Developing reflective trainee teacher practice with 360-degree video

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Video self-reflections can be an effective self-development tool for student teachers; however, its value is often limited as video provides only one perspective of the classroom. This project, an interpretive case study, used think-aloud protocol and interviews to explore how the use of 360-degree video can support student teacher reflection. Results suggest that the immersive, embodied experience of reflecting using 360-degree video develops a more nuanced understanding of microteaching practice, as well as supporting student teachers’ self-efficacy towards teaching. This has the potential to facilitate a more active and student-centred approach to initial teacher education within Higher Education.

Keywords: 360-degree video; reflection; Initial Teacher Education; embodied; situated learning; student teachers

# Introduction and theoretical framework

## 1.1 The value of reflection on teacher practice

The capacity for teachers to reflect on their pedagogical practice has been argued as being important for their development for some time (e.g., Tripp & Rich, 2012a). Much of what teacher education calls a reflective approach is grounded in the works of Dewey (1933) who provided one of the earliest definitions of reflective teaching as an “active, persistent, and careful consideration of belief or supposed form of knowledge in the light of the grounds that support it and the further conclusions to which it ends” (Dewey, 1933, p. 9, cited in Tripp & Rich, 2012b). In this way, reflection is a self-critical, exploratory process through which teachers “consider the effect of their pedagogical decisions on their situated practice with the aim of improving those practices” (Tripp & Rich, 2012a, p. 678). Schön (1983, 1987) explored the relationship between theory and professional practice, resulting in a view of learning to teach that is inextricably linked to prior experiences, beliefs, and attitudes. It has been argued that his notion of reflection-in-action, in which teachers reflect on their practice *in situ*, versus reflection-on-action, a more retrospective approach to considering what happened in a lesson, provides a way to fundamentally rethink how we view the relationship between theory and professional practice (Tripp & Rich, 2012a). It is this first approach that could develop more situated decision-making which, according to Rich and Hannafin (2009), is a key teaching skill. This is particularly important for teacher education which uses reflection to narrow the gap between educational theory and pedagogical practice (Atkinson, 2012; Ibrahim-Didi, 2015), developing student teachers’ ability to consider their teaching in the light of theory with the aim of change and improvement (as suggested, for example, by the four stages of Kolb’s [1984] experiential learning cycle - concrete experience, reflective observation, abstract conceptualisation and active experimentation).

Ibrahim-Didi (2015) suggests that despite the wide range of approaches to reflection, there is general agreement that it is a forward-looking process which facilitates creative approaches to solving contextually situated problems (e.g., Collin, Karsenti, & Komis, 2013; Postholm, 2008; Urzúa & Vásquez, 2008; Wilson, 2008). Bryan and Recesso (2006) propose that student teachers who are able to reflect, which they define as framing issues of teaching and learning, confronting their beliefs about these issues, and experimenting with alternative solutions to issues of teaching and learning, subsequently develop a deeper understanding of their practice. As a result, reflection is developed as a central skill within the majority of initial teacher education programs (Collin et al., 2013).

However, despite the heralded benefits of reflection, research has identified potential difficulties with reflecting on practice; for example, Bryan and Recesso (2006) suggest that prospective teachers have difficulties confronting, analyzing, and evaluating their own practice (see also Farrell & Ives, 2015; Gelfuso, 2016; [Körkkö](https://www.sciencedirect.com/science/article/pii/S0742051X16300142#!), [Kyrö-Ämmälä](https://www.sciencedirect.com/science/article/pii/S0742051X16300142#!), [& Turunen](https://www.sciencedirect.com/science/article/pii/S0742051X16300142#!), 2016). Teacher educators have, therefore, for some time been exploring ways to scaffold student (and practicing) teacher reflection to better enable it to support and develop their practice; use of video is one such approach.

## 1.2 Video as a tool for supporting reflection

Video has been used as a professional development tool for existing and trainee teachers for some time and in a range of contexts (e.g., Christ, Arya, & Chiu, 2012, 2017; McNeill & Krajcik, 2011); in particular, video self-reflections where trainees are recorded during a teaching episode and subsequently watch this back to scaffold their ability to learn about and from their practice, has been shown to be an effective self-development tool (e.g., Arya & Christ, 2013; Calandra, Sun, & Puvirajah, 2014; Christ et al., 2012; Collins, Cook-Cottone, Robinson, & Sullivan, 2004; Sherin & van Es, 2005). Further, video reflections with peers can provide opportunities for trainee teachers to get feedback, develop a greater understanding of their strengths and areas for development, and generate ideas to improve their pedagogy (Arya, Christ, & Chiu, 2015; Christ et al., 2012; Eröz-Tuga, 2013; Shanahan & Tochelli, 2014). This has resulted in extensive use of video for supporting teacher practice, with journals such as Teachers College Record embedding video clips into the text of articles and researchers, such as Craig (2013), using digital narrative storytelling to support teaching and learning.

Although a wide range of studies have found video to be beneficial for teacher and student teacher reflection, Tripp and Rich (2012a) suggest that the approaches used to establish this varies significantly between projects; for example, within some research teachers were asked to reflect on videos of their practice independently, whilst in others they did so in conjunction with others. Differing approaches also used varying methods of video reflection, means of scaffolding teacher reflection and ways of assessing any subsequent benefits. Tripp and Rich (2012a) identify six key dimensions along which studies tended to differ: (1) type of reflection tasks student teachers were asked to complete, (2) the level of scaffolding of reflection, (3) whether reflection was undertaken individually or collaboratively, (4) video length, (5) number of reflections undertaken (both on the same video, or teach-reflect cycles using separate videos), and (6) methods of measuring reflection. Whatever the approach taken, the consensus appears to be that teachers involved in video reflection see it as one of the most valuable and transformative aspects of their professional development (Borko, Jacobs, Eiteljorg, & Pittman, 2008; Griswold, 2004; Tripp & Rich, 2012b); video reflections encourage teachers to engage with their teaching from a new perspective, thereby identifying hitherto for unnoticed features of their practice for consideration (Bryan & Recesso, 2006; Griswold, 2004; Miller, 2009). This process is constructivist in that student teachers or teachers are working together with their mentors to actively construct meaning by adding newly learned experiences or information to existing knowledge structures (Wittrock, 1974). Teachers often feel that video-based feedback is more helpful than simple supervisor evaluations or written self-reflection without video feedback because video provides a common frame of reference on which the discussions are based, rather than relying on often incomplete or inconsistent memories of the event (Miller & Carney, 2008; Rich & Hannafin, 2008a; Wang & Hartley, 2003; Wright, 2008). Consequently, studies suggest that teachers’ written or spoken reflections tend to be more focused and accurate than teacher reflections without video (Shepherd & Hannafin, 2009; Welsch & Devlin, 2004) and, thereby, teachers or student teachers almost invariably improve their practice after using video to reflect on their pedagogical practice (e.g., Dawson, Dawson, & Forness, 2001; Shepherd & Hannafin, 2009; Stadler, 2003).

Despite these reported benefits of using video to support teacher and trainee teacher reflection, Bryan and Recesso (2006) suggest that there are a number of common barriers to using video playback as a tool to promote reflective thinking and teaching practice; these include firstly, the student teachers’ inability to identify or recognise issues in teaching and learning, generally resulting from less well-developed understanding of pedagogy and practice but also, we would suggest, the result of being unpractised in the art of reflection; secondly, students’ reluctance to engage in self-criticism, thereby only seeing the positives (believing that everything ‘went well’); and thirdly a fear of revealing too many perceived areas for development (Abell, Bryan, & Anderson, 1998; Pavlovic & Friedland, 1997). Ibrahim-Didi (2015) further argues that these standard approaches to video do not provide the “spatial and temporal situatedness required to help [student] teachers to draw on their body-based reflective capabilities in the moment” (p. 240). She argues instead that opportunities afforded by virtual reality (VR; e.g., Jaeger, 2013) and the use of 360-degree video might offer more immersive and embodied approaches to reflection. The next section explores the potential of 360-degree video to do this.

## 1.3 The potential of 360-degree video for supporting embodied reflection

360-degree video is becoming increasingly prevalent in a range of contexts, such as virtual and augmented reality (e.g., Argyriou, Economou, & Bouki, 2017); it is an immersive type of video content which allows the viewer to look around in all directions, giving them choice and control over what they see. In addition, spatial audio can be recorded by certain cameras which provides directional information to the viewer to enable them to identify the source of student speech from anywhere within the classroom.

Ibrahim-Didi (2015) suggests that reflection is a “dynamic process that is embodied at the level of the biophysical through perception” (p. 238); this belief in the body as being central to the process of reflection reformulates Dewey’s (1938) notion of the primacy of hands-on learning and Gibson’s (1977) socio-physical approach to the interplay between physical space and in-situ behaviour, moving reflection beyond the technical and requiring students to develop an understanding of how their body may influence the classroom space (Moore-Russo & Wilesy, 2014). Although sociological approaches to considering reflection are important (e.g., Thompson & Pascal, 2012), Ibrahim-Didi (2015) argues the case for “embedded and embodied, multidimensional aspects of reflection to be facilitated in holistic ways” (p. 237; see also Kinsella, 2007a, 2007b; Moore-Russo & Wilsey, 2014). For reflection to be genuinely useful, teachers must be supported to explore the multifaceted environment in which they practise with an awareness of and sensitivity towards their vantage point so that reflection can translate into action. However, Ibraham-Didi (2015) suggests that most initial teacher training routes or models fail to recognise the situated nature of reflection, possibly as a consequence of the partitioning of mind and body that exists in more traditional practices of reflection (Kinsella, 2007b); this can restrict the ability of trainees to translate reflection into action and change their practice (e.g., Beauchamp, 2015). In acknowledging that reflective practice emerges from action within a specific context, it can be situated in the realm of experience (Polanyi, 1967), drawing from phenomenology and recognising that “human cognition is deeply rooted in the body’s interaction with its physical environment” (Lindgren & Johnson-Glenberg, 2013, p. 446). The argument is then that teacher reflection could, therefore, be considered a situated, body-dependent process.

With this in mind, Author (2012) draws attention to the potential of mobile technologies to exploit the complexities and interconnected affordances of social and physical (as opposed to virtual) spaces as a rich resource for situated learning. More specifically, Ibraham-Didi (2015) suggests that 360-degree video has the potential to offer student teachers the opportunity to explicitly develop critical skills needed to reflect-in-action (after Schön, 1983, 1987). In particular, it is the immersive and situated approach that is the critical and facilitative step in supporting reflection-*in*-action, rather than reflection-*on*-action, by drawing on the concept of embodiment (e.g., Rosch, Thompson, & Varela, 1991). Research on embodied cognition is well established (Corcoran, 2018) with the consensus that it defines how “human cognition is originally rooted in sensori-motor processes and thus determined by bodily experiences” (Fischer, Moeller, Bientzle, Cress, & Nuerk, 2011, p. 178). Craig et al. (2018) develop this, suggesting that embodied knowledge is knowledge dwelling in the body and enacted through the body. Taking an embodied approach through use of 360-degree video, student teachers might effectively re-experience the classroom setting, the video acting as a proxy for real-life, providing them the ‘opportunity to ‘read’ the environment, examine their own immediate responses to classroom situations and learn to exercise metacognitive control over their own responses in context’ (Ibrahim-Didi, 2015, p. 235). According to constructivist and sociocultural perspectives (e.g., Piaget, 1990; Vygotsky, 1978), the situated experiences of student teachers within the space and time of their classroom teaching construct understanding (Lakoff & Johnson, 1999). Gallagher (2005) argues for the centrality of the body in how one perceives the world and interacts with others (Author, 2012). He takes a pragmatic stance based on the phenomenological viewpoint that our “primary and usual way of being in the world is pragmatic interaction (characterized by action, involvement, and interaction based on environmental and contextual factors), rather than mentalistic or contemplation” (Gallagher, 2005, p. 212). The suggestion is that the “situatedness” (Gibson, 1977) of 360-degree video would enable student teachers to develop a sense of body awareness that might allow them to reflectively examine their practice, in doing so increasing their ability to “‘notice’ aspects of practice that have particular significance in educational settings and inform their professional responses” (p. 235).

We suggest that the drawing together of theories of embodied cognition and situated learning makes use of 360-degree video for reflection so powerful. While situated learning is a sociocultural approach which stresses the importance of context, authenticity, and participation (Ghefali, 2003), and embodied cognition focuses more on body-related aspects of human cognition which is more commonly described in terms of sensorimotor activity (Corcoran, 2018), their differing views on cognition and learning are not necessarily contradictory (Rambusch, 2004). Both clearly foreground cognition as being situated and deeply rooted in sensorimotor activity as linked to perception and action, something which is of significant value for developing teacher reflection. Bresler (2013) states that the disjuncture between theory and practice can only be addressed by positioning the thinking-feeling-doing-being teacher at the experiential core. As such, the embodied approach to reflection may not only develop more nuanced reflection beyond just a cerebral process (Gibson, 1986), but may also facilitate action to improve practice as a result.

Within the literature, therefore, there is a growing awareness of the “complex, nuanced, socially embedded and physically embodied” nature of reflection (Author, 2012, p. 2); this suggests that 360-degree video has significant potential to support student teachers’ reflection on their practice and, thereby their professional development - however, empirical research to support this appears, to date, to be lacking. This project aims to address this significant gap within the literature by making empirical and methodological contributions. To do this, it will be underpinned by the following research question: How does use of 360-degree video support student teachers’ reflection on microteaching activities?

# Research Design

## 2.1 Methodology

This project was framed as an interpretive case study; we adopted Stake’s (1995) instrumental case study approach using detailed examination of a particular, unique context to facilitate wider understanding through what Stake terms *petite generalisations*. These, in the same way as Bassey’s (1999) *fuzzy generalisations*, are general statements with built-in uncertainty which are possible in case study research without reducing its external validity. We also draw on Lyons and LaBoskey’s (2002) use of *exemplars,* concrete examples of practice which are trustworthy models of inquiry for others to try in their own settings (after Mishler, 1990). In this way, our case (exemplar) will facilitate petite or fuzzy generalisations which will enable us to use our empirical findings to make broader recommendations for pedagogy and practice.

## 2.2 Context of the Case Study

The research was undertaken with four students from a cohort of 23 (22 female and one male) second Year BA Primary Education Studies students at a university in England. The undergraduate course is a three-year programme developing students’ content knowledge (CK) and pedagogical content knowledge (PCK; Shulman, 1986) alongside more broad ideas of child development and the sociology and philosophy of education. It is a theory-led course which does not usually provide the opportunity for students to undertake school-based placements, although many students undertake work within school contexts alongside their studies. Students are required to undertake an additional year of Initial Teacher Education (ITE), through either a university- or school-based route, in order to gain Qualified Teacher Status (QTS).

We initially asked for volunteers from the cohort to take part in the study; six females volunteered but unfortunately as a result of illness two withdrew before the microteaching. We recognise that this was a self-selecting sample of students and that the results of the study are not, therefore, generalisable to the rest of the cohort. Libby, Stefanie, Dawn and Kay completed all stages of the research; these are pseudonyms in an attempt to provide anonymity but with the understanding that in such a small sample it is likely that participants will be recognisable to their peers. The nature and experience of student participants broadly reflected the significant diversity of the student cohort as a whole:

* Libby came to university straight from school and has a range of experience working with children within educational contexts, including volunteering work through which she has led small group activities, as well as volunteering within a summer school.
* Stefanie is a mature student with her own daughter. Like Libby, she has also undertaken a range of volunteering across a number of primary school year groups, as well as a brief period of paid work in a nursery.
* Dawn is also a mature student with two young children. She has had only a small amount of previous experience working with children in nursery and school holiday club settings.
* Kay, like Libby, came straight to university from school; she has had a wide range of experience working with children. For example, she has regularly volunteered in a number of primary schools through which she has taught a number of lessons, as well as undertaking paid work at an after school club and summer camps.

The work was particularly aligned with a module exploring creative pedagogies and the humanities subjects in which students were asked to produce a detailed plan for a ten-minute microteaching episode (Kpanja, 2001). Microteaching is a system of controlled practice that makes it possible to teach under controlled conditions (Allen & Eve, 1968). Arsal (2014) suggests that its use in teacher education in particular enables teachers to identify the complexity of teaching and establish a connection between theory and practice. In this case, the microteaching activity was based on a humanities subject (history, geography or religious education) underpinned by theories of creative pedagogies (e.g., Craft, Cremin, Hay, & Clack, 2013). All students taught their ten minute microteaching activity to their peer group to enable reflection; this was the first time that students had been asked to plan and peer teach, and for many was their first ever practical teaching opportunity.

## 2.3 Methods

The research built on this microteaching activity in the following way:

### Stage 1: Teaching recorded with 360-degree video

Students taught their 10-minute teaching excerpt to a class of 30 Year 5 (nine and ten year old) children within a semi-rural Primary Academy School. Microteaching was recorded using two cameras to provide two perspectives: a stereoscopic 360-degree, 3D camera with binaural (surround) audio; and a consumer-level 360-degree (but not 3D) camera with lower resolution. The stereoscopic camera was mounted on a monopod on a central desk within the classroom; the second camera was suspended from the overhead projector and, therefore, provided an alternative ‘birds-eye’ perspective of the room.

### Stage 2: Post-teaching reflection (without video)

Five days after their teaching, students undertook a two-stage reflection activity. Initially they were asked to reflect on how their microteaching activity had gone without the benefit of video. This took the format of a semi-structured reflection process based on the Deweyan idea that learning is contingent upon the integration of experience with reflection and of theory with practice (Humphreys & Susak, 2000; Hartford & MacRuairc, 2008). In this way, the student was encouraged to reflect individually but a range of prompts were used to support this reflection (Harrison, Lawson, & Wortley, 2005).

### Stage 3: Post-teaching reflecting using 360-degree video

The third research stage incorporated 360-degree video into the students’ reflections. Students watched their microteaching activity whilst wearing a standard VR headset (VR Shinecon) in which we inserted a smartphone to stream the video, and the audio to a pair of headphones worn by the student; this creates a fully immersive, first-person perspective (Ibrahim-Didi, 2015). They then used ‘think-aloud protocol’ to reflect on their teaching (e.g., Ericsson & Simon, 1984; Crowther, Keller, & Waddoups, 2004). The think-aloud protocol involves observing students watching their microteaching, noting their pedagogical decisions and asking them to articulate their thoughts and feelings as they watch (Cotton & Gresty, 2006). Ericsson and Simon (1984) suggest that the think-aloud process facilitates exploration of the thought processes of someone performing a specific task. Within traditional think-aloud protocol, the researcher generally should not interact with the participants after having provided the initial task instructions to avoid influencing participants’ thoughts. However, our experiences echoed those of Cotton and Gresty (2006) who found that participants required significantly more guidance with the task; without this, they found it very difficult to know what kind of thoughts or reflections to articulate. As a result, we provided occasional prompts during extended pauses within the think-aloud commentary, such as ‘what are you looking at?’, or ‘can you explain what you are seeing now?’ in an attempt to support students’ reflection without invalidating the subsequent data. There was no specific structure for providing prompts; they were given where necessary with each student. Whilst the prompts were considered useful, they did not comprise a significant amount of the data collected but merely acted as a reminder to think-aloud after periods of quiet watching (as described by Cotton & Gresty, 2006).

### Stage 4: Individual research interviews

During the final stage, we undertook individual, semi-structured interviews with each student, comprising both direct questioning and discussion following unprompted comments (e.g., Longhurst, 2010), to explore their experience with using the 360-degree video and its impact on their reflections on practice. Initial interview questions are given in Appendix 1.

## 2.4 Data Analysis

The video-recorded student reflections (including those elicited using think-aloud protocol) and audio-recorded interviews were transcribed; transcriptions and open-ended questionnaire responses were submitted to thematic analysis using QDA Miner Lite and a process of naturalistic coding to back up our impressions from the interviews, attempting to balance breadth and depth of focus (after Dey, 1993). Through this process a set of classification categories emerging from the data (inductive content analysis) was used to follow through strands in learning across it; this was an iterative process undertaken a number of times to increase validity of the coding. To further support the internal validity of the research and increase the reliability of our conclusions, data analysis was undertaken independently by two researchers. It should be noted at this point that analysis focused on emergent themes which addressed the primary research question (ways that the use of 360-degree video supported reflection); while some reflection on broader issues, such as classroom management, took place, they are not the focus of this paper and so are not included here. Table 1 illustrates the set of categories emerging from the data, along with examples from each category.

|  |  |  |
| --- | --- | --- |
| **Theme** | **Category** | **Example quotation** |
| Advantages of reflecting with 360-degree video | Spatial reflection (observing the whole class) | You notice the whole of the class and see things that you would never have been able to see otherwise with a normal camera … it helped you to notice things in every corner (Dawn) |
| Heterogeneous class (observing individual pupils) | I think [he] wasn't engaged from the beginning … he then didn't join in much with the discussion on his table … I could of perhaps somehow included him more … so it made me think about it a bit more (Stephanie) |
| Temporal reflection | I was trying to get things done quickly but it wasn't, it was kind of going quite slowly and I could see that in the video (Libby) |
| Agency | You have a full view so you can look wherever you'd like to look and can choose where you'd like to look (Dawn) |
| Self-Efficacy | It’s given me a confidence boost … I now know I can do it … it's helped quite a lot I think (Libby) |
| Potential use of 360-degree video for reflection | Watching peer videos | It would be quite helpful to watch each others' and to see how each other had got on and just to see what each other did and how they managed the class and what their activity was (Dawn). |
| Explore different pedagogies | It's quite helpful in showing like the use of different pedagogies and how certain methods of teaching work and how others don't so you can look back and sort of see how creativity can work …successfully and not so well (Kay) |
| Support theory-testing | I looked at a bit of theory on using maps as games or using the card games that's where I got that idea from. I probably need to go back and look at more research in terms of that after looking at the video as to their strategies of how they would do it (Dawn) |

Table 1. Example quotation from student reflections (think aloud protocol) and interviews for categories produced from inductive content analysis during open coding process.

## 2.5 Ethical Considerations

In undertaking the research, we followed the British Educational Research Association (BERA) Ethical Guidelines (2011) and obtained ethical approval from [Authors’ university] prior to the commencement of the project; this included consideration of not only the student participants, but also the school children involved in the microteaching activities. One additional point to note is that one researcher is the Course Leader for the cohort of students; this gave her good understanding of the context and experience of the students, as well as creating a non-threatening research environment (Taylor & Bogdan, 1998) and supporting democratisation of the research process (Karnieli-Miller, Strier, & Pessach, 2009). However, we recognise that the power relation exposed by this relationship and the conflicting researcher-tutor roles may have affected participant recruitment, as well as the responses students gave during the interview process (Kvale, 1996).

# 3. Results and Discussion

This section firstly considers students’ reflections about their microteaching activity before, during (using think-aloud protocol) and after watching the 360-degree video; it then takes a thematic approach to answering the key research question, considering how the use of 360-degree video supported student teachers’ reflection of microteaching activities. In the latter part of the section we move on to explore the implications of the findings for practice, in particular drawing out ways that trainee teacher pedagogical practice may be supported by the use of 360-degree video.

## 3.1 How does use of 360-degree video support trainee teachers’ reflection on microteaching activities?

In students’ initial microteaching reflections, observations tended to be brief with little exemplification to support them. For example, when reflecting on one aspect of her microteaching Dawn noted “I didn’t foresee all of the children coming towards me at once.” There was also a focus on the logistical aspects of the lesson, for example “I thought it was very rushed … handing out the paper took quite a long time which I hadn’t quite appreciated” (Stefanie) and “The timings and stuff, erm didn't quite go to plan” (Libby). Reflections also centred on what children did during the lesson, including their behaviour, such as Kay’s comment that “all the children got engaged and they were listening well,” but with little evidence to suggest why this was the case. Students were asked to provide evidence for pupil learning across their microteaching and responses were, in general, superficial. For example, Libby argued pupils had learnt because “if I asked them something they would know what it was,” without any reflection as to what pupils’ existing knowledge might have been and how she knew learning had taken place. Initial student reflections also suggested a lack of understanding of differences *between* students. For example, when asked if any pupils found a particular task to be challenging, Libby responded “No, I don't think so, no. I mean they all put their hands up at one point or another I think.” Finally, many of the initial student observations focused on negative aspects of their microteaching; for example, Dawn’s first reflection was “I think it went quite badly.”

However, throughout their think-aloud protocol whilst watching the 360-degree video and then in their subsequent reflection on their microteaching, students were able to provide significantly more detail to support their reflection; for example, Kay considers:

When I am in the classroom I just go to the children with their hands up … watching it back I can see that there were lots of children looking very confused and … talking to their partners, asking them for help … I could have gone around and clarified anything they weren't sure of.

Sometimes observations made whilst watching the 360-degree video contradicted students’ initial reflections; for example, Kay had seemed confident that students had learnt something in her initial reflection, but then after watching the 360-degree video commented “when I was standing there I couldn't see all the children looked really confused … pulling faces when I explained the tasks, whereas looking it back I can actually see the children's faces … not really knowing what I have explained and how they do it.” Perhaps because of this, through watching the 360-degree video students appeared to develop a more nuanced understanding of what was taking place at different points during the lesson, thereby being more cognizant of tensions within their teaching (Bryan & Recesso, 2006); Kay commented:

When I was explaining the stone activity towards the end, quite a lot of them were a little bit confused. I feel like maybe I could have gone over that better or had something on the board for them to look at to help them like they did for the previous task ‘cos looking round I could see a few children sort of be like 'huh? 'What do we have to do?' and at the time I didn't realise whereas if I did realise I could have … explained it in a different way.

In this way, watching the 360-degree video appeared to lead students to be able to think more about how they might approach the task differently in the future, a fundamental part of the reflective process. This would suggest that students are moving from stage 2 (reflective observation) into stage 3 (abstract conceptualisation) within Kolb’s experiential learning cycle as they conclude and learn from the experience with the ultimate aim of re-planning and trying out what they have learnt (Kolb, 1984).

This brief discussion suggests that students were beginning to reflect in a more nuanced and applied way through watching 360-degree video footage of their microteaching, beginning to appreciate the complex nature of learning and activity of teaching. Drawing on a range of reflection and interview data we will now consider why this might be the case with a focus on two themes: embodied reflection, and developing student self-efficacy.

### 3.1.1 Embodied reflection

One of the themes emerging from student reflections on the process of watching 360-degree video was that of being able to observe the *whole class*; for example, Stefanie noted “I think it was helpful to see shots of almost the whole class at the same time say for hands up … you really appreciated their engagement more from seeing it as an all round video.” Kay in particular developed this idea further:

it was also helpful because it shows a different sort of view of what I saw when I was there so I was able to look around the whole classroom at one time … it felt more that I was revisiting the classroom because with a video it's all sort of merged together and you don't necessarily get the reactions … all different children, you don't get the noise levels … you don't really have the sort of atmosphere where you are able to look all around. On the TV you sort of feel that you're there but not that you're actually there so you imagine what it would be like to be there. Whereas this you've got the 360 you're able to look around and get all the emotions of the children and actually feel like you are back there.

Students describe an embodied experience suggested by Ibrahim-Didi (2015) in which they have spatial and temporal situatedness, thereby allowing them to “draw on their body-based reflective capabilities in the moment” (p. 240); students feel as though they are back in the classroom. This is clearly articulated by Kay who describes “you're able to look around and sort of get all the emotions of the children and actually feel like you are back there.” Perhaps significantly, students are also given agency to explore the space as they wish; for example, Dawn explains “If you know that in your class you wouldn't have seen a certain section then you can choose to look at it using the 360-video. You can use it to fill in your gaps.” This agency allows students to explore particular incidents or pupils prompted either by memories of the microteaching, or visual or auditory cues during the 360-degree video footage. For example, Dawn comments “I saw children having a chat at the back of the class which I had no idea was going on at the time. And even a normal camera which was focused on the front of the class wouldn't have been able to have seen that.” Kay reiterates this point stating “in a video you would just hear lots of noise, you couldn't hear where the noise is coming from.” Immersive 360-degree video recording captures the classroom context in all directions; however, as it is captured from one location it creates an embodied feeling of ‘being there’ (Ibrahim-Didi, 2015), in essence capturing Heidegger’s *Dasein* (Dreyfus & Wrathall, 2005). Further, it affords students the possibility of interacting with recorded video via the VR headset that allows them to look around in any direction in the classroom setting at any time. Through providing this opportunity, the use of 360-degree video has the potential to develop a more personalised and inclusive approach to reflection; Stefanie comments “there was one child who I think wasn't entirely engaged … being able to see him … made me think well why did I not get him in from the beginning?” Kay further develops this idea:

I learnt that I sort of need to be a little bit more inclusive. I was going to certain children and helping them but not necessarily helping every child in the classroom as much as I should have … so I feel that I could include some more inclusive teaching practices or strategies when I go in the classroom.

 This holistic, immersive experience also enables students to better consider their own position within the class; for example, Dawn comments “it enabled you to see yourself rather than just the children and how you interact with the children” and Libby “I think it's useful for looking back on yourself and … making yourself more conscious of what happens in the classroom and what you're like.”

Beyond space, the use of 360-degree video also supported students to better understand *time* within the context of their microteaching. Both Libby and Stefanie explore this; for example, Libby commented “I thought that I was … trying to get things done quickly but I wasn't, it was kind of going quite slowly and I could see that in the video.” As such, the use of 360-degree video heightened students’ visceral bodily consciousness in the *space and time* of the microteaching (Barton & Ryan, 2014), supporting them to actively construct new meaning and, as a result, develop their reflection beyond anything possible without it: “This is a real opportunity to reflect sort of actually feeling like you're back there so you can say oh, I didn't quite do that and think about that …. So you can actually think about what you did” (Kay).In this way, it appears to support student teachers to develop the skills of observation necessary for understanding the causal relationship between multiple factors which influence practice in context, as hypothesised by Ibrahim-Didi (2015).

### 3.1.2 Supporting student self-efficacy towards teaching

One recurring theme throughout student think aloud and final interview transcriptions was that of increasing self-confidence through watching the 360-degree video footage: Libby comments “I think it's useful for looking back on yourself and … making yourself more conscious of what happens in the classroom and what you're like in the classroom, to develop … your confidence.” Dawn develops this idea reflecting “I think watching yourself back and being able to see that you didn't do as badly as you thought [helps] you become more confident as a teacher because you can reflect on the good things that you did as well as the bad.” This reflects a number of studies suggesting that students behave more confidently and positively, or have greater self-efficacy towards microteaching, having undergone the process of doing it (Arsal, 2004; Kpanja, 2001). However, beyond this, it would seem that in allowing students to re-experience the embodied teaching process, the use of the 360-degree video itself may further support students’ self-efficacy towards teaching.

According to Bandura (1997) there are four sources of self-efficacy: mastery experience (in which students recognise how well they have done at a task), vicarious experience (whereby students’ knowledge of how others have performed can gauge information about their own capabilities), social persuasions (where self-efficacy beliefs are affected positively or negatively by the verbal or non-verbal communication of others), and physiological reactions (mediated by the emotional reaction students have to a task). Individuals form their self-efficacy beliefs by interpreting information from all four of these sources, but for most people interpreting the result of their own performance, enactive mastery experience, is the most important source (Usher & Pajares, 2009). Within the context of 360-degree video, the embodied experience of watching the microteaching appears to reaffirm this mastery experience for students, thereby increasing any positive effect on their self-efficacy. Further, the immersive and emotional reengagement also magnifies physiological reactions as students relive their teaching. While social cognitive theory generally suggests that individual knowledge is developed through observation of others within the context of social interactions or experiences (Bandura, 1986), with use of 360-degree video those interactions are with oneself – the student is interacting with their own experiences – but this is equally as powerful. What is perhaps interesting within the context of this research is whether this student confidence was, in reality, misplaced. The students were at the very start of their teacher training journey, and for three of them their first opportunity to teach children in schools; it may be, therefore, the excitement of actually viewing themselves as a teacher (their ultimate ambition) developed self-efficacy, rather than the microteaching being particularly effective at supporting students’ learning. There is also the danger that if this process were repeated over a number of cycles, and as the students learnt more pedagogy and experienced more school-based learning, use of the 360-degree video may develop more self-criticality which may then negatively impact their self-efficacy. We suggest further more longitudinal research is needed to explore these potential areas for concern; however, it seems to be the case that within the context of this small case study 360-degree video develops student teachers’ self-efficacy towards teaching.

## 3.2 In what ways might student teacher pedagogical practice be supported by 360-degree video?

While relatively small, the case described in this study is presented as an empirical carrier of the ephemeral situations and meaningful learning experiences (Kostiainen, Ukskoski, Ruohotie-Lyhty, Kauppinen, Kainulainen, & Makinen, 2018) student teachers experience which are important for their professional development. In this way, it allows fuzzy generalisations to be made which are of relevance beyond the strictly local context of this case. The study suggests that use of 360-degree video can effectively be used as a tool to support student teachers’ reflection on their practice. One of the initial observations during think aloud protocol was that students said very little (hence needed some prompting, as detailed above); it is likely that this was partly the result of students’ complete immersion in the video, thereby supporting the idea that 360-degree video provided embodied cognition (they were physically and, therefore, mentally reliving the microteaching and, therefore, had to be brought back to the present to remember to ‘think aloud’; e.g., Wilson, 2002). However, it is likely that as students were at the beginning of their practical teacher training they also lacked both PCK (Shulman, 1986) and the understanding of how to reflect on their practice (as suggested by Bryan & Recesso, 2006). We suggest that 360-degree video could be used in a range of ways to support students to develop their reflection; for example, initially immersing themselves in footage of their peers’ teaching with edited hot spots placed at key moments during the video which prompt students to answer specific questions or reflect on particular incidents. Students may also be exposed to embodied reflections of peers, lecturers or school-based teachers to scaffold their own reflections but also highlight different approaches to reflection. Indeed school-based teacher mentors may also benefit from this process, gaining an insight into approaches to lesson reflection and feedback for their own development. However, encouraging students to undertake a microteaching and 360-degree video watching activity themselves is likely to have the biggest impact on their practice; it is possible that this could support a process which is neither exclusively reflection-*in*-action nor reflection-*on*-action (Schön, 1983), but is instead a hybrid which exploits some of the strengths of both. The use of 360-degree video provides trainees with the opportunity to relive the classroom experience (*in* action), but also seeks to reveal (to them and the tutor), and challenge, the tacit knowledge and assumptions underpinning their practice (*on* action). This would not only develop student teachers’ ability to reflect retrospectively on their practice, but also their ability to react and adapt within the context of a lesson. Fives, Hamman, and Olivarez (2007) suggest that student teachers are in the uncertain position in that their understanding of pedagogy and child development is still naïve; in this immature state, they are then immersed in classroom circumstances that may or may not provide them with support, encouragement, and opportunities to develop their knowledge and experience success ([Fimian & Blanton, 1987](http://www.sciencedirect.com/science/article/pii/S0742051X06000394%22%20%5Cl%20%22bib25)). Use of 360-degree video at the early stages of their teaching practice (even within the context of a course which is predominantly theory-based) would not only help teach student teachers to be able to reflect (seeing it as part of, not apart from the learning process), but also begin to develop their self-efficacy towards teaching practice within a less stressful environment. This may ultimately make them more resilient when they enter teaching practice, decreasing potential stress or burnout (Fives et al., 2007) and supporting teacher retention.

# Conclusions

Results of this study show that 360-degree video supports students’ reflection of their practice and, as a result, both develops a more nuanced understanding of their microteaching, and supports their self-efficacy. The immersive, embodied experience of watching the 360-degree video footage appears particularly significant as it becomes a proxy for real-life classroom settings through which students are able to re-experience their teaching, emplaced within its space and time, *being there* in an embodied sense (after Heidegger, 1962) and with agency to select where and with what to engage. This “situatedness” (Gibson, 1977) supports students to produce reflections which show a much better understanding of their and their pupils’ behaviours, priming them on ways in which they can respond to the immediacy of the context (as suggested by Craig et al., 2018; Ibrahim-Didi, 2015) and developing in them a better appreciation of pupil engagement and learning. Further, use of 360-degree video also appears to provide opportunities to develop authentic mastery experiences through which trainees can develop their self-efficacy towards teaching (after social cognitive theory; Bandura, 1986). This meshes well with situated learning which is a socio-cultural process that is the result of bodily interactions with the world (Rambusch, 2004). One of the novel aspects of this study is, therefore, that it brings together multiple conceptual frameworks of situated learning, embodied cognition and social cognitive theory through 360-degree video to transform the way that we support student teacher reflection and, thereby, practice.

An additional point of note is that through the process of watching and reflecting on 360-degree footage, student teachers are not merely an audience observing and analysing the practice of others, but they become active participants in the learning process, generating and analysing their own primary data (or practice). As such, this methodological approach illustrates practice urged by authors such as Healey and Jenkins (2009, 2018) or Kuh (2017) to increase student engagement through research and inquiry. The study, therefore, has implications for broader Higher Education practice within ITE as it facilitates student-centred, research-based active learning, current ideals in Higher Education contexts (e.g., Niemi & Nevgi, 2014).

However, there are a number of limitations to the project; for example, this is a small case study both in time-scale and participant size - further research is needed to explore the impact of 360-degree video on a larger group of students and over a longer period of time. Ibrahim-Didi (2015) suggests that in providing an authentic sense of being situated within a classroom, use of 360-degree video offers significant potential for developing reflective practice which reconnects the mind with the body (and, thereby, thinking with doing; Kinsella, 2007b). As such, future work would also benefit from exploring in more depth how 360-degree video might be used most effectively with student teachers, for example observing video multiple times, providing peer watching, reflection and collaboration opportunities (as suggested by Barber, 1990) and undertaking repeated microteaching-reflection-replanning cycles (active experimentation, as suggested by Kolb, 1984). Notwithstanding these limitations, this study goes some way to address Ibrahim-Didi’s (2015) suggestion that an embodied cognition approach to ITE supports their situated professional vision and reflective capabilities (p. 242); this has significant implications for both teacher education but more broadly student-centred, active learning practices within Higher Education contexts.

# References

Allen, D., & Eve, A. (1968). Microteaching. *Theory into Practice*, *7*(5), 181-185.

Abell, S. K., Bryan, L. A., & Anderson, M. A. (1998). Investigating preservice elementary science teacher reflective thinking using integrated media case-based instruction. *Science Education, 82*(4)*,* 491–509.

Argyriou, L., Economou, D. & Bouki, V. (2017). 360-degree interactive video application for Cultural Heritage Education. In: *iLRN 2017: Coimbra workshop, long and short paper, and poster proceedings from the Third Immersive Learning Research Network Conference.* Retrieved from [https://dx.doi.org/10.3217%2F978-3-85125-530-0](https://dx.doi.org/10.3217/978-3-85125-530-0).

Arya, P., & Christ, T. (2013). An exploration of how professors’ facilitation is related to literacy teachers’ meaning construction process during video-case discussions. *Journal of Reading Education,* *39*(1), 15-22.

Arya, P., Christ, T., & Chiu, M. M. (2015). Links between characteristics of collaborative peer video analysis events and literacy teachers’ outcomes. *Journal of Technology and Teacher Education, 23*(2), 159-183.

Arsal, Z. (2014). Microteaching and pre-service teachers’ sense of self-efficacy in Teaching. *European Journal of Teacher Education, 37*(4), 453-464.

Atkinson, B. (2012). Rethinking reflection: Teachers’ critiques. *The Teacher Educator,* *47*(3), 175–194.

Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory.* Englewood Cliffs, NJ: Prentice Hall.

Bandura, A. (1997). *Self-efficacy: The exercise of control*. New York: Freeman.

Barber, L. (1990). Self-assessment. In J. Milman & L. Darling-Hammond (Eds.), *The new handbook of teacher evaluation: assessing elementary and secondary school teachers* (pp. 216–228). Newbury Park, CA: Sage.

Barton, G., & Ryan, M. (2014). Multimodal approaches to reflective teaching and assessment in higher education. *Higher Education Research & Development,* *33*(3), 409-424.

Bassey, M. (1999). *Case study research in educational settings.* Buckingham: Open University Press.

Beauchamp, C. (2015). Reflection in teacher education: Issues emerging from a review of current literature. *Reflective Practice,* *16*(1), 123-129.

Borko, H., Jacobs, J., Eiteljorg, E. & Pittman, M. E. (2008). Video as a tool for fostering productive discussions in mathematics professional development. *Teaching and Teacher Education, 24*(2) 417–436.

Bresler, L. (2013). *Knowing bodies, moving minds: Towards embodied teaching and learning* *(Vol. 3)*. Berlin/Heidelberg, DE: Springer Science & Business Media.

British Educational Research Association. (2011). *Ethical guidelines for educational research.* London: BERA.

Bryan, L. A., & Recesso, A. (2006). Promoting reflection with a web-based video analysis tool. *Journal of Computing in Teacher Education, 23*(1) 31–39.

Calandra, B., Sun, Y., & Puvirajah, A. (2014). A new perspective on teachers' video aided reflection. *Journal of Digital Learning in Teacher Education, 30*(3), 104-109.

Christ, T., Arya, P., & Chiu, M. M. (2012). Collaborative peer video analysis: Insights about literacy assessment & instruction. *Journal of Literacy Research, 44*(2), 171-199.

Christ, T., Arya, P., & Chiu, M. M. (2017). Video use in teacher education: An international survey of practices. *Teaching and Teacher Education*, *63*, 22-35.

Collin, S., Karsenti, T., & Komis, V. (2013). Reflective practice in initial teacher training: Critiques and perspectives. *Reflective Practice: International and Multidisciplinary Perspectives*, *14*(1), 104–117.

Collins, J. L., Cook-Cottone, C. P., Robinson, J. S., & Sullivan, R. R. (2004). Technology and new directions in professional development: applications of digital video, peer review, and self-reflection. *Journal of Educational Technology Systems*, *33*(2), 131–146.

Cotton, D., & Gresty, K. (2006).Reflecting on the think-aloud method for evaluating e-learning. *British Journal of Educational Technology*, *37*(1), 45-54.

Corcoran, R. P. (2018). An embodied cognition approach to enhancing reading achievement in New York City public schools: Promising evidence. *Teaching and Teacher Education, 71,* 78-85.

Craft, A., Cremin, T., Hay, P. & Clack, J. (2013). Creative primary schools: Developing and maintaining pedagogy for creativity. *Ethnography and Education*, *9*(1), 16–34.

Craig, C. J., You, J., Zou, Y., Verma, R., Stokes, D., Evans, P., & Curtis, G. (2018). The embodied nature of narrative knowledge: A cross-study analysis of embodied knowledge in teaching, learning, and life. *Teaching and Teacher Education,* 71, 329-240.

Craig, C. J. (2013). Opportunities and challenges in representing narrative inquiries digitally. *Teachers College Record,* 115, 1-45.

Crowther, M. S., Keller, C. C., & Waddoups, G. L. (2004). Improving the quality and effectiveness of computer-mediated instruction through usability evaluations. *British Journal of Educational Technology*, *35*(3), 289–304.

Dawson, P. J., Dawson, K. E., & Forness, S. R. (2001). Effect of video feedback on teacher behavior. *Journal of Educational Research*, *68*(5), 197–201.

Dewey, J. (1933). *How we think: A restatement of the relation of reflective thinking to the educative process.* New York: D.C. Heath and Company.

Dewey, J. (1938). *Experience and education*. New York: Collier Books.

Dey, I. (1993). *Qualitative data analysis: A user-friendly guide for social scientists*. Abingdon: Routledge.

Dreyfus, H.L., & Wrathall, M.A. (2005). *A Companion to Heidegger.* Oxford: Blackwell Publishing.

Author, 2012 [details removed for peer review]

Ericsson, K. A., & Simon, H. A. (1984). *Protocol analysis: verbal reports as data*. London: MIT Press.

Eröz-Tuga, P. B. (2013). Reflective feedback session using video recordings. *English Language Teaching, 67*(2), 175-183.

Farrell, T. S. C., & Ives, J. (2015). Exploring teacher beliefs and classroom practices through reflective practice: A case study. *Language Teaching Research*, 19(5), 594-610. Retrieved from <https://doi.org/10.1177/1362168814541722>.

Fimian, M. J., & Blanton, L. P. (1987). Stress, burnout, and role problems among teacher trainees and first-year teachers. *Journal of Occupational Behavior*, *8*(2), 157-165.

Fischer, U., Moeller, K., Bientzle, M., Cress,U., & Nuerk, H.-C. (2011). Sensori-motor spatial training of number magnitude representation. *Psychonomic Bulletin & Review, 18,* 177-183.

Fives, H., Hamman, D., & Olivarez, A. (2007). Does burnout begin with student-teaching? Analyzing efficacy, burnout, and support during the student-teaching semester. *Teaching and Teacher Education*, *23*(6), 916-934.

Gallagher, S. (2005). *How the body shapes the mind.* Oxford: OUP.

Gelfuso, A. (2016). [A framework for facilitating video-mediated reflection: Supporting preservice teachers as they create ‘warranted assertabilities’ about literacy teaching and learning](https://www.sciencedirect.com/science/article/pii/S0742051X16300579). *Teaching and Teacher Education*, 58, 68-79.

Ghefaili, A. (2003). Cognitive Apprenticeship, Technology, and the Contextualization of Learning Environments. *Journal of Educational Computing, Design and Online Learning*, 4, 1-27. Retrieved from <http://citeseerx.ist.psu.edu/viewdoc/download;jsessionid=EC890C20E1D3A0A40386015BEFBC7B69?doi=10.1.1.331.1704&rep=rep1&type=pdf>

Gibson, J. J. (1977). The theory of affordances. In: R. Shaw & J. Bransford (Eds.) *Perceiving, acting, and knowing.* New Jersey: Lawrence Erlbaum Associates.

Gibson, J. J. (1986). *The ecological approach to visual perception*. New York: Houghton Mifflin Harcourt.

Griswold, S. L. (2004). Videotaped performances: guiding teacher professional development within a competency-based framework. *Dissertation Abstracts International*, *65*(10), 3760 (UMI No. 3150452).

Harrison, J., Lawson, T., & Wortley, A. (2005). Facilitating the professional learning of new teachers through critical reflection on practice during mentoring meetings. *European Journal of Teacher Education, 28*(3), 267-292.

Hartford, J., & MacRuairc, G. (2008). Engaging student teachers in meaningful reflective practice. *Teaching and Teacher Education, 24*(7), 1884-1892.

Healey, M., & Jenkins, A. (2009). *Developing undergraduate research and inquiry.* York: Higher Education Academy.

Healey, M. J., & Jenkins, A. (2018). The role of academic developers in embedding high-impact undergraduate research and inquiry in mainstream higher education: twenty years’ reflection. *International Journal for Academic Development,* *23*(1). 52-64.

Heidegger, M. (1962). *Being and time.* New York: Harper and Row.

Humphreys, K., & Susak, Z. (2000). Learning how to fish: Issues for teachers engaging in self-evaluation and reflective enquiry in school. *Research in Education*, *64*(1), 78–90.

Ibrahim-Didi, K. (2015). Immersion within 360 video settings: Capitalising on embodied perspectives to develop reflection-in-action within pre-service teacher education. In T. Thomas, E. Levin, P. Dawson, K. Fraser & R. Hadgraft (Eds.), *Research and Development in Higher Education: Learning for Life and Work in a Complex World*, 38 (pp 235-245). Melbourne, Australia.

Jaeger, E. (2013). Teacher reflection: Supports, barriers, and results. *Issues in Teacher Education, 22*(1), 87-102.

Karnieli-Miller, O., Strier, R., & Pessach, L. (2009). Pearls, Piths and Provocation: Power relations in qualitative research. *Qualitative Health Research, 19*(2), 279-289.

Kinsella, E. (2007a). Technical rationality in Schön's reflective practice: Dichotomous or non dualistic epistemological position. *Nursing Philosophy,* *8*(2), 102–113.

Kinsella, E. (2007b). Embodied reflection and the epistemology of reflective practice. *Journal of Philosophy of Education,* *41*(3), 395–409.

Kolb, D. A. (1984). *Experiential learning*. Englewood Cliffs: Prentice Hall.

[Körkkö](https://www.sciencedirect.com/science/article/pii/S0742051X16300142#!), M., [Kyrö-Ämmälä](https://www.sciencedirect.com/science/article/pii/S0742051X16300142#!), O., [& Turunen](https://www.sciencedirect.com/science/article/pii/S0742051X16300142#!), T. (2016). Professional development through reflection in teacher education. *Teaching and Teacher Education*, 55, 198-206.

Kostiainen, E., Ukskoski, T., Ruohotie-Lyhty, M., Kauppinen, M., Kainulainen, J., & Mäkinen, T. (2018). Meaningful learning in teacher education. *Teaching and Teacher Education, 71,* 66-77.

Kpanja, E. (2001). A study of the effects of video tape recording in microteaching training. *British Journal of Educational Technology*, *32*(4), 483-486.

Kvale, S. (1996). *Interviews: An introduction to qualitative research interviewing.* London: Sage.

Kuh, G.D. (2017). Foreword. In B. Eynon, & L.M. Gambino (Eds.), *High impact ePortfolio practice: A catalyst for student, faculty, and institutional learning*. Virginia: Stylus Publishing.

Lakoff, G., & Johnson, M. (1999). *Philosophy in the flesh: The embodied mind and its challenge to western thought*. New York: Basic Books.

Lindgren, R., & Johnson-Glenberg, M. C. (2013). Emboldened by Embodiment: Six Precepts regarding the Future of Embodied Learning and Mixed Reality Technologies. *Educational Researcher*. *42*(8), 445- 452.

Longhurst, R. (2010). Semi-structured interviews and focus groups. In N. Clifford, S. French, & G. Valentine (Eds.), *Key methods in geography* (pp. 103–115). London: Sage.

Lyons, N., & LaBoskey, V. K. (2002). *Narrative inquiry in practice: Advancing the knowledge of teaching.* New York: Teachers College Press.

McNeill, K. L., & Krajcik, J. S. (2011). *Supporting grade 5-8 students in constructing explanations in science: The claim, evidence, and reasoning framework for talk and writing.* New Jersey, Pearson.

Miller, M. J. (2009). Talking about our troubles: using video-based dialogue to build preservice teachers’ professional knowledge. *The Teacher Educator*, *44*(3), 143–163.

Miller, M., & Carney, J. (2008). Using video annotation software to enhance the mentoring and professional development of teacher candidates. *Washington State* *Kappan: a journal for research, leadership, and practice*, *2*(2), 16–17.

Mishler, E. (1990). Validation in inquiry-guided research: The role of exemplars in narrative studies. *Harvard Educational Review, 60*(4), 415-442.

Moore-Russo, D. A., & Wilsey, J. N. (2014). Delving into the meaning of productive reflection: A study of future teachers’ reflections on representations of teaching. *Teaching and Teacher Education*, 37, 76-90.

Niemi, H., & Nevgi, A. (2014). Research studies and active learning promoting professional competences in Finnish teacher education. *Teaching and Teacher Education,* 43, 131-142.

Pavlovic, S., & Friedland, B. (1997). *Reflectivity in teaching & supervision.* Paper presented at the American Conference on Rural Special Education, San Antonio, TX.

Piaget, J. (1990). *The child's conception of the world*. New York: Littlefield Adams.

Polanyi, M. (1967). *The tacit dimension*. New York: Doubleday.

Postholm, M. B. (2008). Teachers developing practice: Reflection as key activity. *Teaching and Teacher Education*, *24*(7), 1717-1728.

Rambusch, J. (2004). *Embodiment and situated learning* (Masters thesis. University of Skövde, Sweden). Retrieved from [https://www.diva-portal.org/smash/get/diva2:3324/FULLTEXT02.pdf](https://www.diva-portal.org/smash/get/diva2%3A3324/FULLTEXT02.pdf)

Rich, P., & Hannafin, M. J. (2008). Decisions and reasons: examining pre-service teacher decision-making through video self-analysis. *Journal of Computing in Higher Education, 20*(1), 62–94.

Rich, P., & Hannafin, M. J. (2009). Scaffolded video self-analysis: discrepancies between preservice teachers’ perceived and actual instructional decisions. *Journal of Computing in Higher Education*, *21*(2), 128-145.

Rosch, E., Thompson, E., & Varela, F. J. (1991). [*The embodied mind: Cognitive science and human experience*](https://books.google.com/books?id=QY4RoH2z5DoC&pg=PA172)*.* Cambridge, MA: MIT Press.

Shanahan, L. E., & Tochelli, A. L. (2014). Examining the use of video study groups for developing literacy pedagogical content knowledge for critical elements of strategy instruction with elementary teachers. *Literacy Research and Instruction,* *53*(1), 1-24.

Schön, D. A. (1983). *The reflective practitioner: How professionals think in action*. London: Temple Smith.

Schön, D. (1987). *Educating the reflective practitioner*. San Francisco: Jossey-Bass.

Shepherd, C., & Hannafin, M. J. (2009). Beyond recollection: re-examining preservice teacher practices using structured evidence, analysis, and reflection. *Journal of Technology and Teacher Education*, *17*(2), 229–251.

Sherin, M. G., & van Es, E. A. (2005). Using video to support teachers’ ability to notice classroom interactions. *Journal of Technology and Teacher Education*, *13*(3), 475–491.

Shulman, L. (1986). Those who understand: Knowledge growth in teaching. *Educational Researcher*, *15*(2), 4–14.

Stadler, H. (2003). Videos as a tool to foster the professional development of science teachers. *Proceedings from European Science Education Research Association 2003.* Netherlands. Retrieved from <http://www1.phys.uu.nl/esera2003/programme/pdf%5C156S.pdf>.

Stake, R. E. (1995). *The art of case study research.* California: Sage Publications.

Taylor, S. J., & Bogdan, R. (1998). *Introduction to qualitative research methods* (3rd ed.). New York: John Wiley.

Thompson, N., & Pascal, J. (2012). Developing critically reflective practice. *Reflective Practice: International and Multidisciplinary perspectives*, *13*(2), 311-325.

Tripp, T., & Rich, R. (2012a). The influence of video analysis on the process of teacher change. *Teaching and Teacher Education, 28*(5)*,* 728-739.

Tripp, T., & Rich, P. (2012b). Using video to analyze one’s own teaching. *British Journal of Educational Technology,* *43*(4), 678–704

Urzúa, A., & Vasquez, C. (2008). Reflection and professional identity in teachers' future. oriented discourse. *Teaching and Teacher Education*, *24*(7), 1935-1946.

Usher, E. L., & Pajares, F. (2009). Sources of self-efficacy in mathematics: A validation study. *Contemporary Educational Psychology, 34*(1)*,* 89-101.

Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes.* Cambridge, Mass.: Harvard University Press.

Wang, J. & Hartley, K. (2003). Video technology as a support for teacher education reform. *Journal of Technology and Teacher Education*, *11*(1), 105–138.

Welsch, R. G., & Devlin, P. A. (2004). Developing preservice teachers’ reflection: examining the use of video. *Action in Teacher Education*, *12*(4), 491–509.

Wilson, J. P. (2008). Reflecting-on-the-future: A chronological consideration of reflective practice. *Reflective Practice: International and Multidisciplinary Perspectives*, *9*(2), 177-184.

Wilson, M. W. (2002). Six views of embodied cognition. *Psychonomic Bulletin and Review, 9*(4), 625-636.

Wittrock, M. C. (1974). Learning as a generative activity. *Educational Psychologist, 11*(2)*,* 87–95.

Wright, G. A. (2008). *How does video analysis impact teacher reflection-for-action?* Unpublished doctoral dissertation.

# Appendix 1:

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| --- |
| Semi-structured interview schedule1. Why did you volunteer to take part in this project?
2. Have you used 360-degree video before?
3. Explain how you felt when you watched the 360-degree video back.
4. How did watching the 360-degree video support you to reflect on your practice?
5. How do you think using the 360 degree video will affect your teaching practice?
6. How (if at all) do you think using 360 degree video was different from using ‘normal’ video?
7. Was there anything about using the 360-degree video that you did not find helpful?
8. Would you recommend this process to your peers? Why / why not?
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