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360° Video Integration in Teacher Education: A SWOT Analysis

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INTRODUCTION

In teacher education (TE)[1], video is a common tool used by facilitators for preparing students' internships or during method course learnings (Gaudin and Chaliès, 2015). Christ et al. (2017) identified a range of uses in TE for different types of video use in self-reflection, peer discussion, professor-led discussion and case studies. First experimentations with video use in TE were conducted at Stanford University in the 60s and were based on a micro-teaching approach (Allen and Eve, 1968)[2]. Since these initial integrations of video into TE, a wide range of video tools have been developed. Initially, videos were prepared using a standard camera (i.e., 2D video) followed by important technological improvements, such as subcam (e.g., Lahlou, 1999), or miniature, wearable camera clipped on a pair of eye glasses (e.g., Luna and Sherin, 2017; van Driel et al., 2021), Gopro, google glasses and wide angle video camera with smartphone or tablets. All these devices provide utility for being used in the classroom for producing video and a basis for developing new approaches for TE.

In recent years, facilitators have begun to use various forms of extended reality in TE such as immersive mediums including virtual reality (VR), augmented reality (AR), mixed reality (MR), or more recently 360° video. 360° video, also called immersive videos or spherical videos are video recordings in which a view in every direction is recorded at the same time (Wohl, 2017) by using a specific camera with a fish-eye lens. Some studies have characterized the advantages and potential benefits for using virtual reality (e.g., Billingsley et al., 2019 for a review) for inservice and/or preservice teachers (PSTs). Questionably, of the numerous literature reviews on the use of video in TE over the last 10 years (i.e., Brouwer, 2011; Rook and McDonald, 2012; Tripp and Rich, 2012; Marsh and Mitchell, 2014; Gaudin and Chaliès, 2015; Christ et al., 2017; Major and Watson, 2018; Cattaneo et al., 2019; Hamel and Viau-Guay, 2019), none of them reported any use of 360° video. Further, in higher education, Noetel et al. (2021) reported the potentialities and benefits of video, but they didn't identify 360° video uses.

Indeed, it is imperative to clearly distinguish VR and 360° video because these tools are not of the same nature in order to conceptualize their inherent values (Kittel et al., 2020). Snelson and Hsu (2019) point out that in the literature there is some blurring in the use of the terms 360° video and VR, in that the two terms are often used indiscriminately. VR can be defined based on three main

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[1]For us, in line with Collet (2020), we define teacher education as courses for pre-service teachers that lead to a degree and certification for teaching.

[2]"Microteaching is a scaled down teaching encounter. In microteaching, however, the complexities of the normal teaching encounter have been reduced and the level of feedback to the teacher has been greatly increased [. . .] From a purely descriptive point of view, microteaching is quite simple. Its basic elements are a teacher, the microclass (usually four or five pupils), a short lesson of five to 20 minutes, and predetermined objectives which have been stated for the particular microteaching occasion" (Allen and Eve, 1968, p.181, p.181).

TABLE 1 | Included papers for the SWOT.

Authors	Date	Type of publication
Alamäki et al.	2021	Journal publication
Aguayo et al.	2017	Journal publication
Araiza-Alba et al.	2021	Journal publication
Assilmia et al.	2017	Conference proceeding
Billingsley et al.	2019	Journal publication
Cutler White and Meece	2020	Journal publication
Ferdig et al.	2020	Conference proceeding
Huh	2020	Journal publication
Ibrahim-Didi	2015	Book chapter
Johnson	2018	Journal publication
Kavanagh et al.	2016	Conference proceeding
Kosko et al.	2021	Book chapterChapter
Martín-Gutiérrez et al.	2017	Journal publication
Munafo et al.	2017	Journal publication
Panchuk et al.	2018	Journal publication
Pea et al.	2004	Journal publication
Reyna Zeballos	2018	Conference proceeding
Roche and Gal-Petitfaux	2017	Conference proceeding
Roche and Rolland	2020	Conference proceeding
Sato and Kageto	2020	Journal publication
Snelson and Hsu	2019	Journal publication
Tan et al.	2020	Journal publication
Theelen et al.	2020a	Journal publication
Theelen et al.	2020b	Journal publication
Theelen et al.	2020c	Journal publication
Thompson et al.	2018	Journal publication
Torres et al.	2020	Conference proceeding
Ulrich et al.	2019	Journal publication
Van den Broeck et al.	2017	Conference proceeding
Walshe and Driver	2019	Journal publication
Zolfaghari et al.	2020	Journal publication

dimension: VR is computer-generated, VR is three-dimensional, and VR is interactive (Bryson, 1996). 360° video doesn't offer the possibility to interact with the environment or objects in the video and is not computer generated. 360° videos are from the real world unlike VR. These aspects can explain the increasing use of 360° video by researchers and facilitators in education and training domains over the last 10 years (Reyna Zeballos, 2018). Currently, 360° video are used in a wide range of domain, with students to change their preconceived notions on their career (Assilmia et al., 2017), or to create virtual field trips to integrate in future classrooms for PSTs (Huh, 2020), in medical education (Ulrich et al., 2019), sports training (basketball players; Panchuk et al., 2018, officials; Kittel et al., 2020a), or in water-safety skills to children (Araiza-Alba et al., 2021). The research field of 360° video uses in TE is relatively recent and Reyna Zeballos, (2018) highlight that research in the field is not yet robust.

Moreover, we can note there is an increasing use of 360° video in TE (e.g., Kosko et al., 2021). Despite the pilot study of Pea et al. (2004) with teachers in the DIVER project (Digital Interactive Video Exploration and Reflection), there has been an increasing number of new studies about 360° video uses in TE due to miniaturization of cameras, their ease of use (Kavanagh et al., 2016), and their lower purchase cost (Aguayo et al., 2017). This evolution can be explained by the increasing ease to view this type of video with a smartphone (e.g., Martín-Gutiérrez et al., 2017), but also because 360° video makes it possible to overcome the difficulties related to the creation of VR resources (e.g., Kavanagh et al., 2016), which requires a significant cost but also high technical skills, as opposed to 360° VR (Kittel et al., 2020). In TE, 2D videos can provide a means to present oneself but also of someone else (Kleinknecht and Schneider, 2013), often referred to as allo-confrontation situations[3] (Mollo and Falzon, 2004). These two types of viewing are also used in the context of 360° video use.

The aim for this SWOT analysis was to evaluate all aspects of the benefits and risks of the integration of 360° video in TE. While Kittel et al. (2020) provided a SWOT analysis on the use of 360° VR for developing perceptual-cognitive skills, there is no such SWOT analysis for the use of this technology in TE. To inform this SWOT, a manual search of primary research portals including ERIC, SCIENCE DIRECT, LEARNTECHLIB, Proquest, and PubMed was conducted. Keywords used in the search included "video," "360," "teacher" and "education." Additional research was procurred from Google Scholar using the same keywords. We only selected papers for the SWOT that presented information about Strengths, Weaknesses, Opportunities, Threats in using 360° video in education and training (See **Table 1** for included papers).

Through our SWOT analysis, the objective is to guide choices and decisions of researchers and facilitators in terms of resources to be used in TE and particularly 360° video. Our SWOT analysis will help build on described strengths, minimise weaknesses, seize available opportunities and counteract threats about 360° video uses in TE (**Figure 1**).

STRENGTHS

Within the last 3 years, numerous studies (e.g. Ibrahim-Didi, 2015; Roche and Gal-Petitfaux, 2017; Theelen et al., 2019; Theelen et al., 2020a; Theelen et al., 2020b; Theelen et al., 2020c; Kosko et al., 2021) have been developed on the use of 360° video in teacher education. They have shown the interest of using 360° video, for example, to develop interpersonal skills (identifying and interpreting events in the classroom related to teacher/student relationships, Theelen et al., 2019; Theelen et al., 2020b), or the ability to "notice" (Ferdig et al., 2020). Walshe and Driver (2019) have shown that the use of 360° video can help develop a more nuanced understanding of teaching practices but also offer PST the opportunity to "relive" the situation as if they were back in the classroom and to develop embodied and situated reflection. The interest of 360° video both in self viewing situations (Walshe and Driver, 2019), and in allo-confrontation viewing (from 360° video databases) has been demonstrated (Theelen et al., 2019) and this in various viewing conditions: viewing on computer, on smartphone or smartphone with HMD. This tool thus seems to be an interesting lever to immerse teachers in real classroom situations.

[3]Mollo and Falzon (2004) defined allo-confrontation like a method in which participants are confronting with an activity they practice but which is performed by someone else, without the latter being present.

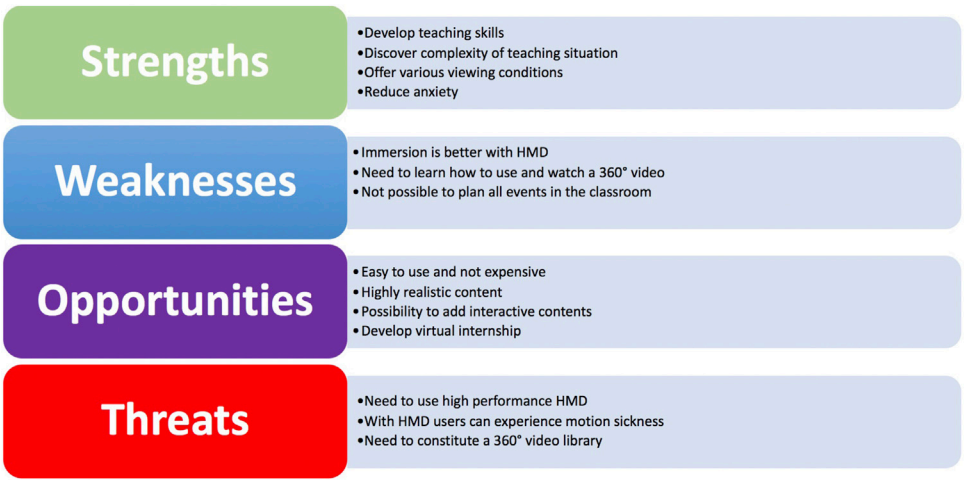

FIGURE 1 | Summary of key findings from SWOT analysis.

One of the main strengths of 360° video use in TE is its suggested usefulness for accessing the complexity of classroom situations (e.g., Roche and Gal-Petitfaux, 2017; Theelen et al., 2019; Roche and Rolland, 2020). With this type of video medium, a PST is no longer placed in a situation of "passive" spectator viewing a video framed by the person filming, but can rather be more actively engaged in the 360° video where they can explore deeper video details. PSTs have the possibility of orienting oneself in the space of the viewed class situation and thus perceive certain angles of view and observe only certain groups or the whole classroom situation. 360° video provide viewers an important degree of freedom on *what* to watch. When PSTs watch 360° video in an allo-confrontation situation (i.e., of another's teaching practices), this type of activity can help PSTs reduce anxiety they may feel before their first real-life classroom experiences (Theelen et al., 2020a).

Many studies have shown that PSTs experience high levels of stress before and during their first classroom experiences (e.g., Payne and Manning, 1990; Wadlington et al., 1998). These feelings of anxiety and stress are often related to classroom management issues (e.g., Murray-Harvey et al., 2000; Akmal et al., 2019). When PSTs are confronted to some difficulties in classroom management, they experienced a gap between the training they received during TE, and real classroom situation during internship. This gap between theory and practice is also known as the "practice shock" (e.g., Korthagen 2010). Shadiev et al. (2021) underline 360° video uses can reduce stress about real situations in which participants are going to learn or work. By using 360° video, PSTs can discover the spatial organization of a classroom and be immersed in the polysensory aspects of the classroom environment (e.g., sounds), which prepares them for actual classroom teaching situations (e.g., Sato and Kageto, 2020; Zolfaghari et al., 2020, authors, 2020). 360° video should be a powerful tool for helping PSTs to learn to manage classroom situation (Theelen et al., 2019) and also reduce the gap between theory and practice. Thompson et al. (2018) said "a 360-degree video is a powerful tool that can bring learners into environments that would otherwise be inaccessible" (p.1) and also, for example, discover in advance the university in which PST will be able to study (Cutler White and Meece, 2020). During periods of lockdown, 360° video can provide virtual access to schools while they are closed.

In comparison to 2D video, 360° video offers viewing possibilities that can enrich the benefits of allo-confrontation situations conducted with 2D videos. The use of 2D video in TE is suggested to produce a "keyhole effect" (Sherin and van Es, 2009) reducing the complexity of the situations viewed, limiting the full richness of real situations. With 360° video the viewers can explore the whole aspects of the teaching situation (authors, 2017). Technical possibilities of 360° video are very interesting in TE because 360° video could generate a large range of questions about classroom phenomena (e.g., authors). This aspect is also encouraging by the fact that 360° video offers a high degree of realism with respect to the situations viewed. For example, Kittel et al. (2019) reported that 360° video has a higher degree of psychological fidelity than 2D video. Indeed, the more realistic the simulation situations are and the closer representativeness to the situations they prepare for, the greater the engagement in the simulation situations and the learning (Dubiago et al., 2018; Kittel et al., 2020a). Because of its realness and groundedness in actual classroom practices, 360° video can enable more effective learning among PSTs than other training resources. For example, Ibrahim-Didi (2015) points out that the use of 360° video leads a PST to feel physically present in the classroom situation being viewed.

WEAKNESSES

The use of 360° video and new technologies has some inherent difficulties. While the use of 360° video allows teachers to be immersed in the situations they are watching, one drawback is they can't interact directly with the content they are watching. They only can turn around in the viewed video. Moreover, in

order to amplify the feeling of immersion through 360° video use, Van den Broeck et al. (2017) point out that there is still a need for head mounted displays (HMDs). It therefore seems interesting to consider viewing with HMDs in order to increase the immersive effects. However, the purchase of this type of device may be a hindrance to the development of the use of 360° video in training, or at least encourage computer-based use that remains less immersive.

Also, viewing 360° videos is not as simple as viewing a 2D video as there is a necessary aspect of understanding, for example, how to orientate oneself to the image, to zoom in the image (on computer or smartphone), to adjust the quality of the image to facilitate the viewing, or to use an HMD with one's smartphone. Tan et al. (2020) showed that the use of 360° videos can be distracting or even disabling, if PSTs do not know how to use them. Realistically, not all PSTs and all current university students are digital natives (Brown and Czerniewicz, 2010; Kirschner and De Bruyckere, 2017). Therefore, to properly use a 360° video it is necessary to train PSTs to its use in their professional development as it was originally necessary to train them to laptop use. With VR, it is possible to determine all scenarios and consider multiple options due to the fact that these resources are computer generated. However, with 360° video, it's not possible to anticipate classroom events that are filmed in an ecological context (unless they are scripted). Also, if the 360° video offers resources allowing high-fidelity simulation situations, the variety of events is dependent on the real situations filmed and reduces the wealth of options and choices available to the viewer. Finally, the management, storage and realization of 360° video can pose problems for facilitators who are not trained in the use of this new technology, particularly when 2D videos accommodate easier usable and are realizable by all, even with a smartphone. Moreover, in order to be shared easily but also to use the functions of 360° videos (e.g., zoom, change of orientation), it is necessary to be able to upload these videos on a specific platform, such as YouTube. A weakness worth addressing is how not all facilitators are trained for this.

OPPORTUNITIES

Shadiev et al. (2021) showed that 360° video is widely availability and not very expensive. This technology is easy to use, by teachers and students and can afford opportunity for them to create their own content for TE. Currently, 360° video does not offer opportunities to interact with and move around the environment being viewed. Torres et al. (2020) pointed out that 360° video offers highly realistic contents but lacks interactivity. In the continuity of their work, it is possible to add interactive contents (e.g., quizzes, images, texts) in a 360° video in order to increase the feeling of immersion.

Moreover, according to Torres et al. (2020), even without interactions, 360° videos are more engaging than 2D videos and interactive 360° videos can improve attention and retention of visual information presented in an interactive way. This type of interactive video would encourage PSTs to explore the video more in depth and their engagement in the viewing situation can be higher. The development of interactive 360° video, which can be more usefully termed "hyper360video" (in reference to the hypervideos[4] (interactive 2D videos) developed by Cattaneo et al., 2016) seems to us to be an interesting avenue to explore in TE.

Another opportunity concerns if the 360° video allows teachers in training to see the whole classroom situation from different perspectives, it does not necessarily allow them to perceive the details of the classroom situations. 360° video therefore has the potential to be a resource of choice to help constitute an element of a multimodal training course (Roche and Gal-Petitfaux, 2015) integrating point-of-view (POV) but also 2D videos in order to develop the ability to observe classroom situations in TE. Finally, if some courses in TE have developed online virtual internships (Theelen et al., 2020c), they were based on 2D video in order to support students' reflective activity on the observed professional gestures and teaching skills. 360° video use could increase the authenticity of the situations viewed during these "virtual internships." Zolfaghari et al. (2020) proposed asynchronous virtual internship experiences based on 360° video during courses at University and that the use of this technology could also be considered online, especially during lockdown periods and to scaffold teachers' internships in TE.

THREATS

Torres et al. (2020) noted that the mainstream adoption of HMDs has led to an increase in the consumption of 360° video. However, in TE the use of HMDs is often done with low-cost models which may limit PSTs engagement in viewing situations. Alamäki et al. (2021) showed that the use of low-cost HMDs decreased users' positive experiences when viewing 360° videos. The experience of 360° videos was better without low-cost VR headsets. Low-cost HMDs with a smartphone proved to be complicated to use when viewing 360° videos. However, Alamäki et al. (2021) did show that 360° videos created a more positive effect than 2D videos. Therefore, it would be preferable to view 360° videos with high performance HMDs to create a positive experience for the PST. However, the purchase of this type of equipment has a high cost that may lead to the abandonment of the use of this type of technology. In addition, during a pandemic, it may be necessary for each student to have their own HMD in order to avoid the risk of infection, which again raises the issue of the cost of viewing equipment.

Finally, viewing 360° videos using HMD may lead users to experience unpleasant, motion sickness-like sensations (Lawson, 2014), or vertigo (Johnson, 2018) leading to abandonment of the technology. In addition, Munafo et al. (2017) confirmed that HMD use can cause motion sickness-like sensations and that women in particular are more susceptible to these conditions. Furthermore, Shadiev et al. (2021) also reported that 360° video uses with HMD can lead participants to experience physical discomforts such as headache, dizziness, and nausea. Another threat to the use of 360°

[4]Interactive 2D videos (Cattaneo et al., 2016).

video in teacher education is the availability of 360° video vignettes. As this technology has been democratized for less than 10 years, it is not yet widespread and facilitators do not have a database of 360° videos as with 2D video. Especially during the pandemic, it is difficult for PSTs to make videos of their own teaching. Also, the use of 360° video in self-confrontation can be delicate to implement and for an allo-confrontation use, it would be necessary that free access platforms based on 360° videos exist. To our knowledge, this type of resources does not yet exist.

DISCUSSION

360° video seems to be a potentially fruitful tool to use in the context of TE, especially to allow virtual internships in lockdown periods but also to accompany PST during their real internship. Fundamentally, 360° video technology can offer the possibility to create virtual learning environments that promotes authentic learning (Shadiev et al., 2021; Snelson and Hsu, 2019). The various strengths and opportunities outlined in this SWOT analysis demonstrate 360° videos can constitute a real affordance in TE. This especially extends from interpreting and identifying interpersonal aspects of classroom management and augmented experiences that provide deeper learning about teaching situations. We consider the weaknesses and threats in possible application challenges and PST's user experience of 360° video to provide foundations for future testing and evaluation.

360° video has many possibilities such as uses at the university, or during synchronous or asynchronous hybrid courses. Through this SWOT analysis, we can consider 360° video a disruptive technology (Flavin, 2017) and also a disruptive innovation. 360° video can be considered like a disruptive technology because it emphasizes practice and uses rather than design, that could change the way we organize, design and made teacher education courses in the future. A disruptive innovation can be based on types of instructional design and not only on the use of technology. 360° video is not a magical tool and as such it should be carefully applied and strategically planned within in TE. While 360° video is highly developed in some fields (e.g., Medicine, Healthcare or language learning; Shadiev et al., 2021), it seems important to develop these uses in TE in order to increase teaching skills acquisition. With simulation based on 2D video in TE said to have potential to train PSTs in specific diagnostic activities (Codreanu et al., 2021), 360° video could therefore enrich this type of simulations as they offer more realistic conditions.

AUTHOR CONTRIBUTIONS

LR wrote the article. AK, IC, and CR all helped with the conceptual idea and editing.

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