

The Screen and the Sand-Timer: The integration of the interactive whiteboard into an early years free-flow learning environment

Abstract

This paper aims to explore how the Interactive Whiteboard (IWB) is situated in the social and material conditions of an early years free-flow learning environment. It examines how the affordances of the IWB and the expectations of the surrounding classroom impact on how activity involving the IWB unfolds. It achieves this through an analysis of observations, documented through video, of how children enter into and exit from activities involving the IWB during free-flow activity time. We share the different types of entrance and exit observed, and what these suggest about the social and material conditions in which IWB is situated. Based on these findings, we suggest opportunities for the disruption of existing patterns of integration of the IWB into the learning environment, so as to explore the potential for more collaborative and creative engagement with the technology. Specifically, we argue that the emphasis on turn-taking that characterises the early years learning environment – an emphasis reinforced by the inability of the IWB to support simultaneous engagement by multiple users – is prompting children to engage individually with the resources and miss opportunities to create and play together.

Introduction

A growing body of research considers young children's interactions with digital technologies and how play and learning unfold in digital environments. A lack of research however has focused on the practical integration of digital technologies in early childhood settings and specifically how children in a free-flow early learning environment move between interacting with digital technologies and other spaces and activities available. In this paper, we explore how 4-5 year old children enter into and exit from activity involving the IWB with the aim of highlighting the social and material factors that impact on how these transitions unfold. Our explorations are framed by concepts from social semiotic theory (semiotic resources, affordances; see van

Leeuwen, 2005; Kress, 2009; Bezemer & Kress, 2015; Hodge & Kress, 1988) and new literacy studies ('classroom-ness'; see Burnett et al., 2014; Burnett, 2014).

The following background sections will consider previous research on children's interactions with digital technologies in early childhood settings and interweave this with an overview of the theoretical framing of the study, which takes the concepts of semiotic resources, affordances and classroom-ness as its main parameters. Following this background, we outline the processes of data collection and analysis as applied in this study. We present five categories relating to how children entered into their interactions with the IWB and four categories relating to how children exited these interactions; these categories are each considered in relation to the social and material conditions that shaped the activity as it unfolded. We argue that this categorisation of entrances and exits facilitates a consideration of how practitioners can creative disrupt the organisation of time and space around digital technologies in the classroom context, so as to foster more creative and collaborative forms of engagement.

Digital environments in early childhood education

Numerous large-scale surveys have shown that digital technologies are increasingly a part of young children's everyday lives. Recent statistics from Ofcom (2016) show that parents in the UK estimate that their children aged 3-4 spend on average 8 hours and 18 minutes per week in online environments, and 16% of 3-4 year old children own their own tablets. Qualitative research on children's engagement with digital technologies in the home suggests that children engage with technologies in a range of ways, using them for play, learning and creative activities (Plowman et al., 2010a). Research in the field has challenged the idea that engagement in digital environments cannot count as 'real play' (Edwards, 2013; Edwards, 2016), with researchers demonstrating how online games feed into complex cultural identities and interact across fluid boundaries with play in offline environments (Marsh, 2010; Marsh et al., 2016). Research by Palaiologou (2016) involving focus groups, interviews and questionnaires with parents across four European countries suggests that parents are generally positive about children's engagement with digital technologies in the home and consider digital interaction to be a vital component in learning and development in contemporary society.

Studies conducted on digital technologies in early years learning environments present a different story to those conducted in the home. Palaiologou (2016) noted that parents often felt confused by what they saw as negative attitudes among nursery practitioners regarding children's interactions with digital technologies, with many of the nurseries attended by the children in Palaiologou's study having a 'no technology' policy in place. In the research of Author (2017), digital technologies were described by one early years practitioner as 'not that early years-ish' because while they associated early years learning with physically messy and open-ended play, they saw children's interactions with digital technologies as lacking sensory richness and too constrained to allow children's imagination to flourish. This sentiment was echoed among other practitioners in the study who felt reluctant to introduce digital technologies into creative activities, because they felt they might limit children's self-expression. In research by Dunn et al. (2018), which focused on the perspectives of children aged 4-7 years about the use of iPads in school, digital tablets were seen by the children as an important point of connection between home and school experiences. While they associated tablets with both environments, they highlighted the differences that surrounded engagement with the technology in either setting, for example, they explained that in schools they were more constrained about what apps they could download and use on the tablets.

Practitioners' attitudes to children's interactions with digital technologies shape how they engage with children before, during and after these interactions in the early learning environment. Plowman et al. (2010b) noted that practitioners often engaged in what they referred to as 'reactive supervision' in relation to digital technologies, only becoming involved when digital technologies in the classroom encounter technical problems or there was the need to mediate social conflicts around the technology. They argued that it was important for practitioners to expand their active mediation of the children's engagement with digital technologies. Similarly the Byron Review (2008; a government report published in the UK that focused on children's relationship to digital technologies and new media, and how best adults can support children in relation to this) and the follow-up research of Duerager and Livingstone (2012) called for adults surrounding children to become more involved in children's interactions with digital technologies, supporting children to have positive digital experiences and to open up spaces for working through negative experiences together. To facilitate this

kind of proactive engagement in early years practice, Edwards (2016) has put forward a web-mapping tool that enables practitioners to see the connections that run across children's online and offline play, so that digital play is seen in the context of children's play practices more generally, rather than being perceived as distinct altogether.

Of course, research has also documented positive examples of digital integration into early years settings. There is a notable lack of research around the introduction of the IWB in early years learning environments, but more research has been conducted about the integration of digital tablets into young children's play, learning and creativity. For example, Kucirkova et al. (2014) highlights the potential of open-ended story-making apps available through digital tablets to enable peer discussion and experiential learning. Flewitt et al. (2014) offer an account of digital tablets as taken up in a classroom where the children had moderate to severe learning disabilities; they argued that in contrast to the commonly held view that experiences with digital technologies are lacking in sensory richness, the tablets enabled new kinds of touch and engagement among the children they observed. In the study by Dunn et al. (2018), children's perceptions of the iPad included a strong association with games and fun, both in home and school contexts. Most enjoyment was associated with iPad apps that enabled a high degree of choice and creative expression through open content. There are similarities and differences between digital tablets and IWBs. While both devices are activated through touch (one touch at a time since neither of these types of device respond to multiple touch inputs simultaneously), tablets are much smaller and are therefore more likely to be associated with solitary engagement than IWBs, which are typically one per classroom, and therefore seen as existing in relation to a wider community of learners and teachers. The particular affordances of the IWB are considered in further detail in the following section.

Affordances, semiotic resources and classroom-ness

The concept of 'affordances' was first introduced by Gibson in the field of ecological psychology in the 1960s. He used the term to refer to the way in which our perception of the world around us unfolds relative to action. According to this view, rather than perceiving elements of the environment as neutral objects, we see immediately the types of action that these elements encourage us to perform. For example, when we

see a chair, we perceive the action of sitting down. Social semiotic theory has borrowed the concept of affordances to explain how different modes and media shape how meaning is made (Hodge & Kress, 1988) – how different ‘semiotic resources’ contribute to meaning-making. Semiotic resources are the ‘actions and artefacts we use to communicate’ (van Leeuwen, 2005, p. 2); they comprise both the tools involved in communication (e.g. paper and pens) and the physical actions that we need in order to engage with these tools (e.g. touch, manipulation). Semiotic resources have their own affordances and through these affordances, they impact on how we create and share meanings.

The affordances of semiotic resources stem from both the physical properties of the resources and their sociocultural associations. The IWB’s affordances for example stem from both the physical properties of the technology (e.g. its size, its static-ness, its attachment to another device, its activation through touch) and its social associations (its tendency to appear in educational settings; its use by teachers often at the front of the class but with an emphasis on collaboration and interactive learning e.g. Mercer et al., 2010; Jewitt et al., 2007). We can consider the affordances of the IWB theoretically through looking at its physical properties removed from activity (this is its ‘theoretical semiotic potential’ according to van Leeuwen, 2005) or we can engage with the ‘actual semiotic potential’ through direct observation of its use. The affordances of semiotic resources are not static. The affordances of the IWB will change over time depending on how it is used. As Kress and Jewitt (2003, p. 2) describe, each set of semiotic resources is subject to cultural investment over time and through this investment the use of the resources becomes more ‘fully and finely articulated’. According to this perspective, resources that are relatively new, such as the IWB, will show more fluidity in how they are used because the affordances are still being negotiated through each interaction.

The affordances of a technology depend on the context in which the technology is situated. In a classroom context, the affordances of an IWB will be different to those that arise in a public outdoors space for example. The notion of classroom-ness put forward by Burnett (2014) describes how semiotic resources are taken up in particular ways in the context of the classroom. Technologies and their affordances are shaped by the distinct practices and rules that relate to classroom spaces. Classrooms are a particular kind of sociotechnical environment in which certain types of behaviour are

prioritised. For example, early years classrooms tend to place an emphasis on turn-taking and this will impact on the way that particular technologies are taken up in this space (Author, 2017). Burnett (2014) stresses that classroom-ness is not a one-way phenomenon. The classroom context has an impact on how resources are taken up, but the context is simultaneously shaped by the presence of and engagement with the resources. The presence of an IWB has the potential to change practices in a classroom space so that how classroom-ness is enacted is also transformed. Thus, it makes sense to ask not just how the use of the IWB is impacted by the social and material conditions of the classroom context, but also to take inspiration from what we observe of the IWB's activity in involvement and consider how this might disrupt the classroom context as we know it.

So what constitutes classroom-ness in the situation we are observing? Early years pedagogy in the UK tends to be characterised by an explicit commitment to child-centredness and play (Stephen, 2010). In this approach, children are given a high level of freedom to engage with activities and resources how and when they choose. While this commitment is often voiced by centres of early childhood education, research by McInnes et al. (2011) has shown that this might not translate into the valuing of children's choices, democratic participation and open-ended play in everyday interactions. McInnes et al. compared two early years settings in the UK; while both settings identified as 'play-based', in one setting the children interviewed indicated that the presence of an adult would indicate 'not-play', while in the other, the presence of an adult would not mean that the time for playing was over. This suggests that the children in either setting have picked up on implicit messaging about the value of play and whether adults in the setting are supportive of free-flow play or are likely to encourage more formalised learning activities. Similarly, while there might be a stated commitment to 'stretchy time' (Craft et al., 2014), that is, allowing children to shorten or extend planned activity times in order to facilitate creative thinking, this might be more constrained in the everyday practices of the early years learning environment, where clock time is used to structure the day and 'smooth' transitions are typically 'idealised' (Rose & Whitty, 2010; Pacini-Ketchabaw, 2012, 2013). What this suggests is that the context in which we are observing children's activity with the IWB is complex; though we have described it as a 'free-flow early years learning environment', the social and material conditions that impact on the use of the IWB will be more

complicated and nuanced than this phrase suggests. To understand how digital technologies are integrated into early years learning environments – and to explore new ways in which this might be done – we need to remain open to the complexity of the everyday interactions that collectively the social and material conditions that shape how technologies are engaged in children’s play and learning.

Study Design

Data for the study was collected through observations of a reception class of 30 4-5 year old children in a state primary school. In this particular environment, it was typical for the children to have some group time for 30-40 minutes at the beginning of the day, and after lunchtime each day. At times other than this in the school day, the children engaged in free-flow activity, moving freely around the classroom, and to the outdoors environment if this was considered by the practitioners to be appropriate given the weather and if practitioners were available to supervise outdoors play. In theory, children could spend as much or as little time as they liked at different ‘activity stations’ around the learning environment, but in reality, there were of course material and social pressures that worked to shape children’s behaviours, movement and engagement in the environment. Resources that were considered to be scarce or likely to lead to dispute (such as the IWB or the bikes in the outdoors play area) were subject to more overt management by practitioners. For the IWB, this took the form of a sand-timer placed on a small table next to the IWB, which encouraged children to monitor their interactions with the IWB and refrain from spending ‘too long’ on their turn with the resources. For the bikes outside, practitioners supervising the play would intervene if children were thought to be spending ‘too long’ on the bikes. Other areas in the learning environment were relatively un-managed in comparison – for example, the drawing table, and the blocks construction area, involved less structured supervision and children could move to and from these areas with what appeared to be relative freedom.

Practitioners moved around activity stations in the learning environment, though many were concerned with conducting formal observations on particular children, or working with small groups of selected children on particular literacy activities. Since the research was conducted at the end of the academic year, there was concern among

the practitioners around getting the children 'ready' for the next school years, and getting the paperwork associated with each child – portfolios of completed work and observations – 'ready' to pass onto the teacher who would take them in the subsequent year. Thus, it is likely that the teachers and teaching assistants working with the children in this class were more intent on completing school-based tasks as opposed to interactions with the children in the 'here and now'. As we explain below, there was a noticeable lack of practitioner involvement in the children's interactions with the IWB in the observations we made as part of this research study.

The observations focused on children's interactions with the IWB and the connected laptop during free-flow activity time when they could choose what activities to engage with. The IWB was placed at the centre of the classroom, next to the teacher's chair, which was placed at the head of the carpet area where the children would gather as a group at the start of the day and after lunch. Moving out from the carpet (and the IWB), the classroom comprised several activity stations, which each involved a table, a few chairs and resources relevant to the suggested activity for that station. The carpet's boundaries offered a material distinction between the areas for the free-flow activity and the area for whole-class engagement. This was reinforced by the presence of a large shelf unit positioned along one side of the carpet, creating a stronger sense of enclosure around the carpet whole-group area. The IWB, placed as it was on the other side of the carpet to the free-flow activity stations, crossed a boundary between the whole-class space and the free-flow space in a way that no other resources did. Children had to come onto the carpet in order to interact with the IWB – they were essentially moving into the domain of teacher-led activity, especially as they stood on a stool positioned right next to the special 'teacher's chair' – the only adult armchair in the classroom, covered in papers and resources that the children were not allowed to touch.

Over the course of one week, the primary researcher (first author of this paper) made observations of children's engagement with the IWB for about four hours of each day. The children had access to a limited range of websites and software on the IWB, which primarily focused on literacy, numeracy and 'topic' learning (e.g. in history). At the start of the week, the most popular website used by the children was a literacy game. The game involved users seeing a word on the screen and then dragging letters from around the screen that were in this word into a virtual toilet. When the user was

confident that they had put all of the letters in the word into the toilet, they could then flush the toilet. The task as it was intended by the designers to be carried out was not of interest or beyond the capacities of many of the children in the class, and the study observations relate to children generally dragging the letters around the screen in what appeared to be a random way, and trying repeatedly to flush the toilet without having engaged with the particular word on the screen. This demonstrates the potential for children to engage in digital play in ways that are unanticipated by designers or practitioners; Marsh et al. (2016) refer to this as ‘transgressive play’ and argue that it is a prevalent form of children’s engagement with digital technologies.

In order to open and extend children’s interactions with the IWB, particularly in relation to creative play, the researcher introduced a simple art-making programme called ‘tuxpaint’ to the children, and this quickly became the most popular application for the children to use on the IWB, perhaps because the children were drawn to the potentials for choice and creativity within this app in comparison to the others available (see Dunn et al., 2018). Tuxpaint is free art-making software aimed at 2-8 year old children. It enables children to use a range of tools, including filling the screen with colour, line drawing, and stamping images of a range of types onto the screen, including photographs of mundane objects (like jugs and nutcrackers) and cartoons of more fantastical material (like aliens and ghosts). It offers an engaging multimodal package, since children’s placement of visual material on the screen is automatically accompanied by written captions that appear along the bottom of the screen and non-linguistic sounds that relate to their physical activity (e.g. a ‘doink’ sound every time they stamp an image onto the screen).

The study was set up working closely with the primary school in which it was based. The headteacher of the school was familiar with the work of the primary researcher around digital technologies and was eager for the school to participate in further research in this field. Consent was sought from the parents/carers of the children in the class through an ‘opt-out’ procedure. The participant information sheet was distributed to all of the parents/carers, along with a letter from the school explaining that if parents/carers felt uncomfortable with their child being video observed as part of the research, they should let the school or researcher know orally or through the opt-out form, which was circulated three weeks prior to the research taking place. The children were introduced to the primary researcher at the beginning of the week; she

was described by the teacher to the children as ‘another teacher, who is interested in what you get up to this week when you have ‘choosing time’’. An opt-out procedure was felt to be appropriate in these circumstances because the children were not participating in an activity that went beyond their typical involvement in the school day. No visual data is presented in this paper in order to protect the anonymity of the children in the study, and pseudonyms are used in all of the observations. The study was approved by the university ethics committee at the researchers’ institution.

The observations were conducted at the end of the academic year so the children were used to engaging with the IWB, which was accessible to them in free-flow activity time, as well as being used for whole-class activities by the teacher. The children could interact with the IWB when they wished and there were often periods of time when no child was using the IWB. There was no active encouragement for children to use the IWB. The researcher would wait for a child or children to become involved with the resource and would then begin the observation, which was captured through a videocamera or iPad camera. The observations were made from a small distance away from the children, though it was sometimes necessary for the researcher to move forward or back depending on what constituted the best angle to capture the children’s interaction with the IWB.

Although the researcher sought to intervene as little as possible, it was sometimes necessary to support children with practical issues relating to the IWB. If the programme on the IWB broke down and the children were unable to fix it, the researcher would step in. Similarly, if a conflict occurred between the children and escalated to a level that was concerning to the researcher, the researcher made the judgment to become involved. In the wider field of study of the classroom, the researcher adopted a participant role, acting as a teaching assistant in other classroom activities. As a result, the observations depended on rapid shifts between participant and observer roles.

Video observations were conducted in line with Flewitt’s (2005) recommendations regarding ongoing assent from children in research studies. Flewitt suggests that researchers need to think about children’s assent as something that occurs and re-occurs as data is being collected. A child may be comfortable with being video recorded at the start of the recording, but a minute into the observation, they may demonstrate signs of discomfort verbally or through multimodal communication. The

researcher was alert to the children's engagement and multimodal indicators of discomfort. If these occurred, the camera was turned off or orientated elsewhere.

Other adults in the classroom during the week of observations were a teacher and a teaching assistant. Neither of these practitioners interacted with the children while they used the IWB or connected laptop, despite being reassured by the researcher that they should go on interacting with the children in the class as they would do normally. The lack of child-adult interaction around the IWB might have been the result of the practitioners' reluctance to be caught on camera, the time pressures of the classroom or may be indicative of a more general reluctance to engage with children's digital activities, as suggested by Plowman et al. (2010b).

32 video observations were made, which ranged in length from four seconds to 29 minutes and 43 seconds. In total, one hour, 39 minutes and 20 seconds of footage was collected, with the majority of observations being a few minutes long. Across the video observations, 20 different children were captured as participants in the activity. For particular videos, this ranged from one child interacting to seven children interacting with the resources. The data demonstrates that some children were clearly more drawn to the IWB than others as they would appear in multiple video observations, while some members of the class were never seen in the video observations interacting with the IWB. In addition to the video observations, written field notes were made in the middle and end of the school day. These notes document initial impressions of how the children were engaging with the IWB resources.

Analysis was microgenetic (Rojas-Drummond et al., 2008), focusing on moments of transition into and out of activity involving the IWB. We decided to examine children's entrances into and exits from activity involving the IWB because we felt that by looking at the rough boundaries of the activity in time and space could help to understand the IWB in relation to the wider sociomaterial context in which it was situated. This was based partly on Goffman's (1974, reprinted in Lemert & Branaman, 1997) explanations of frame analysis applied to social action; he suggests that 'the assumptions that cut an activity off from the external surround also mark the ways in which this activity is inevitably bound to the surrounding world' (p. 159). This comment highlights how the framing of social activity in time and space – the parameters that demarcate it from other forms of activity – are both boundaries and points of connection. In the context

of this study, the entrances and exits are taken as clues to the social and material factors that constitute how the IWB exists in relation to the classroom more broadly.

The first step in this fine-grained analysis was a rough multimodal transcription of all of the video data, which focused on various modes of communication including speech, facial expression, movement, body position and gesture. This involved a table of activity that was broken down into these communicative modes, so that that we could document what was happening in each mode at a point in the video. We felt multimodal transcription to be necessary because the children's interaction with the IWB involved all of the modes of interaction, and with just a transcript of verbal activity we would have lost a lot of information about the nature of children's interactions with the IWB and with each other (Bezemer & Mavers, 2011). The transcriptions of the video observations were annotated in relation to the research focus on transitions into and out of interactions with the IWB. How were children entering the activity? How were children leaving the activity? What affordances of the IWB, and what wider material and social conditions appeared to influence the way that the children transitioned into or out of the interaction with the IWB? Themes emerged by grouping these annotations and through iterative engagement with the video data, field notes and previous literature in the field. For further discussion of the process of thematic analysis see Braun and Clarke (2006) and Guest et al. (2011). The themes derived through the analysis relate to broad categories of entrance into and exit from interactions with the IWB.

Findings

The findings below are presented as five categories of entrance, and four categories of exit. All types of entrance and exit are included in the descriptions below – even if they were only enacted in a single observation, on the basis that they all related to potential manifestations of activity around and involving the technology. These categories are not intended as an exhaustive list – other observations may produce other forms of entrance and exit. Each type of entrance and exit is explained below, illustrated with written vignettes and, where relevant, points of connection with previous research are shared.

Entrance

Engaged watching

Children would sometimes watch the visual activity as it unfolded on the IWB or the laptop before having a go themselves. Audience members were more or less interactive with the person interacting directly with the IWB. Sometimes they watched in silence; other times, they made suggestions, or pointed and laughed at things that were happening on the laptop. Audience members often connected with one another about the visual activity that was unfolding.

Corey has picked the magic icon and has started to create the 'railing effect' which makes a new noise. Awchang and Liam gather around the laptop to watch this unfolding visual effect.

The IWB set-up afforded the creation of an interactive audience since there was a second site (the laptop) at which activity could be observed. This second site gave rise to 'onlooker play' (Parten, 1932) whereby children watched the behaviours of the primary user and were inspired by this observation. When children moved from being in the audience to directly interacting with the IWB, they often continued themes or activities that had been started by the previous participant who they had observed. The significance of the audience in this study resonates with the earlier research findings of Labbo (1996) who carried out observations of classroom computer text-making and found that children often constructed the activity as a public performance, rather than seeing the computer screen as a personal canvas. Similarly, my own research on children's collective art-making using a laptop computer placed in the classroom (Author, 2016) shows how motifs and narratives can reappear across children's digital art-making in the same class environment; these recurring details were taken up not just by members of an immediate audience, but passed across times and spaces outside of the immediate environment surrounding the computer. For example, children at the start of the week developed a metaphor of 'flooding' ('jelly floods' and 'mud floods') to explain the action of filling the screen with a new colour. Then, at the end of the week, other children – who had not engaged in digital art-making previously – were adopting the metaphor of 'flooding' immediately when they started to engage in digital art-making. This suggests that the metaphor was shared by children in conversation and play that took place in spaces other than around the

computer. This highlights how digital technologies, or novel resources more generally, can instigate the development of new shared vocabularies between children in a learning community and that this vocabulary has a life beyond the resources themselves and activities involving them. It brings the significance of the wider audience, as opposed to the direct user, to the fore of observations around creative play via digital technologies in the classroom.

Queueing

Children sometimes queued to use the IWB. This was different to the presence of an audience because in this behaviour the emphasis was on waiting rather than on watching. Children would queue behind the person directly interacting with the IWB but would not interact with them, other than to put physical or verbal pressure on them to hurry up and finish their go.

Ayman draws on the board. Lexi waits behind Ayman showing signs of boredom: looking around, rolling her eyes and sighing. Other children intervene. They cluster around the IWB and tell Ayman that Lexi wants a go. Ayman leaves.

The emphasis on turn-taking and patient waiting is an important part of the classroom-ness of this context. Early years environments tend to place significance on the fair distribution of resources, particularly when these resources are seen as scarce, as digital technologies often are (Author, 2017). The behaviour of queuing is based on the idea that each individual child should 'own' their go, and that only direct involvement with the IWB through touch constitutes having a turn. While children in the audience role could gather ideas for their own participation through observation, children in the queue tended not to actively observe the person in front of them and came to the board with fewer ideas about what to do next. Waiting for a turn is a good example of the bi-directionality of classroom-ness: it shows how the etiquette that governs classroom spaces more generally can be applied to new resources (such as the IWB) but also how the new resources can potentially challenge these typical behaviours, so that alternative behaviours (e.g. engaged watching) emerge. Queuing in these observations was linked to the presence of the sand-timer on the table next to the IWB. Although this was not used by the majority of the children, its presence

was a signal to the children about the adults' expectations regarding carefully timed turn-taking.

Scribing

In this study, scribing was a rare way of entering interaction with the IWB: it occurred just once in the episodes observed. It involved one child being invited by another child (who had been using the IWB previously) to engage with the IWB in order to finish a task according to their intentions. In the example below, a child who is too short to reach the top of the IWB asks another child, who is taller, to do this for him.

Voychek approaches the IWB and wants to have a go. He picks a colour even though Ayman is using the board. He draws on the board and Ayman gets annoyed saying: 'Hey!'. Ayman picks white again and says to Voychek: 'make it all white, you have to make it all white'. Once this has happened, he jumps down and says to Voychek, 'do that bit', pointing to the top left-hand corner. Voychek is taller and so can cover this bit of the board.

Scribing can be seen as a form of collaboration. As Craft and Wegerif (2006) note, collaborative creativity need not depend on the verbal sharing of ideas; it can relate to a physical togetherness in order to achieve a particular creative product. Here Voychek and Ayman are together in their creative process: one supplies the primary creative ideas and the other supplies the physical activity. As with the engaged watching, adopting the role of the scribe enables children to gather ideas about how to interact with the IWB in anticipation of their own direct involvement. Scribing constructs the IWB as a public, collaborative tool; it challenges the emphasis on personal ownership that alternative behaviours – such as queuing – reinforce.

Covert interference

Covert interference involved an individual interacting with the IWB-laptop through the secondary site of activity (either the IWB or laptop depending on which device the primary user was engaged with). The child responsible for the interference tended to be aware that this was a socially dangerous behaviour and something they 'should' not do. They sometimes pretended that they were only an engaged audience member

and then would take the opportunity to physically manipulate the visual activity as it occurred. Sometimes this would happen without the primary user being aware.

Liam picks a frog using the 'stamp' tool in tuxpaint. Corey, who is watching at the laptop, says 'OHHHH FROG, I DON'T LIKE FROGS'. Corey starts to use the laptop touchpad. Liam is confused that the IWB appears to no longer be responding to his touch. I explain quietly to Corey that it makes it hard for Liam and he stops touching the mousepad.

Covert interference is enabled through the affordances of the IWB-laptop set-up, in which there are two sites of physical access. This feature can sometimes afford simultaneous engagement between users, for example, as when two individuals create a piece of artwork on paper together both using their own crayon (see Author, 2015). However, in this physical set-up, simultaneous engagement is not enabled, since when one input is active, the other input is automatically disabled. As apparent in the examples above, covert interference is generally seen as challenging expectations associated with the classroom space. As participant observer, the primary researcher tended to reinforce this perspective further by suggesting that children were being 'unfair' when they tried to affect the visual activity through the second site of input (as in the first example). This is an example of how the affordances of relatively novel semiotic resources are subject to cultural investment over time, which shapes how future patterns of use will unfold (Kress & Jewitt, 2003).

Direct interference

In instances of direct interference, children tried to physically manipulate tools in the primary site of engagement. For example, they ran up to the IWB and tried to insert themselves between the screen and the child who was directly interacting with the IWB. Most often this type of behaviour led to conflict between the primary user and the person who was interfering.

Some of the girls move up to the board and try to press buttons on the screen. One says: 'Oh! You made a love heart!' to another of the girls. Corey, who has been interacting with the IWB until now, angrily says: 'no! get off!'. The girls move away but say to Corey: 'we're allowed to play'.

Direct interference is afforded by the IWB since the screen is such a large, vertical interface that appears to belong to everyone in the classroom. Furthermore, because the IWB is a relatively new resource in the early years free-flow environment, the etiquette that surrounds the resources is not conventionalised (Russell et al., 2002; Kress & Jewitt, 2003). The IWB sometimes becomes a space that needs defending by the primary user. The verbal exchange in the second example demonstrates the tension that surrounds the IWB in terms of what type of resource it is. Is it a resource that can only be used by one child at a time, or is it a resource that everyone can play with simultaneously, as one of the children seems to suggest?

Exit

Spontaneous exit

Some exits from the IWB interaction were labelled as 'spontaneous' when children appeared to be leaving the activity according to their own decision rather than an external pressure. In these exits, it seemed that the child enjoyed a sense of completion in the activity before they moved away from the resources.

Masha moves back to the stamp tool and picks a huge penguin cartoon image and stamps it onto the screen repeatedly. Again, she covers over the images with the pink. Amy, who is watching the IWB and waiting for her turn says to the researcher: 'She's rubbing it'. Masha looks at the IWB for a moment, then steps down from the stool and moves away to another part of the classroom.

This type of exit is likely to be seen as an example of positive engagement transition in early years pedagogy because of the emphasis on self-determination and intentionality (Cremin et al., 2006). It is important however to question our idealisation of this type of transition at the expense of others. Prioritising apparent self-determination can lead us towards a perspective in which we see children as necessarily having a purpose that they wish to carry out and complete in relation to every activity, rather than allowing for a spontaneous interplay between children and material resources, through which a purpose can emerge (MacRae, 2011; Trafi-Prats, forthcoming).

Immediate social pressure

Children often moved away from their interaction with the IWB when they were under external social pressure to do so. This could involve verbal directives from other children ('you have to give me a go!') or directives from an adult ('you need to be fair'). It could also come about implicitly, for example with children waiting to use the resources showing signs of frustration and impatience through nonverbal communication.

Liam is interacting with the IWB. Molly wants to have a go and asks me. I tell her to ask Liam. She does and this appears to break the flow in his activity. He does not respond to her. Molly stands directly behind Liam and his eye contact flits back and forth from the IWB screen to Molly standing behind him. He covers the screen in white. I wonder whether this is a way of owning his own work without understanding the possibility of 'saving' what he has done. He would rather destroy what he has created than have another person interfere with it. He steps down from the stool and moves on to another activity.

As with queueing, the immediate social pressures that sometimes marked the exit of children from interacting with the IWB were strongly linked to the emphasis on turn-taking in the classroom context. Material elements of the environment such as the sand-timer as well as verbal and physical aspects of individuals' interaction all acted to suggest to children that they should limit their use of the IWB in terms of time and should move onto another activity to allow others a turn after a just a few minutes. Why was the IWB constructed as a scarce resource when there were many times observed during the free-flow activity time when no child was interacting with the IWB? This echoes the finding of Plowman and Stephen (2005) that, even though the computer in an early years classroom was often not in use during free-flow activity time, the children spent a lot of the time when they were using the computer trying to negotiate access and disagreeing about whose turn it should be. This paradox suggests that scarcity and abundance are as much a question of perception as the quantifiable reality of resources in the learning environment. Attempts to control turn-taking around a particular set of semiotic resources act as a signal to children that these resources are problematic when it comes to sharing. Other resources – such as paper on the drawing table – are not subject to such attention, and are therefore less

likely to become associated with the need to explicitly negotiate and assert your individual 'go'.

Responding to classroom 'tidy-up'

'Tidy up time' was a particular type of external pressure that could bring interaction with the IWB to a close. In this particular setting, tidy up time was signalled through the sound of the tambourine and children, directed by the teacher, who would walk around the classroom and outdoors environment shouting 'tidy up time!'. All children at this point were expected to stop what they were doing and begin to put resources away.

Amal is working quietly on the laptop screen. She is using the stamp tool to put flowers on the screen. Each time she puts a new flower on the screen, she sits back and says 'woow'. I am very close to Amal and I am mirroring her exclamations. She looks back at me each time she adds a flower. She claps her hands together, folds her lips inwards, smiles and looks directly at me. I say: 'pretty'. You hear the tambourine and the video immediately ends

Tidy up time is a clear indication of the importance of 'clocking practices' in the early years environment (Pacini-Ketchabaw, 2012; Rose & Whitty, 2010; Sellers, 2013). As a visitor in the classroom, the researcher signalled cooperation with the teacher through strict adherence to tidy up time, specifically by immediately ending observations in order to encourage children to put away resources as soon as the tambourine was heard.

Distraction

Sometimes the children would end their interaction with the IWB because something else in the classroom took their attention and they would move away to join in with another activity.

Eve is interacting with the IWB. She is choosing shapes and colours in quick succession. She looks at the effects she creates on the IWB on the laptop screen, moving rhythmically between the IWB and the laptop. Awchang comes

up behind Eve and pretends to peck at her with a large parrot puppet. They run off together to carry on playing with the puppet in another part of the classroom.

Moments of distraction encourage us to ask questions about the porosity of the boundaries around the IWB activity space. Distraction was a relatively infrequent occurrence in this study, suggesting that the carpet around the IWB was seen as being specifically for children who wished to interact with the IWB directly or indirectly. Awchang was unusual in her movement into the space for the purpose of engaging her friend in another activity altogether. Most commonly, distraction occurred when children interacting with the IWB heard conversations behind them between children who were waiting to use the IWB. The lack of distraction suggests that there were a range of implicit boundaries around the IWB; these were constructed through the interplay of physical features (such as the edges of the carpet on which the IWB was set up) and social associations between particular spaces and activities.

Discussion

The findings present five ways in which children entered into interactions with the IWB and four ways in which they exited from this activity and the associated space. The types of entrance and exit have been explained in the preceding section in relation to the affordances of the IWB and the social and material conditions of the wider context. Affordances of the IWB that appeared to impact on how the activity unfolded included the large interactive surface of the IWB, which facilitated the public nature of activity involving the IWB, but also the impossibility of two (or more) users simultaneously acting upon the IWB, which reinforced a common perception that the IWB needed to be used by one child at a time. The wider context of the classroom was characterised by an emphasis on turn-taking, physically manifest through the sand-timer placed next to the IWB, and verbalised by children and the primary researcher when others were told to 'be fair and let others have a go'. While these affordances and wider contextual features are likely to prompt individualised patterns of use (for example, queuing), rather than collaborative engagement, the observations presented here show diversity in how the children drew the IWB into activity, and point towards the potentials for collaborative creativity in interactions with the IWB. Instances of 'engaged watching', which even included children calling out suggestions to each other for what to do next,

show the potential for the children to use the IWB as part of highly socialised play and creative activity.

We suggest that practitioners can productively disrupt the organisation of time and space in early years learning environments around digital technologies and experiment with alternative practices. When it comes to the integration of relatively new resources, such as the IWB, practitioners can trial and document different ways of managing the time and space around the resources. This kind of playful reflection could open up the possibilities for how we integrate digital technologies into the early years learning environment. For example, in the particular classroom featured in this study, what would happen if the sand-timer were removed? What would happen if children were encouraged by the teacher to collaborate when using the IWB rather than engaging individually, and perhaps opened up these possibilities by sharing examples where children have done this spontaneously, as in some of the examples presented in this study? What would happen if practitioners joined in more with activities around the IWB and focused on co-playing rather than managing conflicts relating to turn-taking? What would happen if a conscious effort were made to deconstruct the discourses of scarcity that so often surround digital technologies in the early years environment?

The study presented in this paper is limited in that it relates to a single classroom context and one set of observations made by a single individual. Having said this, the aim of the research and this paper is not to generalise to all other classrooms or to present a universal typology of activity involving the IWB. Instead, it presents observations and analyses that challenge and prompt re-considerations of the early years learning environment, particularly in relation to the transitions that surround digital resources, such as the IWB. It aims to disrupt the emphasis in early years pedagogy on 'smooth' transitions and to offer a more nuanced typology of how children can enter and exit from engagement in a shared digital environment such as the IWB. It demonstrates how the affordances of the IWB, along with the material and social conditions of the classroom context in which it is situated, shape activity involving the IWB, and can constrain opportunities for collaborative creativity for the sake of 'no-drama' turn-taking.

References

Author (2015)

Author (2017)

Barad, K. (2007). *Meeting the universe halfway: Quantum physics and the entanglement of matter and meaning*. Duke University Press.

Bezemer, J. & Mavers, D. (2011) Multimodal transcription as academic practice: a social semiotic perspective. *International Journal of Social Research Methodology*, 14 (3), 191-206.

Bezemer, J. & Kress, G. (2015) *Multimodality, learning and communication: A social semiotic frame*. London: Routledge.

Björkqvall, A., & Engblom, C. (2010). Young children's exploration of semiotic resources during unofficial computer activities in the classroom. *Journal of early childhood literacy*, 10(3), 271-293.

Burnett, C. (2014). Investigating pupils' interactions around digital texts: A spatial perspective on the "classroom-ness" of digital literacy practices in schools. *Educational Review*, 66(2), 192-209.

Burnett, C., Merchant, G., Pahl, K. & Rowsell, J. (2014) The (im)materiality of literacy: The significance of subjectivity to new literacies research. *Discourse: Studies in the Cultural Politics of Education*, 35 (1), 90-103.

Burnett, C., & Myers, J. (2006). Observing children writing on screen: Exploring the process of multi-modal composition. *Language and Literacy*, 8(2).

Byron, T. (2008). *Safer children in a digital world: The report of the Byron Review: Be safe, be aware, have fun*. London: Department for Children, Schools and Families.

Carter Ching, C., Wang, X. C., Shih, M. L., & Kedem, Y. (2006). Digital photography and journals in a kindergarten-first-grade classroom: Toward meaningful technology integration in early childhood education. *Early Education and Development*, 17(3), 347-371.

Colebrook, C. (2002) *Gilles Deleuze*. London: Routledge.

Craft, A. and Wegerif, R. (2006) Founding editors' editorial – thinking skills and creativity. *Thinking Skills and Creativity*, 1 (1), 1-2.

- Craft, A., Cremin, T., Hay, P., & Clack, J. (2014). Creative primary schools: developing and maintaining pedagogy for creativity. *Ethnography and Education*, 9(1), 16-34.
- Cremin, T., Burnard, P., & Craft, A. (2006). Pedagogy and possibility thinking in the early years. *Thinking skills and creativity*, 1(2), 108-119.
- Deleuze, G. (2006) Bergsonism, 6th edn. New York: Zone Books.
- Duerager, A., & Livingstone, S. (2012). How can parents support children's internet safety? London: EU Kids Online.
- Dunn, J., Gray, C., Moffett, P., & Mitchell, D. (2018). 'It's more funner than doing work': children's perspectives on using tablet computers in the early years of school. *Early Child Development and Care*, 188 (6), 819-831.
- Edwards, S. (2013). Digital play in the early years: a contextual response to the problem of integrating technologies and play-based pedagogies in the early childhood curriculum. *European early childhood education research journal*, 21(2), 199-212.
- Edwards, S. (2016). New concepts of play and the problem of technology, digital media and popular-culture integration with play-based learning in early childhood education. *Technology, Pedagogy and Education*, 25(4), 513-532.
- Flewitt, R. (2005). Conducting research with young children: Some ethical considerations. *Early child development and care*, 175(6), 553-565.
- Flewitt, R., Kucirkova, N., & Messer, D. (2014). Touching the virtual, touching the real: iPads and enabling literacy for students experiencing disability. *Australian Journal of Language & Literacy*, 37(2), 107-116.
- Guest, G., MacQueen, K. M., & Namey, E. E. (2011). *Applied thematic analysis*. Sage.
- Hodge, R., Hodge, R. I. V., & Kress, G. R. (1988). *Social semiotics*. Cornell University Press.
- Jewitt, C., Moss, G., & Cardini, A. (2007). Pace, interactivity and multimodality in teachers' design of texts for interactive whiteboards in the secondary school classroom. *Learning, Media and Technology*, 32(3), 303-317.
- Jewitt, C., & Kress, G. R. (Eds.). (2003). *Multimodal literacy*. New York: Lang.

Kucirkova, N., Messer, D., Sheehy, K., & Panadero, C. F. (2014). Children's engagement with educational iPad apps: Insights from a Spanish classroom. *Computers & Education*, 71, 175-184.

Kress, G. (2009) *Multimodality: a social semiotic approach to contemporary communication*. London: Routledge.

Labbo, L. D. (1996). A semiotic analysis of young children's symbol making in a classroom computer center. *Reading Research Quarterly*, 31(4), 356-385.

MacRae, C. (2011). Making Payton's rocket: Heterotopia and lines of flight. *International Journal of Art & Design Education*, 30(1), 102-112.

Marsh, J. (2010). Young children's play in online virtual worlds. *Journal of early childhood research*, 8(1), 23-39.

Marsh, J., Plowman, L., Yamada-Rice, D., Bishop, J., & Scott, F. (2016). Digital play: A new classification. *Early Years*, 36(3), 242-253.

Mercer, N., Warwick, P., Kershner, R., & Staarman, J. K. (2010). Can the interactive whiteboard help to provide 'dialogic space' for children's collaborative activity?. *Language and education*, 24(5), 367-384.

Ofcom (2016) Children and parents: media use and attitudes. Accessed online 31.01.2018 from <https://www.ofcom.org.uk/research-and-data/media-literacy-research/childrens/children-parents-nov16>

Pacini-Ketchabaw, V. (2012). Acting with the clock: Clocking practices in early childhood. *Contemporary Issues in Early Childhood*, 13(2), 154-160.

Pacini-Ketchabaw, V. (2013). Politicizing transitions in early childhood. *Global Studies of Childhood*, 3(3), 221-229.

Palaiologou, I. (2016). Children under five and digital technologies: implications for early years pedagogy. *European Early Childhood Education Research Journal*, 24(1), 5-24.

Parten, M. B. (1932). Social participation among pre-school children. *The Journal of Abnormal and Social Psychology*, 27(3), 243.

Plowman, L., & Stephen, C. (2005). Children, play, and computers in pre-school education. *British journal of educational technology*, 36(2), 145-157.

Plowman, L., Stephen, C., & McPake, J. (2010a). Supporting young children's learning with technology at home and in preschool. *Research Papers in Education*, 25(1), 93-113.

Plowman, L., Stephen, C., & McPake, J. (2010b). *Growing up with technology: Young children learning in a digital world*. London: Routledge.

Samuelsson, I. P., & Carlsson, M. A. (2008). The playing learning child: Towards a pedagogy of early childhood. *Scandinavian journal of educational research*, 52(6), 623-641.

Rojas-Drummond, S. M., Albarrán, C. D., & Littleton, K. S. (2008). Collaboration, creativity and the co-construction of oral and written texts. *Thinking skills and creativity*, 3(3), 177-191.

Rose, S., & Whitty, P. (2010). "Where do we find the time to do this?" Struggling Against the Tyranny of Time. *Alberta Journal of Educational Research*, 56(3), 257.

Schiller*, J., & Tillett, B. (2004). Using digital images with young children: Challenges of integration. *Early Child Development and Care*, 174(4), 401-414.

Sellers, M. (2013). *Young children becoming curriculum: Deleuze, Te Whāriki and curricular understandings*. London: Routledge.

Stephen, C. (2010). Pedagogy: The silent partner in early years learning. *Early Years*, 30(1), 15-28.

Van Leeuwen, T. (2005) *Introducing Social Semiotics*. London: Psychology Press.