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Preserving Sequential Context: Developing Participatory Video Analysis Practice

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Preserving Sequential Context: Developing Participatory Video Analysis Practice

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Abstract: An open challenge for participatory design research is how to engage users and other stakeholders early in the design process, not only as informants, but as participants in the analysis of field data, prior to the formulation of design problems. Involving novice analysts introduces additional complexity as they are simultaneously domain experts but with little time available to engage with activities that do not directly inform their practice. In this paper, we develop methods that balance making data-rich video analysis accessible, whilst preserving enough of the sequential context of the video so that novice analysts can make informed judgements. We introduce a modified version of the Video Card Game, adapted to involve primary school teachers in video analysis for design. We evaluate two instances of the method. Our findings, among others discussed, suggest the approach enabled participants to leverage their domain knowledge in analytic tasks.

Keywords: video analysis; video data; participatory; education

1. Introduction

Facilitating participation in the formative stages of design can be challenging, particularly before problems have been defined, the design context has been understood, or stakeholders have articulated their values and priorities. Yet without participant input, design researchers may develop a myopic view of the problem space that misses key insights that would lead to better understanding of the problem space and potential design solutions. Participants bring a deep contextual knowledge, which enables richer considerations of formulating the problem space beyond what any lone designer is likely to achieve. Participatory techniques in such instances are not a means of outsourcing the challenging work of analysis, but are ways to bring in other perspectives into the design process to aid in problem articulation and reduce designers' own bias; problem setting is seen as a core aspect of reflexive practice of design (Schon, 1983). The design process benefits when participants are provided with the opportunity to articulate their viewpoints, augmenting the problem

definition with new perspectives, and occasioning an opportunity to shift the designer's own ontological understanding of the design space. In practice, such facilitation is intended to lead to the creation of outcomes that are much more closely tied to the participants' needs, and thereby increase the fit and uptake of the systems designed (Buur & Matthews, 2008).

Within complex organizational settings, aligning the designer's perceptions to the orientation of stakeholders is challenging, but of paramount importance in realising the value of participatory design processes (Brandt et al., 2012). Designers often rely on methods (generative workshops, prototyping and evaluation sessions) to engage participants (Gray, 2016; Kwiatkowska et al., 2014a, 2014b; Lloyd, 2017; Malins & Grant, 2010; Rasmussen et al., 2011) with the aim of providing platforms and avenues to bring participant perspectives into light – to help shape possible design solutions. The challenge however is in creating opportunities where multiple participants are empowered to play significant roles in framing the problem space to begin with, whilst also catering to pragmatic considerations (time, effort, comfort etc). Prior work in participatory design has provided practitioners and other stakeholders with a multitude of methods, tools and techniques to facilitate open dialogue, including with, and through, video. The use of video in such design practices has evolved over time. Early uses saw video as "hard data" (Buur et al., 2000) a fairly neutral fly-on-the-wall perspective of real world events, available for objective and rigorous analysis, so that design requirements and contextual challenges could be identified (Jordan & Henderson, 1995). More progressive (and critical) uses of video in participatory design have since emerged, where video is understood as an actor in the situation, as a fluid material for design ideation and exploration (e.g. sketching scenarios, improvisation, e.g. Binder, 1999), or as a social medium for participants to come to shared perspectives on design spaces (c.f. Ylirisku & Buur, 2007).

However, in bridging these various traditions of video use, an aspect of these methods that remains under-explored is how to effectively bring participants into initial analyses of field data, to generate shared understandings and collaborative insights. In particular, bringing participants early into the design process and providing them with opportunities to evaluate raw data can be a time-consuming task for stakeholders who rarely have the imperative to undertake such activities. Participants have often been reduced to the roles of informants (Druin, 2002), rather than co-analysts, for example. One of the established methods developed to bring participants into the analytical stage of the process is the video card game (Buur & Soendergaard, 2000). This study extends and modifies the popular video card game genre of participatory design methods to elicit non-designers' input in sequential interaction analysis by (1) making analysis a shorter process than the traditional video card game; (2) increasing the number of video cards per clip to gain richer contextual understanding in the analysis; and, (3) having the participants watch the entire video with the cards in sequence.

Video data is often gathered as a means of capturing some of the richest interactions in design research. We see an opportunity to explore how to evolve the video card game, which currently requires a significant time investment, into a more accessible and pragmatic format, whilst maintaining the contextual integrity of the data. As we detail below,

maintaining a balance between accessibility (of video analysis methods) and preserving enough context in segments of video remains a challenge for design research. This study uses video data from novice designers (8-10 year old students) to elicit both teachers' reflections and pedagogical expertise in reviewing student interactions with tangible artefacts. We present results from a series of design workshops that explore the method.

2. Literature Review

While there is a wealth of design methods that have been developed as a means of cooperatively involving stakeholders in generative and evaluative aspects of design, the same cannot be said of methods to engage stakeholders in co-analysis of raw research data. There are a number of possible reasons for this. Many forms of (research) analysis are derived from, and wedded to, particular philosophical positions. To enact them faithfully often requires a significant degree of understanding of their epistemological foundations (Lincoln & Denzin, 2000). This does not only entail what should be done in analysis, but often (and more importantly) what should not be done, i.e. what analytic moves are invalid from an epistemological stance. Certain contextual approaches (such as ethnomethodology) avoid the importation of concepts derived from theory; whereas others are founded in particular theoretical frameworks that are intended to guide the analysis, priming the analyst for what to look for and the kinds of relationships to expect in the data (Shapiro, 1994). Indeed, there is an argument that cooperative analysis itself is founded in a philosophical viewpoint that knowledge, understanding and action are irredeemably situated in the social and the ecological settings (Lave, 1988; Vygotskiĭ, 1997) in which they appear, and as such our methods of analysis should capture this milieu. So, while Design Thinking and Participatory Design have advanced many ways of making the generative and evaluative activities of design available to non-design oriented stakeholders for participation, the co-analysis of data can present unique hurdles to participation.

Muller, Wildman & White (1993) recognised that the lack of involvement of participants in 'up-stream' design process methods meant that participants had a reduced ability to define the problem space. Methods such as CARD (Muller, 2001) and PICTIVE (Muller et al., 1993) were developed as participatory design tools that sought to involve users in both the macro and micro levels of the design process. These have been integral in the further development of methods to involve users in the analysis of data (Buur et al., 2000; Chin et al., 1997; Ylirisku & Buur, 2007).

A number of these methods have based themselves on the principles of video interaction analysis (Jordan & Henderson, 1995). Video interaction analysis is a rigorous analytic that provides for the collaborative generation of rich insights that are grounded in the context of study. Jordan & Henderson (1995) discuss the benefits of having multiple viewpoints involved in video analysis, as it challenges researchers' 'preconceived notions', and compels analysts to contend with competing frames of what is taking place in the data. Further discussions on the use of video in collaborative design processes have resulted in video

being reconsidered as 'design media' (Buur et al., 2000), not only containing rich data, but also being open to various interpretations and meanings, both in its viewing and what (and how it) is recorded. The Video Card Game (Buur & Soendergaard, 2000) was one such early method in the engagement of users with video, developed during a project conducted in an industrial setting in which participants were able to direct what the camera was viewing and to tell stories to the camera. This resulted in participant-led video recordings that were then cut into clips of one to three minutes. The 'game' component was a format for analysis, providing an engaging and enjoyable way for people of differing backgrounds to discuss work practices. With each video being represented physically as an annotatable card, the cards became a means for users to take ownership of the video clips. Having non-designers participate in the analysis stage provided further engagement in the design process. Since the game's introduction, further adaptions of video have been made to contexts such as education (Brereton et al., 2003) and everyday practices of select groups (Moore & Buur, 2005). As well as exploring types of tangible tools such as 'scrabble tiles' (Buur et al., 2014) and 'Video action walls' (Buur et al., 2004).

Chin, Rosson & Carroll (1997), describe a process of developing scenarios (Carroll, 1996) from raw video data, observations and field notes. The scenarios consisted of both textual and video content and were grounded in events that the external participants (in their case teachers) were familiar with and could relate to. The results from the study showed that the teacher-participants engaged and contributed meaningfully to the scenarios using terminology that both participants and designers were able to share.

The above methods have enabled analysis to be an engaging activity for participants. They have done this through adapting raw video data to create novel methods of engaging non-designer participants. In spite of these advances in participatory forms of analysis, there remains an open challenge for researchers to strike a balance between making the data accessible to participants, and preserving enough contextualisation in the data to enable stakeholder analysts to generate observations grounded in the sequential organisation of the phenomena as they unfold. It is this balance that is a challenge to achieve when participants have divergent domain experience and theoretical commitments, and yet must provide meaningful insights from short engagement with video data. The holistic ecology of everyday phenomena, as witnessable in an ongoing sequence of video data, has often (by necessity) been sacrificed in order to create accessible formats for the participation of non-researchers in video analysis activities. For this reason, we have experimented with a hybrid approach that has sought to preserve the sequential order of small clips of video in presentation to novice analysts yet provide them compartmentalised resources (such as video cards representing short 30-second segments) to annotate and thematise.

3. The Study

The participatory video study formed part of a much broader study, in which its main overarching objective was to understand how students use technology in a design process,

exploring how technology can be developed to support students' learning of design skills. We utilized ethnographic methods to understand the context, and video logged students' interactions as detailed below. From the video data, we ran two iterations of sequential analysis activities to explore and refine the proposed method.

3.1 Prior work

Video clips were sourced from a study of students in a one hour after school class designing tangible technological artefacts, taking place over a span of 25 weeks. Students had the opportunity to design a technology solution to cater to a problem of their own choice. Examples of the type of projects included: designing tools to provide soothing sounds to someone who is feeling upset; and a teddy bear that detects the heartrate of anxious children in hospitals. An adapted 'design thinking' process tailored to the educational context (Razzouk & Shute, 2012) was given by helpers and teachers, providing a support structure to help students through this process. Design support consisted of methodological tools to help guide them through several iterations of research, defining the problem domain, ideation, prototyping and testing. After the problems had been articulated, they ideated, prototyped and tested with tangible technology, finding ways to appropriate technology to find a solution to their problem. It was in this phase of interacting in a collaborative way, that we collected 25 hours of video data, from four different groups of students exploring the technology available to them, and conceptualizing and designing their proposed solutions. From this video data four researchers, working in pairs, logged the clips, using Jordan & Henderson's (1995) principles as a framework.

3.2 Contextual Challenges

To capture the ecology in which the students engaged with the technology, we sought to incorporate teachers' views on both the interactions with the technology and pedagogical importance of the process. Being familiar with the video card game (Buur & Soendergaard 2000) as a way to enlist practitioners' views on data and position them as partners in the design process, we ran a collaborative activity around video analysis. In the formulation of the method to the given context, we considered several factors that we needed to employ when undertaking design activities with teachers as participants in a design process.

The first is that teachers are notoriously time-poor, which means that any designed activity requires careful planning to reduce the amount of time they need to devote outside the classroom, or from class planning and preparing feedback. For this reason, obtaining large numbers of teachers for an activity can also be problematic, as it is unusual for a school to allow several teachers for an out-of-class activity, let alone one that is centred on design research that is not immediately of direct benefit to their pedagogical practice. From discussions with teachers, we found that an activity of approximately one hour with about two participants at a time would be achievable. Furthermore, being a stakeholder in a design process does not necessarily equate to valuing the relevance of what the designers are trying to achieve. Therefore, it is imperative that the designers make activities as constructive,

relevant and meaningful to the stakeholders as possible. Previous work (Buur et al., 2014; Buur & Soendergaard, 2000) in this space has been conducted with companies, who have a stake in the design outcomes, or as a part of a university course as a component of assessment (Brereton et al., 2003). In our case working with teachers, we have a different onus—our solutions will not necessarily directly benefit them immediately, and we have greater need for them to undertake an analysis activity as participants. The intent was that by providing a set of sequences to teachers that depict activities of students problem solving with technology, we would create an engaging opportunity for teachers to reflect on pedagogic practices around technology; this would also serve as an opportunity to reflect upon their own practice (Schon, 1983). Additionally, it had the potential to provide us with valuable insights into how the technology impacted the students' development. In this way we adapted our activity to suit our particular domain for the ways primary schools are notably distinct from the industrial contexts that inspired the original versions of the Video Card Game. Our sequential interactive analysis activity was designed to preserve aspects of the original version of the video card game, but to tweak them in ways that better mapped to our particular institutional conditions. We discuss our activity below.

4. The Method: Sequential Interactive Analysis Activity

Our game involved video taken from three sets of problem-solving sequences that we had identified were recurring patterns of problems (Jordan & Henderson, 1995), and two sets we considered interesting phenomena. These five sequences were chosen in response to time limitations. The problem-solving sequences depicted a problem the students were trying to solve i.e. understanding how heart rate monitors worked or trying to get a speaker to play a sound. The sequences ran for approximately three to four minutes. We structured the activity so that it could be played within an hour. In order to help participants keep track of their observations, we made visual cards (Figure 1, Step 1) which were numbered sequentially to correspond to sections of the video. Keeping the video and cards numbered in sequential order afforded navigation through fast-paced, complex and rich data, and had the added benefit of helping us to understand the process the children in the videos went through to obtain a designed solution with the given technology (the aim of our initial study).

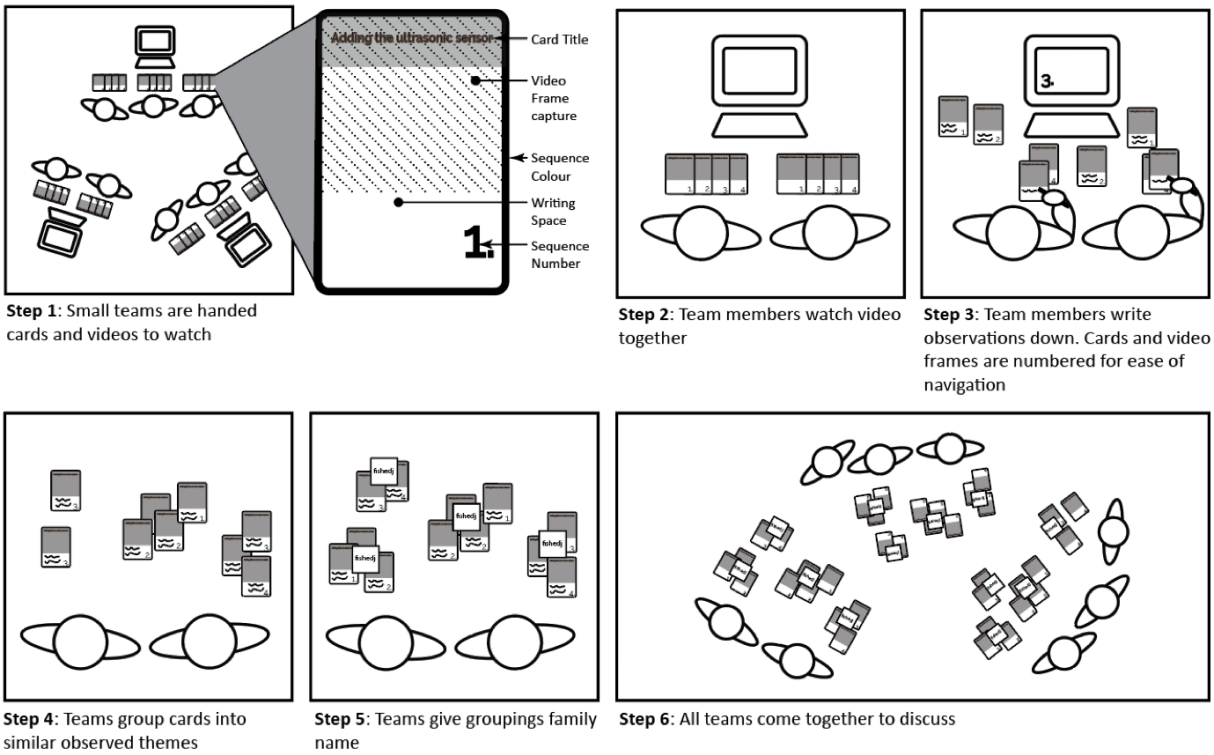

Figure 1 Story Board of Sequential Interaction Analysis Method

After watching the short videos, participants were instructed to write down observations on the cards—things that caught their attention or that they found interesting or noteworthy (Figure 1, Step 3). From these they were to produce insights in small groups of two or three (Figure 1, Step 4). After they had organised their (collective) insights, the participants competed with each other for how many themed families they could find, adding a fun and engaging game element to the method (Figure 1, Step 6).

We ran the activity in two instances. The first instance (see Table 1) was a multi-disciplinary set, which included a number of researchers from journalism, interaction design and anthropology. This allowed us to understand how the format of the game might work for participants for whom the context itself (children/classrooms) was outside their domain. In this instance, it was important for us to evaluate how the activity would make the data accessible and what observations it would make available to participants. The second instance (Table 1) was with the target group—two teachers, each of whom were paired with a researcher. Having two instances of running the activity enabled us to reveal the extent to which domain knowledge has an impact on the type of insights that can be gleaned, but also to provide us with a broader range of design insights to consider.

Table 1 Participant Overview.

Groups	Instance	No of Participants	Video
G1	1	3	1 & 2
G2	1	3	3 & 4
G3	1	2	3 & 5
G4	2	2	3 & 4
G5	2	2	4 & 5

The two sessions were audio recorded and photographed, to capture how participants of the game utilised the elements (tangible cards, video and post-it notes) and tasks to generate insights. We were also interested to understand the types of observations game participants were able to make and bring to the ensuing discussion. From each session, we photographed the annotated cards and their layouts on the tables, so we had access to the physical artefacts and themes that featured in the discussion. The audio data was reviewed with selected sequences then transcribed. The audio, cards and photographs were then thematized as a means of evaluating the activity and the insights it generated. In our results we refer to what was written on the cards in single quotes i.e. '*control*' and what was spoken by participants in double quotes i.e. "*declarative*".

4.1 Method findings of first instance

We had eight game participants for the first instance – two groups of three (G1 and G2), and one group of two (G3). Each group had a device on which to play the video that they could control as they liked. Videos were distributed between the groups, with only one video viewed by two different groups (Table 1). Most participants had at least a limited understanding of the context or the technology, and all were familiar with qualitative analysis.

From the outset we observed each group approached the task in slightly different ways. Teams used different strategies in how they decided to frame the data they were obtaining, how they distributed that information amongst their cards and then organised their cards in family groupings. Our analysis breaks down our observations from the activities which we have organised into themes: framing, information distribution and card organisation.

Framing

Applying different frames to the problem, such as viewing the information from different standpoints or framing it to their own lived experience were strategies that were employed to contribute to both the observations and later discussions.

Framing to lived experience - Participants who had some professional educational expertise, found an opportunity to bring their domain knowledge to their observations. For other groups, their lived experience of having been a school student was a valuable resource. One collective group's experience in classroom practices focused their attention on the social

elements of the video. They drew attention to the positions of the children and their access, or lack thereof, to the technology.

Viewpoint frame - Participants tried on different perspectives: from students, teachers and technologists. One observed conversation discussed the appropriateness of terms to frame their observations. *"What else [other themes] have you got?" "Testing and problem solving… and a little bit of trouble shooting I guess." "Yeah, I like those terms, because that is what they [the children] probably see themselves as doing."* Rather than donning a theoretical or technology-oriented view, participants tried to incorporate terms the students themselves would likely use. Other groups used terms they thought teachers would use such as '*risk-taking*', and others formed themes from a technical viewpoint, e.g. '*false signal interpretation*'.

Distributing information

The cards provided an opportunity to cognitively offload and organise the data. Some participants used the cards as placeholders in the video, writing down a rough transcript of the interactions and audio they observed. In some videos this became difficult because of the noisiness of the environment in which the audio was taken, and so having quotes placed on the cards helped them to make out what students were saying. Other groups opted to write observations on post-it-notes, then distribute their main/interesting observations between the cards, creating a sequence that wasn't attached to the video, using the numbers on the cards as a guide.

Card Organisation

After writing on the cards, the cards offered enough flexibility to enable participants to sort out data though adding extra notes, or colours to segregate different themes coming through linking meaning onto various actions observed (Figure 2).

Figure 2 *[left] Individually writing down observations on cards while watching video. [right] Creating overall themes from observations as a team.*

4.2 First Instance Outcomes

Two broad outcomes were produced from the groups participating in the method. These were '*Social rather than technical*' and '*Tool as mediator*'. Outcomes are discussed below.

Social rather than technical - Although not all researchers had an interaction design background, all were familiar with the domain. Our assumption was that they would identify more technology-related problems the students were having, being critical of how the technology kits were designed for the tasks they witnessed in the video. However, this wasn't the case. Researchers were bringing up how student's social issues were being impacted, unrelated to technology more than other types of observations. Themes that were brought to light were: time management "*we only have nine minutes left*"; defining types of control such as negotiation, power and acting out '*only one device so difficult to negotiate*'; team dynamics such as '*blame the colleague*', lack of results and lack of order '*verging on chaos*'.

Tool as mediator - One group explored themes relating to how students navigated the social using technology as a mediator, commenting on how students use technology as '*a social tool for attention*' when uttering phrases as "*look at this*" or "*should this sit up here?".* It was observed how students shared differing hypotheses around the technology to create understanding between themselves '*create some kind of intersubjective understanding of what is being attempted, what is going on*'.

4.3 Reflections on the first instance

Several issues arose in undertaking the activity in the first instance, making us re-evaluate the activity prior to running the second instance. The first was in the *distribution of videos*. Only two groups of the three had one video in common. When game participants came together to discuss, this was limiting their discussions as some teams had no data in common. To improve this in the second instance, we decided that teams should have at least one video in common, to order to aid discussions between teams (Table 1).

A second issue was with respect to the degree the *game* aspect of the activity was not engaged with. Certainly, time was a factor. But additionally, participants were not particularly motivated to play the game, preferring instead to discuss the findings they found interesting in the video. A third issue was with respect to *mindset*. Trading off the casual qualities of playing a game, and the seriousness of analysing, some participants were not always focused on observing the videos, being drawn into defining and solving the problems they observed rather than analysing what was visible in the video data.

Moving forward, it was integral to the purpose of our study that we obtained the teachers' expertise of what was happening on the videos, in helping us bring another frame onto our video data, to understand genuine design problems before exploring solutions. We felt that for our second instance we needed a sharper strategy, to ensure participants had occasion to carefully analyse the videos, and to facilitate a more open-ended discussion after producing families of observational themes.

4.4 Method findings of Second Instance

Modifications to Activity

To compensate for the reduced time, we separated the teachers and paired each with a researcher who was familiar with video analysis. We then brought the groups together to discuss the types of themes they saw coming through the data. We had two groups of two participants. The first group (G4) consisted of a researcher who hadn't seen the data, and a teacher who had been a part of the project supporting the students, and so was intimately aware of the projects undertaken by the students. The second Group (G5) consisted of a researcher who had previously participated in the first instance (of the modified game) and a grade 6 teacher who had not been part of the project but had undertaken similar projects in their classrooms.

Framing

Teacher participants were familiar with the type of activities and context represented in the video. Therefore, they were able to frame their insights in particular ways, such as towards the learning outcomes of the students. From comments made it was obvious that even from the two-minute video capture, teachers were able to draw on their knowledge and appreciate the complexity in the data: "There is a lot going on there, we might need to see that again".

Figure 3 *[left] Insights are produced from observations contained on the cards. [right] Small teams work together, discussing their observations and writing down themes.*

Distributing information

In both sessions, game participants waited to annotate cards until after the entire video was watched. The cards were used as placeholders for thoughts, e.g. '*I wonder if…, I think…. Sparking curiosity, making predictions, highly engaged' 'Recopy, Control, Instructions – shout when works*', rather than as a detailed description of what was happening. Although the cards were used as placeholders, teachers tended to use them as prompts of what they had witnessed in the videos. The themes produced covered a broad range of issues (Figure 3).

One teacher, when seeing the volume of notes from the other group, said, "*We thought we had too many [themes], you must have had good videos*".

Initially, discussions started with broad issues—terms used such as '*curiosity*' or '*growth mind-set*'. However, as the discussion progressed the teachers brought in detailed information from what they had seen from the videos. "*You saw she was really curious, you saw when she picked up the laptop she was looking at the code, she was trying to make a connection, I think, between when she was practically looking at it and what the code was saying." "Practical like project based they really um enjoy it um so yeah you could just tell that engagement was there, umm yeah so just experimenting when they started moving it around the arm you could really see that was happening*".

Engagement

Two interesting phenomena emerged when the teachers participated in the method. Firstly, having a video that took a snapshot of a sequence focused the teachers to look closely at interactions between the students and the technology. These are behaviours that easily can go unnoticed in a busy classroom of 24+ children, however having a short sequence to focus on allowed them to reflect on what the students were learning. "*It was really interesting to watch it back, because watching them on the day they were doing it, I didn't see some of the behaviours, and now watching on the video, I am oh my goodness they didn't work as a team at all and um the boys are very much had to be perfect they wouldn't take a risk on something where as the girls were oh we will try this…*". Secondly, even in the short time frame of the workshop, their initial understanding of what had happened in the video changed through discussion and analysis. The same teacher who initially had a negative reaction to one of the groups' conduct, on further reflection and analysis of the data, came to the realisation that that team might have been more on track compared to the team who looked like they were working well together. This raised a discussion about the difference between good collaboration and team functioning being something that was not necessarily coterminous with students' possessing high quality understandings.

4.5 Second Instance Outcomes

Some interesting outcomes from the workshop were: students' use of language '*statements were very declarative, not exploratory*'; comparisons between the two videos '*the first more experimenting the second was more understanding…*'; students approaches to technology "*found there was a little collaboration when it worked, and a little bit of discussion because it worked… it is very interesting to find ways to give little victories, you need more opportunity to have those experiences*".

5. Discussion

Ownership of artefacts engages participants in analytic activities: Understanding the balance between making video analysis accessible and still maintaining a level of engagement with

our game participants led us to design an activity that allows meaningful input from not only non-designers but those who wouldn't directly benefit from the outcomes. This balance was achieved by having artefacts such as post-it notes and cards that allowed game participants to make their own with annotations, giving them partial ownership of process. This can be seen in how both instances the teams organised and distributed information as they saw fit. This ownership also gave both the teacher and researcher participants the impetus to fit frames that were meaningful to them. We see this in the way researchers would try to make sense of the data by considering frames from the users in the video. Teachers, in particular, saw this as an opportunity to reconsider their pedagogical practices through a different lens. A clear example of this is when game participants were discussing their insights, they would point to the cards and say statements such as "*in this one*" or "*we found*" then extrapolate with examples from the video. Teacher participants would explicitly refer to their changed perception "*now watching on the video*, *I am oh my goodness they didn't work as a team at all*" as one that had changed after engaging in the activity, this statement is also mirrored as an insight on the cards (figure 3). These examples show that it was very much a participatory design tool that not just researchers, but the teachers were invested in, and not an external methodological imposition. This emerged in the post activity discussion of how teachers perceived using the tool.

Including domain experts in analysis provides rich insights for design: As designers we only gained from the process of involving teachers. While bringing in other researchers to analyse data made us challenge our 'preconceived notions' (Jordan & Henderson, 1995) such as seeing tangible 'tools as a mediator' and advocating for social inclusion, involving the teachers as domain experts provided a unique lens on the data that was more easily translatable to design applications. For example, in the design of technology that supports the learning environment, the teachers' contributions highlighted the need to balance between making technology complex enough to realise students' design ambitions, whilst still providing opportunities for "small victories", and providing ways the technology can support collaboration through discussion. Buur et al (2000) describe this type of analysis as video acting as a material to design with. These insights wouldn't have been derived had we not engaged teachers with our raw data.

Sequential video offered unique opportunities for domain expert participants: Having a sequential video that was situated in a context that was familiar to our domain expert participants, enabled them to see how students acted not just with a component of technology but rather in a complex and rich environment. Teachers were able to offer insights regarding students' actions in a social environment, interacting with technology, and how these interactions were hampering or encouraging learning in the ecology of the classroom. The teachers drew our attention to how parts of the system gave rise to students engaging in an emerging understanding (Sawyer et al., 2003) of both technology and problem solving strategies.

In these respects, the activity successfully negotiated a balance between preserving (enough) local context within video data to make it meaningful to participants yet constructing an

accessible (enough) format for both domain novices (researchers) and research novices (teachers) to engage in the painstaking work of video analysis for design. However, there were considerations and trade-offs being made when it came to perform the activity with teachers. We did not offer all videos to participants; we only showed those videos we identified as a repetitive problem-solving issue or if the video was particularly interesting. This was done to reduce the amount of time for the activity but also as a way of directing discussions. Another consideration was having short videos meant that a teacher who had been there throughout the data gathering time, saw a lot more value in the data than a teacher for whom the data was unfamiliar. Further studies to understand how well context was preserved, for example experimenting with longer video sections (5-10 minutes) to give additional context, would clarify the extent to which this may be indicative of a more general issue; yet this may also result in making the task of analysis more laborious to stakeholders.

In taking our analysis activity to both researchers and teachers, we were able to determine how the process afforded open-ended discussions and insights for design solutions to be gathered. Our activity resulted in engaging a range of participants 'up stream' (Muller et al., 1993) in the design process, extending long-standing design methods and formats that have been developed to create participatory bridges between the activities of design and analysis.

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