think back to a specific lesson where you used iPad that you particularly enjoyed. Can you describe exactly what you did? What do you think you learnt from that lesson and how did the iPad help?
3. How does it make you feel when you use an iPad in learning?
4. Do you ever use the camera on iPad in lessons? What sort of things might you do? Does it help you understand what you’re learning about better?
5. Are there any apps you use that you use that make use of multitouch? Can you give me any examples? How do you think this helps with learning?
6. Do you ever read on iPad? Can you describe the apps you use and what that’s like? How is it the same or different than using paper?
7. Does your learning ever involve making and creating things? What sorts of apps do you use for that? Do you find that helps you with learning?
8. Have you ever used any coding apps? Can you tell me what they are and what they’re like to use? Do you find learning with them difficult or easy?
9. What do you make of educational games like Spelling Shed and Times Table Rockstars? Can you describe what they’re like to use? Do they help your spelling and maths?
10. What do you think about the fact you get an iPad each? How does it feel? Are there things you can do in your learning that you would find harder if you had to share?
11. What sorts of things go wrong on your iPad? How does that affect you? Do you think it impacts your learning?