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Successful implementation of the 360° video teaching approach to promote immersion and theory-practice transfer in social work

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This study examines the use of 360° videos in social work education, an innovative teaching approach developed at the University of Applied Sciences in Münster and tested at the University of Applied Sciences in Fulda. The research aims to evaluate the potential of 360° videos for enhancing immersion, promoting theory-practice transfer, and assessing the approach's adaptability to different institutional settings. Findings indicate that 360° videos significantly increase students' sense of presence and flow, fostering deeper engagement and understanding of the material. A comparative analysis of the implementations at Münster and Fulda confirms the reproducibility of these effects across different contexts. The study addresses the key factors required for successfully adopting this teaching method at other universities. Future research should explore the long-term impact of 360° videos on teaching quality and learning outcomes, further leveraging immersive technologies to strengthen the integration of theory into practice.

KEYWORDS

education, virtual reality, social work, vignettes, theory-practice transfer

1 Introduction

The implementation research is grounded in the Extended Reality (XR) subproject's content and the approach of teaching with 360° videos developed therein (Averbeck et al., 2024). In this context, an immersive learning approach was developed and tested in teaching at the University of Applied Science in Münster. Immersive learning is based on the concept of education as a series of active, phenomenological experiences based on presence within a physical or digital medium, such as virtual reality or 360° video (Mystakidis and Lympouridis, 2023, p. 396). The objective of this immersive learning approach is to establish a novel form of theory-practice transfer for teaching, which is intended to complement existing formats (role plays, practice visits, and case examples). The evaluation results of 261 students demonstrate that the approach proves to be a useful addition to existing teaching and represents added value for teaching. Students rate the general use of 360° videos as "good" and beneficial for understanding the teaching content.

The immersion, immediacy of experience, and increased motivation factors indicate the fundamental potential of virtual reality technology for teaching and learning (Sunday et al., 2023, p. 1). The presentation of case situations using 360° videos offers students an immersive experience, enabling them to empathize with the situation and enhance their comprehension of the learning content with the assistance of the experience of presence (Averbeck et al., 2024, p. 119). Ensuring the long-term and sustainable expansion of this

innovation beyond the project's initial location necessitates the transfer of its content. In this regard, it is essential to share the approaches and their implementation with other universities, facilitating the dissemination, research, testing, and continuous improvement of the approach. In the context of implementation research, the objective is to identify the most effective strategies for reproducing this approach and to determine the factors that contribute to successful outcomes (Schrader and Hasselhorn, 2020, p. 7). To this end, the results are examined independently of the specific seminar context for which the videos were created. This approach is implemented with the proviso that the same results should be achieved if possible.

The objective of this article is threefold: first, to describe the implementation of the approach at the Department of Social Work at Fulda University of Applied Sciences; second, to present the research results and the procedure; and third, to identify the conditions for a successful transfer. This article, in conjunction with the teaching materials for the 360° videos (available as OER), enables all university personnel to implement the teaching approach in a comparable way at their own institution.

2 Theoretical framework

2.1 Immersion and flow

The state of immersion is characterized by the focus of attention on a medium and its content, which conveys a sense of reality in a non-physical world (Rosendahl and Wagner, 2023, p. 1321). The degree of immersion in the media environment is influenced by various factors, including the possibilities for interaction, the perspective, the realism of the environment depicted, the respective medium (Rosendahl and Wagner, 2023, p. 1321) and the ambisonic or monophonic sound (Ferdig et al., 2023, p. 895).

Chen and Hwang (2022) demonstrated that immersion can influence self-efficacy and, in addition, a reduction in speech anxiety was observed in the test subjects in the learning application. The degree of immersion in virtual reality and 360° video is positively correlated with the flow experience, which is characterized by a feeling of harmonious match between a person's perceived abilities and the requirements of the task (Škola et al., 2020, p. 12).

The two perceptual states of immersion and flow experience can be evaluated using the valid questionnaires "MEC Spatial Presence Questionnaire (MEC-SPQ)" by Vorderer et al. (2004) to measure spatial presence and the questionnaire to measure flow experience by Rheinberg et al. (2003).

2.2 Technological readiness

The concept of technology readiness encompasses three aspects: technology acceptance, technology competence beliefs, and technology control beliefs. Technology readiness can be measured using the instrument developed by Neyer et al. (2012). Technology acceptance is understood to mean personal reference and interest in technical innovations. Technology competence conviction refers to the expected own adaptability to technical innovations, while technology control conviction refers to the perceived extent of influence and control over technical processes and their effects (Neyer et al., 2012, p. 87).

2.3 Utilization of 360° videos in education

It is imperative to draw a distinction between the term "360° videos" and that of "virtual reality." These 360° videos allow viewers to choose their own viewing angle. The 360° videos are not interactive and can be viewed with devices other than VR glasses (Roche et al., 2025, p. 4). Monoscopic (2D) 360° videos show the same video for both eyes, which means that depth perception is not possible, whereas stereoscopic (3D) 360° videos show a different video for each eye, which allows the viewer to perceive the depth of the video. The stereoscopic 360° videos are recorded with a camera that has six surrounding lenses spaced at the distance between the eyes, allowing it to output two exactly matched videos for the viewer's eyes (see Figure 1).

In this context, a differentiation from 3D is relevant because the three-dimensional effect has the potential to enhance the user's sense of presence and immersion (Stelzmann et al., 2022, p. 198). In the educational context, 360° videos are divided into three different types: (1) immersive 360° videos, which are specifically designed to appeal to the emotions and focus on the viewer's empathy. Secondly, there are exploratory 360° videos, which can make places accessible to recipients that are difficult to reach or risky to visit. Finally, there are practice-oriented 360° videos, which demonstrate specific applications and methods and convey their case contexts (Feuerstein and Neumann, 2022, p. 76). A common thread among these three types is their capacity to facilitate authentic learning experiences that are oriented toward subsequent practical application (Davidsen et al., 2022, p. 2–3). The utilization of 360° videos in educational settings can be regarded as a relatively accessible option, given the ease of use associated with virtual reality (VR) glasses and the moderate effort required for filming (Pirker and Dengel, 2021, p. 76). The research domain of 360° videos and their application in educational settings is expanding at a steady rate (Ranieri et al., 2022, p. 1204). Consequently, further development and research into suitable teaching methodologies are essential. It is theorized that 360° videos facilitate an immersive learning environment, offering direct exposure to case studies

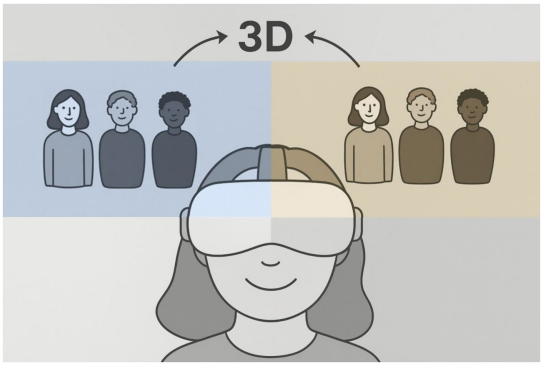

FIGURE 1
Stereoscopic 360° video with VR glasses.

(Veber et al., 2023, p. 3). These videos are also regarded as conducive to evoking emotional responses (Della Libera et al., 2023, p. 3) and fostering empathy (Rambaree et al., 2023, p. 2). The use of VR glasses and videos has been shown to stimulate spatial thinking and users' cognitive abilities at a high level, thereby promoting problem-solving skills, among other things (Deng et al., 2023, according to Afifah et al., 2024, p. 343). A positive effect on learning performance through 360° videos could be determined (Babaita et al., 2024, p. 25–27). The evaluation data from the XR subproject at the Münster location, with a sample size of 261 students, can be used to gain in-depth insights into the teaching approach. The teaching approach with 360° videos for theory-practice transfer has been shown to create immersion and flow experiences in students. The evaluation of this approach employed a Likert scale, ranging from 1 (strongly disagree) to 7 (strongly agree), and the resulting data were overwhelmingly favorable (Table 1).

The evaluation results indicate that the framework conditions of the teaching approach are perceived as coherent and optimal (G-IL1-5, G-ML1-4, G-MVR1-3, G-IVR3). However, the items pertaining to interaction (G-IL7) and independent learning (G-IL6) are in the lower range of "rather not applicable." The occurrence of physical discomfort (G-IVR4) among a limited number of students is indicated by the mean value of "Does not apply," although the standard deviation also reveals that there are individual students who experience physical discomfort.

The students' assessment of the event-related items (GIVR1-2) is particularly positive, affirming the added value for students. Similarly, students rate the use of the VR glasses, satisfaction with the effort required to use them, and learning success using the VR glasses on a grading scale from 1 (very good) to 6 (unsatisfactory), with a grade of 2 (good).

However, the lack of interaction inherent to 360° videos presents a significant limitation, necessitating that learning objects be planned into the teaching purely for the purpose of viewing, as discussed by Ranieri et al. (2022, p. 1201). Viewing 360° videos requires users to pay full attention to the visual and auditory stimuli presented, which leads to a higher cognitive load than when viewing conventional fixed-frame videos (Chao et al., 2021, p. 15). The effect of higher cognitive load should be considered when assessing the limitations of 360° videos. Consequently, it is recommended that the viewing duration be maintained at approximately 5 min to minimize user overload.

TABLE 1 Evaluation results of the XR subproject.

Item	SD	M
G-IL 1- I had trouble following the video.	1.27	2.20
G-IL 2- Important information was revealed in the video.	0.92	5.75
G-IL 3- The video contains elements that could be left out.	1.06	2.54
G-IL 4- The speakers in the video were convincing.	1.08	5.50
G-IL 5- The video encourages active engagement with the content.	0.85	6.04
G-IL 6- The video helped me decide for myself how and when I want to learn.	1.65	3.92
G-IL 7- The video included interactive elements.	1.76	3.07
G-ML 1- The length of the videos was optimal.	1.25	5.43
G-ML 2- The technical quality of the video was optimal.	1.26	5.04
G-ML 3- The integration of the videos into the event was optimal.	0.97	6.01
G-ML 4- The comprehensibility of the language used in the video was optimal.	1.45	5.50
G-MVR 1- The user-friendliness of the VR application software was optimal.	0.98	5.70
G-MVR 2- The user-friendliness of the VR hardware was optimal.	0.97	5.68
G-MVR 3- The technical realization of the virtual environment was optimal.	1.05	5.62
G-MVR 4- Overall, the use of VR elements in this event was optimal.	0.99	5.84
G-IVR 1- The integration of VR into the event made sense.	1.08	6.08
G-IVR 2- Working in VR contributed to the understanding of the respective meeting content.	1.12	6.00
G-IVR 3- The environment was realistically designed.	0.89	6.15
G-IVR 4- I felt physically unwell (e.g., sickness, dizziness)	1.73	2.27

M = mean, SD = standard deviation, scale values = 1–7.

2.4 Implementation research

The objective of implementation research is to describe and analyze the processes that occur when concepts are implemented and established (Petermann, 2014, p. 122). Implementation research plays a crucial role in the transfer and introduction of new concepts, as it allows for the identification and addressing of "imprecisely, conceptually weak, poorly planned, or false expectations" (Petermann, 2014, p. 122). The taxonomy of implementation outcomes, as developed by Grimshaw et al. (2006) and Michie et al. (2009), can serve as a foundational framework for monitoring implementation based on these factors. Implementation research identifies eight factors that are deemed to be instrumental in determining the success or failure of an intervention. These factors are acceptance, adoption, appropriateness, feasibility, fidelity, implementation costs, penetration, and sustainability. The measurement of these factors can be achieved through the implementation of quantitative and qualitative research methods (Petermann, 2014, p. 124).

When considering implementation research and the associated concept, it is imperative to differentiate it from the closely related intervention research. Intervention research involves the empirical investigation of the effect of innovations in a theoretically grounded manner under experimental conditions in the field (Schrader and Hasselhorn, 2020, p. 2). Conversely, implementation research focuses on the institutional, personnel, and organizational framework conditions that can enable a sustainable establishment in practice (Fixsen et al., 2005, p. 15). According to Schrader and Hasselhorn (2020), the field of implementation studies in Germany is not yet as well developed in the area of higher education and adult and continuing education as it is in the area of early childhood education in primary and secondary schools.

To research implementation, records, observations, or self-assessments are used to capture the results (Petermann, 2014, p. 126). To capture the outcomes, the taxonomy of implementation outcomes is used in a moderated form. In the context of implementation research, a differentiation is made into a total of eight different outcomes (Petermann, 2014, p. 123).

1 *Acceptance*: acceptance can be measured using various criteria. The satisfaction of those involved with the offer, their assessment of it and their knowledge about it are important criteria for determining acceptance. The study also determines whether those involved consider it feasible to use the offer.
2 *Adoption*: this term refers to the intention or decision of those involved to use the offer in practice.
3 *Appropriateness*: the aspect of appropriateness focuses on the perceived fit, timeliness, and compatibility of the offer. In this context, a conceptual proximity to the concept of acceptance can be observed.
4 *Feasibility*: the stakeholders' assessment of feasibility includes an evaluation of the prospects for success regarding the implementation of the new offer in the intended context.
5 *Fidelity*: fidelity reflects the extent to which the planned use of the offer is aligned with the original, as well as the comparable and deviating effects that occur during implementation.
6 *Implementation costs*: implementation costs are defined in terms of the costs of implementing the offer and include the components of the scope of the offer, the complexity of implementation, and the structure/size of the institution. In this context, the costs and benefits of the offer are compared, taking into account the other outcomes.
7 *Penetration*: the term penetration refers to the proportion of implemented and planned offers in relation to the interested employees.
8 *Sustainability*: the term sustainability refers to the extent to which the offer is integrated and institutionalized into the institutional structures.

A comparison of the evaluation results from the Münster site with those from the Fulda site enables an assessment of the success and potential optimization of the implementation at the Fulda site.

The implementation is contingent on the training of teachers, as this has a decisive influence on acceptance and feasibility. The assessment of the relevance of the teaching approach for one's own teaching and the assessment of the feasibility of the same can only take place after the training. In this context, the teachers of the training situation are considered multipliers. The basic orientation of the training's learning mechanisms was based on the approach of Kuboth and Aich (2022), whereby the training is designed so that participants learn by observing the model, through trial actions, feedback, and reflection. The seminar involves the testing of instructional processes for 360° video viewing through the model approach. The evaluation of the training enables the formulation of statements regarding implementation outcomes, as well as the teachers' objectives for the training and their subjective achievement.

2.5 Hypotheses

In light of the extant research and the evaluation results of the XR subproject, several positive effects of the teaching approach can be identified. However, the extent to which these effects depend on the location, the local team, the seminar teachers, and the students remains to be examined. These two aspects will be addressed in the context of the research question, "What steps are necessary to successfully implement a teaching approach developed at the Münster University of Applied Sciences that is based on 360° videos at another university for students of social work, and what key factors contribute to the success of this implementation in teaching practice?" To address this, the survey instruments are aligned with the implementation results, and the evaluation regularly used in Münster for the teaching approach and the individual evaluation of the training and implementation with the teachers are used.

A total of five core hypotheses can be derived from the research question, which must be examined in the context of the study. The first hypothesis refers to the training situation, which is designed based on the learning mechanisms of Kuboth and Aich (2022) and serves as the cornerstone for establishing acceptance among teachers of the teaching approach. Hypothesis 1: The training significantly increases the acceptance and sense of competence of professors, teachers, and employees in using 360° videos in teaching. To elaborate upon this hypothesis, three sub-hypotheses have been formulated. The initial sub-hypothesis concerns the examination of educators' willingness to utilize technology in the context of their sense of competence. The subsequent sub-hypothesis pertains to the assessment of whether the training has enhanced educators' acceptance, thereby investigating its potential impact on increasing acceptance. The third part of the hypothesis is concerned with the examination of the sense of competence in the area of one's own goal setting before and after the training situation.

The second hypothesis pertains to the implementation outcomes (Petermann, 2014, p. 123–125) with the objective of verifying the success of the implementation strategy and identifying potential needs for adaptation. Hypothesis 2: Professors, teachers, and employees have a high level of acceptance and willingness to adopt 360° videos during implementation, rate them as appropriate for their learning objectives, and implement them with a high degree of fidelity. Addressing this hypothesis necessitates an examination of several implementation outcomes, as well as learning success in the context of the teaching staff's learning objectives. With regard to the overall acceptance, the general sense of feasibility, the fidelity of implementation, and the perceived learning success of students through 360° videos, four sub-hypotheses can be formulated.

In the context of the third hypothesis, three implementation outcomes from an organizational perspective are considered, whereby the dean is interviewed as the controlling instance of the teaching approach. In this context, the relation of costs to expected benefits according to the evaluation data of the XR subproject is to be estimated. The considerations outlined above give rise the third hypothesis, which states that the dean will assess the costs of implementing and utilizing 360° videos in education as justified in view of the expected positive implementation factors, as well as the impact on teaching quality and learning outcomes. To explore this hypothesis comprehensively, it is necessary to consider the dean's perspective. This perspective can inform the examination of whether she perceives and encourages sustainability and departmental integration, and whether she approves of the implementation costs in the context of the implementation outcomes and added value.

The fourth hypothesis centers on the impact of implementing the teaching approach with 360° videos at the Fulda site. In this context, a singular consideration of the evaluation developed for the teaching approach in Münster is undertaken, wherein the added value of the same for teaching is called into question. From the foregoing explanations, the fourth hypothesis can be deduced: The integration

of 360° videos in teaching is expected to result in increased immersion, an enhanced flow experience, and a positive overall assessment of the course by students. In addressing the hypothesis, the factor of immersion is examined through a sub-hypothesis to ascertain an increased degree of confirmation. The study also investigates whether students experienced a sense of flow during the integration of the 360° videos. In a final step, students are asked to provide an overall assessment to determine whether they can identify and confirm subjective added value in this approach.

Finally, the fifth hypothesis posits a comparison of the evaluation data to discern possible similarities and differences between the two locations and their implementations. The fifth hypothesis is thus: the students' evaluation results will show comparably positive values as in the previous uses of 360° videos at the Münster location. The hypothesis is addressed through three sub-hypotheses. First, the values of the immersion and flow experience are compared. Second, the overall evaluation of the use of the two locations is compared. The study's objective is to identify any differences between the two locations in the evaluation. This will enable an adjustment of the implementation strategy if necessary and to optimize the added value achieved at the Münster University of Applied Sciences during implementation.

3 Methods

3.1 Study design

The mixed-method design is a methodological framework that utilizes a combination of quantitative and qualitative data collection methods to address the research question and test the hypotheses. The design involves four measurement points, with the first occurring before the training of educators and employees. At this initial point, the willingness to use technology and the acceptance of the approach among the educators and employees involved are quantitatively assessed using a questionnaire. The questionnaire also contains open-ended questions that serve to qualitatively collect the training objectives of the participants. These are collected prior to the training, and subsequently evaluated after the training in order to answer hypothesis 1 (Table 2). In addition, the post-training questionnaire collects the implementation factors of acceptance and feasibility, achievement of objectives and evaluation of the training, utilizing a 5-point scale ranging from "strongly disagree" to "strongly agree." Additionally, the implementation factors of acceptance and feasibility, along with the evaluation of the training, are documented in the post-training questionnaire.

Subsequent to the implementation dates in the seminar, a survey of the educators is carried out, who assess the implementation factors of acceptance, feasibility, fidelity, cooperation, and learning success. Furthermore, an evaluation of the students is carried out, which is structured in the same way as in Münster and includes the factors of immersion, flow experience, and the overall assessment of the approach. Finally, the implementation is examined from an organizational perspective in an interview with the dean and classified according to the implementation factors (Figure 2).

The samples were compiled on the basis of the voluntary willingness of lecturers to expand their seminars with the help of 360° videos, and the student sample was included on the condition that participation was voluntary. The students' voluntary use of the 360° videos in the module is subsequently evaluated. Existing instruments from other studies are used and combined as survey instruments.

Prior to the initiation of the primary data collection phase, the students' propensity to utilize the technological devices will be gauged through a training session that utilizes the concise scale for assessing technological acceptance, as outlined by Neyer et al. (2012). Concurrently, an event evaluation will be conducted, drawing upon the framework developed by Kuboth and Aich (2022). Furthermore, implementation factors are collected at various measurement points using questionnaires and an interview guide, based on Meudt et al. (2020), to measure the transfer success. The students' immersion experience is measured using the questionnaire developed by Vorderer et al. (2004), while the students' flow experience is examined using the questionnaire designed by Rheinberg et al. (2003). The use of 360° videos in teaching is also assessed using individual reflexive items for

TABLE 2 Objectives of the training participants.

Objective	M	SD	Min	*n*
I have familiarized myself extensively with the VR glasses with the 360° videos	4.64	0.50	4	11
I feel empowered to conduct my own seminar session with the 360° videos	4.10	0.73	3	10
I can comprehensively plan the didactic use of 360° videos in teaching	3.50	0.97	2	10
I can transfer the didactic concepts taught to my own teaching	3.89	0.78	3	9
I have the feeling that I can supervise students well when using the 360° videos	3.50	1.08	2	10
I can assess how attractive immersive learning is for students	4.00	0.94	3	10
I know how to get learners interested in using 360° videos	4.11	0.78	3	9
I know how to get students interested in using 360° videos	3.87	0.83	3	8
I can assess the ways in which 360° videos can enrich teaching	4.33	0.50	4	9
I can realistically assess the technical effort required to use 360° videos in teaching	3.73	0.90	2	11
I was able to familiarize myself with the content to such an extent that I did not need any further training to use it.	3.10	0.87	2	10
I have understood how I can adjust and optimize the time for using the VR glasses	3.00	0.81	2	4

M = mean, SD = standard deviation, Min = minimum, *n* = sample size, scale values = 1–7.

an overall evaluation of their use in teaching, based on the survey by Schwinger et al. (2021).

3.2 Data collection

The present study was conducted as part of the implementation of a novel teaching approach at Fulda University of Applied Sciences. To begin with, 360° videos were integrated with existing handouts, processes, and supplementary materials from established teaching contexts. The teaching approach was evaluated using these existing materials to reduce the effort required for educators and to provide an insight into teaching with 360° videos. Thereafter, educators adapted the content of the approach and the associated learning resources, which included the 360° videos, according to their needs. The regular use of the materials made available as open educational resources (OERs) requires not only thorough testing but also the establishment of suitable framework conditions, thereby enabling teachers to work with the 360° videos in a self-determined manner. The implementation of the teaching approach with 360° videos involves the provision of at least 15 VR glasses and the employment of a person to provide technical support. The tasks of this person include the maintenance of the VR glasses, the provision of the VR glasses, the teaching materials, and the supervision of teaching. The framework conditions have been instituted at Fulda University of Applied Sciences and will be comprehensively guaranteed until the end of 2027 in the form of a half-time research employee position, an assistant position, and two technical employees responsible for the VR glasses. The teaching approach at the university is characterized by a symbiotic approach, which is defined as continuous cooperation and exchange between the involved parties (Souvignier and Philipp, 2016, p. 14). This approach ensures that the individual aspects can be adapted to the specific needs of the university and its teaching staff, and it also enables the development of new variants of the teaching approach. The implementation strategy is predicated on three core elements for communicating and anchoring the teaching approach at the university:

1 Training for professors and employees
2 Accompanied first application dates and their evaluation
3 Taking a meta-perspective with the dean of the faculty

To enable a well-founded assessment of the teaching approach and its added value and effort for teaching, it is necessary for lecturers to receive comprehensive training as a first step. The training aims to offer lecturers the opportunity to critically evaluate the approach and assess whether it can enrich their own courses or whether the established teaching approaches can better guarantee the objectives of the seminar. The training course was designed based on the multi-training courses according to Kuboth and Aich (2022). A particular emphasis is placed on the learning mechanisms of the model, through trial treatments, direct feedback, and reflection. The training courses are structured around four thematic focuses, allowing participants to select content relevant to their individual needs and bypass sections that exceed their current level of knowledge and expertise. The first focus is dedicated to the fundamental principles of virtual reality and the use of VR glasses, with an emphasis on imparting fundamental knowledge. The subsequent focus is dedicated to the comprehensive teaching approach with 360° videos, with all steps from preparation

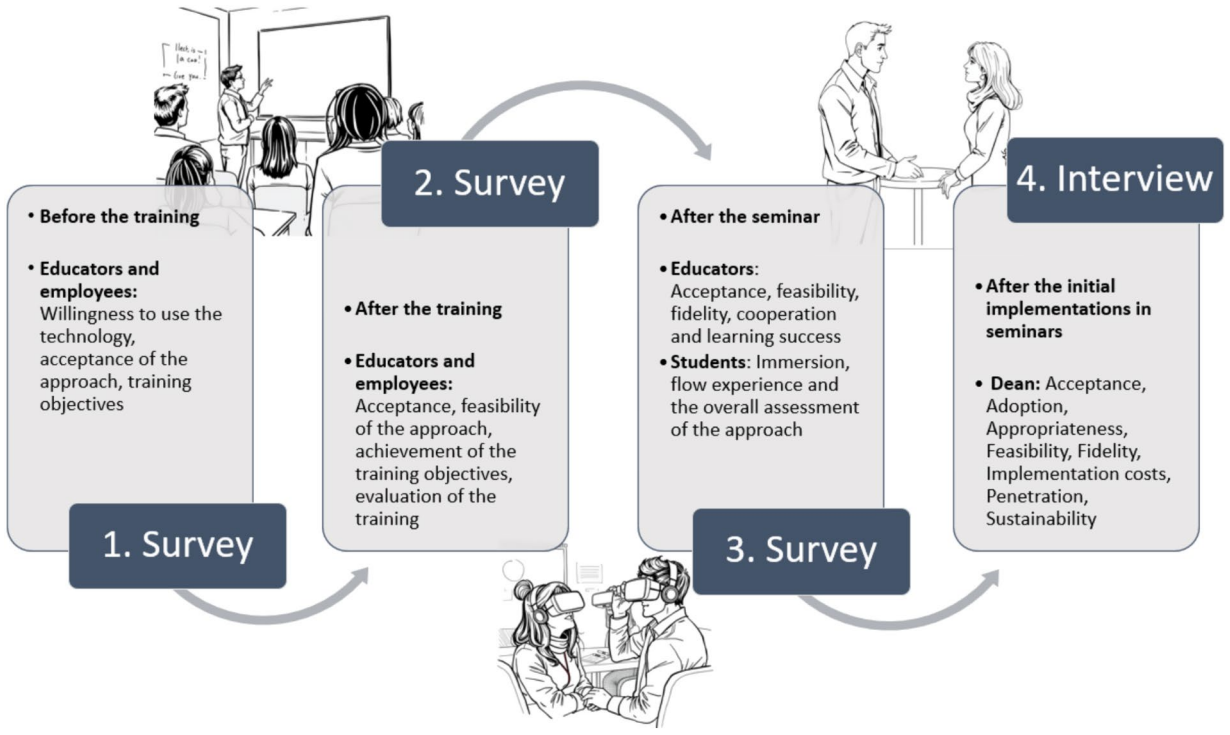

FIGURE 2
Study procedure with four measurement points.

to the concept and follow-up thoroughly explained. The third focus is on providing an overview of other teaching options with VR glasses that go beyond the primary teaching approach with 360° videos. The fourth focus is aimed at imparting specific knowledge and skills to technically prepare and follow up the VR glasses as well as to maintain them during use and solve problems.

Following the training session, the second step involves the first supervised use of the 360° videos in teaching, contingent on educators' willingness. During the first use, educators have the opportunity to examine the effort involved, the processes, the added value, and the challenges for teaching, as well as the feedback from students. Based on these impressions, educators can subsequently assess whether the effort of creating processes, new 360° videos, and teaching materials specially adapted to their teaching could be worthwhile for them or whether these elements are not suitable for their teaching. Following the initial testing in the seminar, the XR sub-project is evaluated, which is also carried out in Münster after each use. This allows the results of the seminars in Fulda to be compared with those in Münster. This approach enables educators to gain insights into the impact of the 360° videos on students from the very first application. As part of the evaluation process, educators are asked to provide their assessment of the implementation outcomes and the general approach. This enables the determination of whether there have been any changes in the outcomes after the initial use of the 360° videos. This second step facilitates the establishment of long-term collaborations with educators, thereby ensuring the integration of 360° video technology into their pedagogical practices. The third step is a summary of the use of 360° videos. Together with the dean, the implementation costs incurred are set in relation to the added value generated for the lecturers and the department. Within this, perspectives are developed that require adjustments to achieve long-term use by the lecturers and to harmonize the use with the needs of the lecturers and the department.

3.3 Data analysis

The quantitative data is analysed using a variety of analytical methods, including mean value comparisons, correlations, Z-tests, and regression analyses. This approach enables the formulation of statements regarding the individual data aspects, as well as comparisons between the respective measurements and measurement times. The interview is analysed using triangulation, thereby ensuring that the dean's statements are contextualized within the broader framework of the quantitative data on implementation outcomes.

4 Findings

4.1 Hypothesis 1: the training significantly increases the acceptance and sense of competence of professors, lecturers and staff in dealing with 360° videos in teaching

Dividing the first hypothesis into three sub-hypotheses makes it easier to process. Each of these sub-hypotheses can be answered separately, while the first hypothesis can only be answered after a combined consideration of all sub-hypotheses. Therefore, the sub-hypotheses are as follows:

1.1 The participants show a high degree of willingness to use technology, which is conducive to the implementation of the new approach.
1.2 Participants will have a high level of acceptance for implementing the approach prior to the training, which will increase after the training.
1.3 With the help of the training, the participants gain an increased sense of competence based on their own goal formulations.

The actors involved in the training were asked about their age and educational qualifications. It was found that the respondents were between 30 and 61 years old and had educational qualifications ranging from a bachelor's degree to a professorship. In addition, most of the respondents indicated that they worked as research employees at the university.

The hypotheses were answered by means of a before and after survey on the educational situation. The answer to the first sub-hypothesis 1.1 is based on the data on technology readiness, which was collected using a 5-point Likert scale (1 = strongly disagree, 3 = partly, 5 = strongly agree). The respondents had a combined technology readiness score of $M = 3.49$, which falls between "partly" and "agree." This leads to the conclusion that there is a willingness to use technology, but it is not strong enough among all participants to speak of a high willingness to use technology among the respondents. In connection with the adoption of the new teaching approach, the respondents were also asked to what extent they were curious about technical innovations. The mean values are $M = 3.92$ (SD = 1.04) and $M = 4.00$ (SD = 0.95). The respondents indicated that they can control the use of new technological developments and that chance plays a minor role. The mean value of $M = 3.85$ indicates a particularly positive assessment, as it points to curiosity and willingness to familiarize themselves with a new teaching approach.

The second sub-hypothesis focuses on the implementation outcome of acceptance, which was also assessed using a 5-point Likert scale. Before the training, acceptance was rated by the respondents with a mean value of 3.53 (SD = 0.48; $n = 8$). After the training, there was a slight tendency toward higher values in the positive range, with a mean of $M = 3.78$ (SD = 0.48; $n = 6$). However, this does not represent a significant change in acceptance scores after training. The MANOVA and the post- hoc Bonferroni test do not provide any evidence for this assumption either, so that a positive but not significant change in the value can be confirmed.

To answer the third sub-hypothesis, the results of the evaluation of the training and the evaluation of the achievement of self-imposed goals are considered in order to capture the participants' feeling of competence as well as possible. In the evaluation of the training, the respondents indicated that the training had resulted in a learning gain ($M = 4.73$; SD = 0.46) and confirmed that the pace of work, amount of material, active learning, number of participants, and level of requirements were just right ($n = 11$). The content of the training can therefore be considered conducive to a sense of competence in this context. On a 5-point Likert scale, the respondents confirmed the goals they had set for themselves before the course as follows:

The educators were able to achieve most of the objectives through the training. In particular, the two goals of becoming fully familiar with the approach and assessing the potential for enrichment were

achieved. Individual educators were not able to achieve five objectives. This is especially true for the aspects of planning and estimating the effort involved, as well as for an item concerning the supervision of students. The worst achievement of objectives is found in the items concerning the absence of training needs and the ability of educators to adapt and optimize the time for the assignment themselves. Both objectives represent the final stage of the understanding of the competence, so that the educators gain the ability to use the approach independently and to adapt it to their own teaching. In summary, it can be said that the final stage of competence understanding has not yet been reached, but a basic competence in using the teaching approach has been established. This sub-hypothesis could have been confirmed to a greater extent if the training participants had carried out the teaching tasks completely independently after the training.

The first hypothesis can be confirmed in several aspects. However, a significant increase in acceptance among the participants could not be demonstrated. Acceptance among the participants was only increased without any demonstrable significance. The goals of the training participants were achieved on average, but not completely for individual participants.

4.2 Hypothesis 2: professors, teachers and employees show a high level of acceptance and willingness to adopt 360° videos when implementing them, rate them as appropriate for their learning objectives and implement them with a high level of fidelity

The present hypothesis focuses on the implementation outcomes at the time of implementation and the first use of the 360° videos in teaching, considering the outcomes, acceptance and feasibility, as well as the fidelity and attributed learning success of students during the first implementation in teaching. The hypothesis is supported by the following four sub-hypotheses:

2.1 The respondents demonstrate a high level of acceptance of the use of 360° videos.
2.2 The respondents demonstrate a high level of feasibility regarding the use of 360° videos.
2.3 The respondents demonstrate a high level of fidelity regarding the utilization of 360° videos.

Furthermore, respondents recognize a high level of learning success among students after using the 360° videos.

The first sub-hypothesis, which postulated that acceptance could be significantly increased through training, was not confirmed, nor was a significant increase in acceptance observed up to the point after using the 360° videos in teaching. The mean value of $M = 3.53$ (SD = 0.48; $n = 8$) to $M = 3.78$ (SD = 0.48; $n = 6$) before the implementation of the approach to $M = 3.85$ (SD = 0.35; $n = 2$) after the implementation of the approach shows a minimal change. However, at all three measurement times, an acceptance is demonstrated that only reaches the category "applies" on the scale and can thus be described as present. Nevertheless, a significant acceptance in the range between $M = 4$ and $M = 5$ could not be demonstrated, thus preventing confirmation of this first part of the second hypothesis.

The second sub-hypothesis, which focuses on the feeling of feasibility, is addressed by means of a survey at two measurement points: after the training and after the first implementation dates. In this way, in addition to confirming or refuting the hypotheses, any changes should also be considered. After the training, the educators still rated the feasibility as positive, with a mean of $M = 3.5$ (SD = 0.523; $n = 5$). It was found that attitudes to the use of 360° videos varied widely and that not all educators considered the use of 360° videos in the educational setting to be feasible. The two professors who tested the use of 360° videos showed a slight improvement in their assessment, resulting in an average score of $M = 3.87$ (SD = 0.354; $n = 2$). However, this assessment cannot be taken as confirmation of a high degree of feasibility. It can only be concluded that regular use in the educational setting is possible in principle. In summary, the sub-hypothesis cannot be fully confirmed either, but it does open up the prospect of feasibility that can still be improved.

To assess the fidelity of implementation, the educators were asked about the implementation. They were asked to what extent the training content was followed and to what extent the content and support of the XR sub-project was followed during planning and implementation. This sub-hypothesis cannot be answered here, as only one educator answered this question in the questionnaire. As a result, the data from the one person appear very positive, with an overall mean of the factor of $M = 4.6$. However, this only represents the individual subjective perception of one teacher and it was not communicated in the questionnaire why the other person did not answer the questions.

The fourth sub-hypothesis focuses on the learning success of the students as perceived by the educators. Due to the fact that the study had only been conducted in two seminars at the Fulda site at the time of the analysis, a sample of two people had to be used. In the survey, the educators stated that the 360° videos had a motivating effect on the students ($M = 5.0$; SD = 0) and that the students showed active participation during the seminar ($M = 5.0$; SD = 0). In addition, the teachers confirmed that the students' skills were strengthened by the 360° videos ($M = 4.5$; SD = 0.70). According to the educators, the students' knowledge could also be improved, although to a lesser extent than in the aspects mentioned above. The quality of teaching based on 360° videos and the improvement of the theory-practice transfer showed positive effects, but these were not as unanimous and clear as for the previous aspects. In summary, the sub-hypothesis can be confirmed, although further tests and research are needed to improve the sample and the significance of the results.

The second hypothesis is not clearly confirmed, so that only individual aspects can be proven on the basis of the data. This results in a limitation of the significance of the hypothesis, although the feasibility and acceptance among teachers is given, although not to the extent that the hypothesis can be fully confirmed.

4.3 Hypothesis 3: the dean considers the costs of implementing and using 360° videos in teaching to be justified in view of the expected positive implementation factors and the impact on teaching quality and learning outcomes

The interview was conducted with Ms. Prof. Ruhmland, who at the time of the study was the Dean of the Department of Social Work

at Fulda University of Applied Sciences, and who agreed to talk about the implementation of the approach from the meta-perspective of her role. This allows the feedback from educators and students to be considered in the context of the professional framework of the organizational perspective.

4.3.1 The dean promotes the sustainability and the penetration of the teaching in the department through the approach of 360° videos in teaching

The initial presentation of the approach and the subsequent training sessions are seen as an important step. The dean describes how interest in the department is the starting point for creating sustainability and penetration, "because we have issues in social work that can actually be addressed very well with this medium" (Interview with Prof. Ruhmland, 2024). It is only with the help of the starting point of interest that a sustainable use by educators can be initiated. Human resources are also important for sustainable implementation. Within the framework of the project "GO-IN," a half-time position has been created for 3 years to introduce innovative content to educators. In addition, the department already has two other positions in the field of media didactics. "We have two technical staff who are involved in the project. These positions are permanent. In this way, we have ensured that knowledge is not completely lost. The same applies to the basic technical equipment, so that the content produced and the teaching assignments" will continue to be used beyond the GO-IN position" (Interview with Prof. Ruhmland, 2024).

From the dean's point of view, sustainability includes "[.] of course the benefit. So both in terms of teaching and in terms of practicality, it really makes sense for us" (Interview with Prof. Ruhmland, 2024). From this perspective, she also emphasizes the long-term perspective about the sustainability factor, "that we have the opportunity to really try it out and apply it here and now, and then in a year or two we can draw a conclusion about how it went" (Interview with Prof. Ruhmland, 2024). This results in an open and at the same time critical attitude toward the approach, so that an in-depth testing over several years can take place, but also a subsequent evaluation and questioning of whether this approach can and should be permanently anchored.

The hypothesis can be confirmed that the sustainability and pervasiveness, in the form of the creation of a foundation through technology, the transfer of knowledge to tenure-track positions, the review of the currently perceived benefits, and the long-term perspective and evaluation of the added value for teaching at the department, can be achieved at the department.

4.3.2 The dean supports the implementation costs because they are justifiable in terms of acceptance, adoption, appropriateness and feasibility

In an interview with the dean, she points to the need for initial investment in innovative teaching methods and emphasizes that technology-based approaches are associated with high initial costs: "I think every innovation requires an initial investment" (Interview with Prof. Ruhmland, 2024). In the interview, she repeatedly refers to the specific requirements of social work, for which the method is particularly suitable, and emphasizes that 360° videos technology presents realistic scenarios that students would otherwise hardly be able to understand in theory. During the interview, it is emphasized that it is crucial to use this technique to vividly convey to students the complex situations they will face in social work.

The project was funded by a combination of different budgetary resources, including university funds, third-party funds, and government funds. According to the dean, this fragmented funding was inevitable: "I do not think it would have been possible any other way" (Interview with Prof. Ruhmland, 2024). The dean identifies the purchase of VR glasses and the creation of a half-time position as the central measures to ensure the technical and organizational implementation. However, she emphasizes that the financial security of the project is a challenge, as some of the funds provided are limited in time. As a result, funding is limited to 3 years, and it is unclear how funding can be secured after that. The dean considers the cost–benefit ratio to be reasonable and necessary for the successful implementation of the innovative teaching approach. She emphasizes that a sound evaluation of the long-term effects will only be possible after extensive testing: "You have to implement something to be able to evaluate it" (Interview with Prof. Ruhmland, 2024). This underscores the need for a science-driven approach to innovation in higher education, in which investments must first be made in order to conduct an evidence-based assessment of effectiveness.

The dean's perspective and statements confirm the two sub-hypotheses, leading to the acceptance of the third hypothesis. The dean considers the costs of implementation at this stage to be justified and sees positive effects in the short and long term, which will come to light as a result of successful implementation.

4.4 Hypothesis 4: the use of 360° videos in teaching leads to increased immersion, a heightened sense of flow and a positive overall assessment of the course by students

4.4.1 Students experience increased immersion through the 360° videos in teaching, so that they feel as if they are present in the case studies

The sense of presence is made up of a total of eight factors, which occur in different forms in the 360° videos, with scaling using a scale of 1–7 (1 = strongly disagree to 7 = strongly agree). The first factor (AZ) refers to attention, with the respondents in Fulda ($n = 10$) indicating with a mean value of $M = 5.53$ (SD = 0.675) that their attention was focused on the 360° videos. The second factor (SSM) is used to capture the "Spatial Situation Model." This model allows an assessment of the extent to which students were able to comprehend and feel the situation. The mean value here is $M = 5.9$, the standard deviation is SD = 0.8. The third factor (SPSL) aims to survey self-localization in the context of spatial presence within the 360° videos. In this context, the students confirmed a localization in these ($M = 4.78$; SD = 1.4). The fourth factor (SPPA) focuses on the potential activities of the students within the 360° video teaching situation. However, it can be seen that the students were only able to a limited extent to perceive possible interactions by means of controlling the media ($M = 3.85$; SD = 1.5). The fifth factor (INV) is used to assess the higher cognitive demand or involvement in the content. The respondents

perceive this consistently with the mean value of $M = 5.2$ (SD = 1.12). The sixth factor (SoD) measures the willingness not to believe the perceived reality. The items were inverted for this purpose, so that the evaluation is also carried out as for the other factors. It can therefore be stated that the tendency not to believe what is perceived is only present to a limited extent ($M = 5.1$; SD = 0.8). The last two factors capture the presence of interest as well as the ability of the respondents to feel spatially present in the 360° videos. The seventh factor (DSI) is used to measure the existing interest in the topic of the 360° videos and VR. It turns out that such interest is only present to a limited extent ($M = 3.26$; SD = 1.19). The eighth factor (VSI) demonstrates that the respondents have a significantly developed spatial sense or attribute this to themselves ($M = 4.95$; SD = 1.23). The students' experience of presence was recorded and yielded a total mean value of $M = 4.82$ (SD = 0.59). This value confirms that a sense of immersion was created by the use of the 360° videos in teaching and is confirmed by the students in a positive range of "applies."

4.4.2 The students experience an increased flow during the didactic use of the 360° videos

According to the available data, the flow experience can be divided into two factors. The first factor includes the smooth progress of the activity ($M = 5.18$; SD = 1.00), while the second factor represents the absorption in the activity ($M = 5.77$; SD = 0.73). The students also confirmed the occurrence of flow experiences in the teaching scenario, with an average value of $M = 5.42$ (SD = 0.8). In the present calculation, the factor of concern was not considered, which only occurred in the sample in aspects with a mean value of $M = 2.23$ (SD = 0.99). The factor of fit was also not included in the calculation because on the corresponding scale, the answer "exactly fitting" corresponds to the scale value 4 and the scale values 1 = low and 7 = high. The students rated the fit as exactly fitting with $M = 4.03$ (SD = 0.48). Accordingly, the sub-hypothesis is clearly confirmed, indicating that the students experience flow.

4.4.3 The students rate the use of 360° videos as positive for understanding and engaging with the teaching content

The students express a positive opinion about the use of 360° videos in teaching. The students evaluate the framework data of the 360° videos as follows: The technical quality of the videos is perceived as optimally designed with an average rating of $M = 5.00$ (SD = 1.71). The comprehensibility of the language in the videos is also rated as very good, with an average rating of $M = 5.7$ (SD = 1.41). The technical implementation of the viewing environment was rated with a mean value of $M = 5.4$ and a standard deviation of SD = 1.26. Likewise, the user-friendliness of the software was rated with a mean value of $M = 5.2$ and a standard deviation of SD = 1.54, as well as the hardware compatibility with a mean value of $M = 5.1$ and a standard deviation of SD = 1.66 ($n = 10$). Furthermore, the aspects of the meaningfulness of the 360° videos in teaching are confirmed, so that the 360° videos contribute to the understanding of the content ($M = 6.7$; SD = 0.48), the 577 environment is realistic ($M = 6.3$; SD = 0.48) and the embedding of VR in the event makes sense ($M = 6.7$; SD = 0.48). The students rate the use of the VR glasses overall as "good" ($M = 5.3$; SD = 0.67), their satisfaction with the effort required to use the VR as "good" ($M = 5.3$; SD = 1.25) and the learning success using VR glasses with the grade "very good" ($M = 5.6$; SD = 0.51). Consequently, the sub-hypothesis can be considered fully confirmed, since the students rate the use as more than appropriate.

Likewise, the fourth hypothesis above can also be proven in the three aspects (immersion, flow experience and overall assessment) with the help of the confirmed sub-hypotheses, in that these occur positively in the application of the 360° videos at the Fulda site. Even if the limited sample size does not allow for a clear conclusion here, this can be supported in the following hypothesis with the help of the comparative data from the Münster site.

4.5 Hypothesis 5: the results of the students' evaluations are similarly positive. This is in line with the previous use of 360° videos at the Münster location

The implementation of the teaching approach at the university site in Fulda makes it possible to compare the results of the students. The two samples have different proportions (Münster: $n = 261$; Fulda: $n = 10$), which makes it possible to compare the initial data from the Fulda site with the data from the fully evaluated Münster site. This comparison will provide insight into the extent to which the implementation has the same effects on students as at the original site in Münster (Table 3).

4.5.1 Students at both campuses show similar levels of immersion experience

The immersion scores of the two locations are very similar in the individual factors as well as in the overall perspective, with only deviations in the range of $M = +/-0.44$ observed for the means. This is the case for the spatial visualization factor, which is directly influenced by the characteristics of the respondents and only indirectly by the teaching approach. Overall, there are no major differences between the two sites, and the immersion effects of the two sites are comparable. The sub-hypothesis can therefore be confirmed by the available immersion data, which show that both locations produce the immersion effect to a similar extent (Table 4).

4.5.2 Students at both university locations show similar values for flow experience

The flow experience can be confirmed in the overall analysis (Flow_I_II) at both locations and shows mean values in the range of $M = 5.12$ in Münster and $M = 5.42$ in Fulda. These values show that the teaching approach, regardless of the location, evokes the flow experience and that the students confirm this in a similar spectrum. A larger deviation can be seen in the individual factors of the flow experience, which is present in the factor "FII," the absorption in the activity. The implementation in Fulda results in a higher value for this factor, which represents a deviation from the mean of +0.96. The deviation indicates that the smaller sample in the Fulda implementation experienced a higher absorption in the teaching approach. In summary, in addition to these better initial results, there were no major deviations in Fulda, so that the sub hypothesis can also be confirmed and the flow experience is evoked in a similar spectrum at both locations.

4.5.3 The students at both locations evaluate the overall didactic approach as similarly positive

The structure was implemented in the two seminars evaluated at the Fulda location in exactly the same way as at the Münster location, with the Münster employees also participating in the implementation of the seminars in Fulda. At both locations, the teaching approach using 360° videos was rated positively in the evaluation, so that the overall assessment of the use, the satisfaction with the effort and the learning success through the use of the VR glasses were rated as good. In the individual aspects of the overall evaluation of the teaching approach, only a few items means showed worse results at the Fulda location than at the Münster location. These are the items that the technical quality of the videos was optimal (Fulda: $M = 4.50$; SD = 1.71; Münster: $M = 5.04$; SD = 1.26), the user friendliness of the software (Fulda: $M = 5.2$; SD = 1.54; Münster: $M = 5.70$; SD = 0.98) and hardware (Fulda: $M = 5.10$; SD = 1.66; Münster: $M = 5.68$; SD = 0.98) as well as the technical implementation of virtual reality (Fulda: $M = 5.40$; SD = 1.26; Münster: $M = 5.62$; SD = 1.05). It is noticeable that the technical conditions for the 360° videos were rated slightly worse in Fulda than in Münster.

For a total of four items, the mean values show larger differences >0.5, which were rated better in Fulda than in Münster. The first item is that the speakers in the video were convincing (Fulda: $M = 6.2$; SD = 0.91; Münster: $M = 5.50$; SD = 1.09). The second item is that the respondents were able to decide for themselves how and when they wanted to learn from the 360° videos (Fulda: $M = 4.89$; SD = 1.61; Münster: $M = 3.92$; SD = 1.66). For the third item, more people in Fulda agreed that the videos contained interactive elements (Fulda: $M = 5.10$; SD = 2.07; Münster: $M = 3.07$; SD = 1.76), and finally that working in VR contributed to understanding (Fulda: $M = 6.70$; SD = 0.48; Münster: $M = 6.00$; SD = 1.12). Considering the individual items together, the sub hypothesis is confirmed in that the results are also very positive and, if only in small deviations, occur below one scale value.

The comparison of the two locations shows that the students experience the teaching approach in a comparable way and see and confirm the added value of the approach regardless of the location. This also confirms the fifth hypothesis, so that the 360° video teaching approach can generate transferable added value and effects for students.

5 Discussion

The present study is dedicated to the question of which steps are necessary for the successful implementation of a teaching approach based on 360° videos developed at the University of Applied Sciences Münster at another university. The focus is on highlighting the steps and identifying the key factors that contribute to the success of this implementation in teaching practice. The results of the study show that the successful implementation of an innovative teaching approach involves four essential steps.

Steps needed for successful implementation:

1 *Preparation:* implementation requires careful preparation, including an initial needs analysis of technical requirements. This is done to understand the specific needs and expectations of the new university and its stakeholders, and to identify the course content that is covered by existing 360° videos and that requires new 360° videos. The added value of 360° videos in combination with VR glasses, as described in this article, must be planned in a well-thought-out framework. To do this, it is necessary to consider in advance which aspects of the module content require a better theory-practice transfer and where aspects of perspective taking and immersion can be useful for understanding the content. The videos are always created in the course in direct collaboration with the teacher (Averbeck et al., 2024, p. 115), so that the content of the videos never stands alone but is always framed in the educational context. Framing is particularly important in the case of ethically critical examples of stigma and stereotypes, as these can only be used as learning material if they are classified and critically reflected upon by the teacher. In seminars, there is usually a viewing phase, then small group work, followed by analysis in plenary and finally reflection and professional classification of the content (Averbeck et al., 2024, p. 116).
2 *Training:* two key aspects are, first, a broad introduction to the approach for teachers to stimulate their interest, which can then be built upon in the training sessions. Second, comprehensive training for teachers to promote familiarity with the technology and the possibilities of 360° video. The training should

TABLE 3 Comparison of the immersion values at the locations.

Factor	Descriptive statistics									
	Münster					Fulda				
	M	SD	Min	Max	*n*	M	SD	Min	Max	*n*
AZ	5.61	0.92	1.0	7.0	259	5.53	0.67	4.7	7.0	10
SSM	5.81	0.84	1.0	7.0	257	5.90	0.86	4.3	7.0	10
SPSL	4.89	1.20	1.0	7.0	259	4.78	1.40	2.5	6.7	10
SPPA	3.50	1.33	1.0	7.0	257	3.85	1.51	2.3	6.8	10
HKB	5.10	0.98	1.0	7.0	256	5.22	1.12	3.3	7.0	10
SoD	5.19	0.71	3.67	7.0	259	5.10	0.80	4.0	6.3	10
DSI	3.60	1.25	1.0	7.0	257	3.27	1.19	1.5	5.0	10
VSI	4.51	1.33	1.0	7.0	258	4.95	1.23	3.5	7.0	10
MEC	4.78	0.58	2.25	6.35	241	4.83	0.60	4.0	6.1	10

AZ = attention allocation, SSM = spatial situation model, SPSL = spatial presence: self location, SPPA = spatial presence: possible actions, HCI = higher cognitive involvement, SoD = suspension of disbelief, DSI = domain specific interest, VSI = visual spatial imagery, M = mean, SD = standard deviation, Min = minimum, Max = maximum, *n* = sample size, scale values = 1–7.

TABLE 4 Comparison of flow experience at the sites.

Factor	Descriptive statistics									
	Münster					Fulda				
	M	SD	Min	Max	*N*	M	SD	Min	Max	*n*
FI	5.34	0.90	2.5	7.0	253	5.18	1.00	3.5	7.0	10
FII	4.82	1.06	1.75	7.0	257	5.78	0.73	4.5	6.8	10
FIII	2.52	1.12	1.0	5.67	242	2.23	0.99	1.0	3.7	10
FIIII	3.90	0.69	1.0	5.67	257	4.03	0.48	3.3	5.0	10
Flow_I_II	5.13	0.83	2.2	7.0	251	5.42	0.81	4.4	6.9	10

FI = smooth automatic progression, FII = absorbedness, FIII = concern component, F_I_II = flow total, M = mean, SD = standard deviation, Min = minimum, Max = maximum, *n* = sample size, scale values = 1–7.

be hands-on and give teachers the opportunity to try and adapt the approach to their own classrooms. This may increase the acceptance and the feeling of competence in using the new technology, as suggested by the results of hypothesis 1.

3 *Pilot phase:* the introduction of the teaching approach should begin with a pilot phase, in which teachers can try out the 360° videos in their seminars under supervision and receive support in linking them didactically with existing content. In this phase, initial experiences can be gathered and possible adjustments can be made to optimally integrate the approach into existing teaching practice.

4 *Evaluation:* ongoing evaluation of implementation is essential to measure the success of the approach and to make improvements. Feedback from students and teachers should be systematically collected and used to further develop the approach and the implementation strategy.

The key factors for implementation identified in the course of answering the hypotheses were acceptance, feasibility, dissemination, and sustainability. Support for adoption by the university and the department was also identified as a key factor, particularly emphasized from the department's perspective in the interview with the dean. As emphasized by Fixsen et al. (2005, p. 15), institutional support can enable the sustainable implementation of innovations in practice.

In terms of technical and human resources, sufficient technical equipment with VR glasses as well as human resources for maintenance and support are essential for successful implementation. The provision of resources, as in the case of the Dean's mixed funding from several projects and programs, contributes significantly to the long-term integration of the approach. The adaptability and flexibility of the teaching approach is also crucial. It must be flexible enough to be adapted to the specific needs of each university. This requires an open mind and a willingness to continuously develop the approach.

The present study on the implementation of 360° videos in higher education in social work has some limitations that should be considered when interpreting the results. A major limitation is the small sample size at the Fulda site (student feedback: $n = 10$; faculty: $n = 2$), which limits the statistical significance of the study and precludes the generalizability of the results.

Another limitation of the study is the limited amount of qualitative data. Although an expert interview was conducted with the dean of the faculty at Fulda University of Applied Sciences, which provided valuable insights from an organizational and institutional perspective, more comprehensive qualitative data from students and teachers could have opened up new aspects. The expert interview with the dean, however, allowed the study to examine the implementation costs, sustainability, and diffusion of the teaching approach from a strategic perspective.

Furthermore, the study did not examine the long-term effects of the use of 360° videos at Fulda University of Applied Sciences. Therefore, it remains to be seen whether the positive effects will be sustained in the long term. A long-term evaluation could provide valuable insights into sustainability and help evaluate the implementation of the teaching approach. Despite its limitations, the present study provides a valuable basis for the further development and dissemination of the 360° video teaching approach. The findings can help to optimize implementation strategies and further promote the acceptance and use of this technology in education.

6 Conclusion and future research

The present study suggests that 360° video is a promising tool for enriching university teaching. Future research should focus on expanding the sample size and using qualitative research methods to gain a more complete picture of the effects and challenges of this teaching approach.

Longitudinal studies would be valuable to examine the sustainability of the learning effects achieved and to understand how the use of 360° videos influences long-term teaching quality and learning outcomes. In addition, research on the impact on graduates' professional practice could provide insights into how well the transfer from theory to practice actually occurs and what adjustments may be needed to further increase the effectiveness of the approach.

Overall, the study suggests that wider implementation of the teaching approach at other universities could be useful. The findings could serve as a basis for the development of standardized implementation strategies to fully exploit the potential of 360° video in higher education. In addition, systematic research and documentation of the implementation process can help identify best practices and promote the acceptance and use of this technology in education.

Data availability statement

The datasets presented in this study can be found in online repositories. The names of the repository/repositories and accession

number(s) can be found at: https://openedu-rlp.de/edu-sharing/components/collections?id=f1724980-0ab1-46f8-b542-9ae8dcca8b22.

Ethics statement

The studies involving humans were approved by Ethics Commission of the University of Münster. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study. Written informed consent was obtained from the individual(s) for the publication of any potentially identifiable images or data included in this article.

Author contributions

FA: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Resources, Software, Visualization, Writing – original draft, Writing – review & editing. TU: Supervision, Writing – review & editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Generative AI statement

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References

Afifah, S., Riska, A. K., Ratu Perwira, N. H., Ratu Perwora, N. H., and Sucipto, L. (2024). The implementation of virtual reality in teaching abstract mathematical concepts at the elementary school level. *Int. Seminar Student Res. Educ. Sci. Technol.* 1, 339–351.

Averbeck, F., Leifeling, S., Müller, K., and Schoenfelder, T. (2024). Virtual reality in social work teaching - two approaches to 360° videos and collaborative working. *Electron. J. E-Learn.* 22, 111–123. doi: 10.34190/ejel.21.6.3225

Babaita, A. O., Kako, M., Teramoto, C., Okamoto, M., Hayashi, Y., Ohshimo, S., et al. (2024). Face-to-face versus 360° VR video: a comparative study of two teaching methods in nursing education. *BMC Nurs.* 23:199. doi: 10.1186/s12912-024-01866-4

Chao, Y.-P., Chuang, H.-H., Hsin, L.-J., Kang, C.-J., Fang, T.-J., Li, H.-Y., et al. (2021). Using a 360° virtual reality or 2D video to learn history taking and physical examination skills for untergraduate medical students: pilot randomized controlled trial. *JMIR Serious Games* 9:13124. doi: 10.2196/13124

Chen, M. R. A., and Hwang, G. J. (2022). Effects of experiencing authentic contexts on English speaking performances, anxiety and motivation of EFL students with different cognitive styles. *Interact. Learn. Environ.* 30, 1619–1639. doi: 10.1080/10494820.2020.1734626

Davidsen, J. G., Larsen, D. V., Rasmussen, S., and Paulsen, L. (2022). Collaborative 360° virtual reality training of medical students in clinical examinations. *Medical Educ. Online* 29:2412398. doi: 10.21203/rs.3.rs-2148506/v1

Della Libera, C., Simon, J., Laroi, F., Quertemont, E., and Wagener, A. (2023). Using 360-degree immersive videos to assess multiple transdiagnostic symptoms: a study focusing on fear of negative evaluation, paranoid thoughts, negative automatic thoughts, and craving. *Virtual Reality* 27, 3565–3580. doi: 10.1007/s10055-023-00779-y

Deng, H., Du, Y., Cai, Q., and Yang, Y. (2023). Influence of intelligent technology applications on the learning effect: virtual reality as an example. *Int. J. Emerg. Technol. Learn.* 18, 4–18. doi: 10.3991/ijet.v18i10.38713

Ferdig, R. E., Kosko, K. W., and Gandolfi, E. (2023). Exploring the relationships between teacher noticing, ambisoniv audio, and variance in focus when viewing 360 video. *Educ. Tech. Res. Dev.* 71, 881–899. doi: 10.1007/s11423-023-10215-2

Feuerstein, M., and Neumann, G. (2022). "Ein konzeptionelles Modell zur Gestaltung von 360°-video Lehr-Lernszenarien im Kontext der Hochschullehre [a conceptual model for designing 360° video teaching and learning scenarios in the context of university teaching]" in 360°-videos in der empirischen Sozialforschung. Ein interdisziplinärer Überblick zum Einsatz von 360°-videos in Forschung und Lehre [60° videos in empirical social research. An interdisciplinary overview of the use of 360° videos in research and teaching]. eds. J. Windscheid and B. Gold (Wiesbaden: Springer VS), 65–101.

Fixsen, D., Naoom, S., Blase, K., Friedman, R., and Wallace, F. (2005). Implementation research: A synthesis of the literature. Tampa, FL: University of South Florida.

Grimshaw, J., Eccles, M., Thomas, R., and MacLennan, G. (2006). Toward evidence-based quality improvement: evidence (and its limitations) of the effectiveness of guideline dissemination and implementation strategies 1966–1998. *J. Gen. Intern. Med.* 21, 14–20. doi: 10.1111/j.1525-1497.2006.00357.x

Kuboth, C., and Aich, G. (2022). Kriterien für erfolgreiche Multiplikator*innen-Schulungen als Grundlage für die Implementierung eines Gesprächstrainings in der Lehrer*innenfortbildung. *Psychol. Erzieh. Unterr.* 69, 90–104.

Meudt, S., Zeuch, N., Neuber, L., and Souvignier, E. (2020). "Kurzskalen zur Erfassung des Transfererfolgs von Leseförderkonzepten in der Schulpraxis [short scales for measuring the transfer success of reading promotion concepts in schools]" in Forschungsinstrumente im Kontext institutioneller (schrift-) sprachlicher Bildung [research instruments in the context of institutional (written) language education]. eds. K. Machowiak, C. Beckerle, S. Gentrup and C. Titz (Bad Heilbrunn: Julius Klinkhardt), 141–157.

Michie, S., Fixsen, D., Grimshaw, J., and Eccles, M. (2009). Specifying and reporting complex behaviour change interventions: the need for a scientific method. *Implement. Sci.* 4:40. doi: 10.1186/1748-5908-4-40

Mystakidis, S., and Lympouridis, V. (2023). Immersive learning. *Encyclopedia* 3, 396–405. doi: 10.3390/encyclopedia3020026

Neyer, F., Felber, J., and Gebhardt, C. (2012). Entwicklung und Validierung einer Kurzskala zur Erfassung von Technikbereitschaft development and validation of a short scale to measure technology readiness. *Diagnostica* 58, 87–99. doi: 10.1026/0012-1924/a000067

Petermann, F. (2014). Implementationsforschung: Grundbegriffe und Konzepte [implementation research: basic terms and concepts]. *Pychol. Rundschau* 65, 122–128. doi: 10.1026/0033-3042/a000214

Pirker, J., and Dengel, A. (2021). The potential of 360-degree virtual reality videos and real VR for education – a literature review. *IEEE Comput. Graph. Appl.* 22, 76–89. doi: 10.1109/MCG.2021.3067999

Rambaree, K., Nässen, N., Holmberg, J., and Fransson, G. (2023). Enhancing cultural empathy in international social work education through virtual reality. *Educ. Sci.* 13:507. doi: 10.3390/educsci13050507

Ranieri, M., Luzzi, D., Cuomo, S., and Bruni, I. (2022). If and how do 360° videos fit into education settings? Results from a scoping review of empirical research. *J. Comput. Assist. Learn.* 38, 1199–1219. doi: 10.1111/jcal.12683

Rheinberg, F., Vollmeyer, R., and Engeser, S. (2003). "Die Erfassung des Flow-Erlebens [Recording the flow experience]" in Diagnostik von motivation und Selbstkonzept (tests und trends N.F. 2) [diagnostics of motivation and self-concept (tests and trends N.F. 2)]. eds. J. Stiensmeier-Pelster and F. Reinberg (Göttingen: Hogrefe), 261–279.

Roche, L., Cunningham, I., and Rolland, C. (2025). What is and what is not 360° video: conceptual definitions for research field. *Front. Educ.* 10:1448483. doi: 10.3389/feduc.2025.1448483

Rosendahl, P., and Wagner, I. (2023). 360° videos in education – a systematic literature review on application areas and future potentials. *Educ. Inf. Technol.* 29, 1319–1355. doi: 10.1007/s10639-022-11549-9

Schrader, J., and Hasselhorn, M. (2020). Implementationsforschung im Bildungsbereich Z. Erziehungswiss. *J. Educ. Sci.* 23, 1–8. doi: 10.1007/s11618-020-00929-x

Ruhmland, M. (2024). Personal interview. (Accessed November 5, 2024).

Schwinger, M., Kärchner, H., and Gehle, M. (2021). Modularer Fragebogen zur evaluation von digitalen Lehr-Lern-Szenarien (Lehrendenversion und Studierendenversion). [modular questionnaire for evaluating digital teaching and learning scenarios (teacher and student versions)] Available online at: https://fragebogen-hochschullehre.de/ (Accessed March 1, 2025).

Škola, F., Rizvic, S., Cozza, M., Barbieri, L., Bruno, F., Skarlatos, D., et al. (2020). Virtual reality with 360-video storytelling in cultural heritage: study of presence, engagement, and immersion. *Sensors* 20:5851. doi: 10.3390/s20205851

Souvignier, E., and Philipp, M. (2016). "Implementation – Begrifflichkeiten, Befunde und Herausforderungen [implementation – concepts, findings and challenges]" in Implementation von Leseförderma ßnahmen. Perspektiven auf Gelingensbedingungen und Hindernisse [implementation of reading promotion measures. Perspectives on success factors and obstacles]. eds. M. Philipp and E. Souvignier (Münster: Waxmann), 9–22.

Stelzmann, D., Toth, R., and Schieferdecker, D. (2022). "360°-(3D-)videos in forschungsorientierten Lehrprojekten – Ein medienpsychologisches Fallbeispiel [360° (3D) videos in research-oriented teaching projects – a case study in media psychology]" in 360°-videos in der empirischen Sozialforschung. Ein interdisziplinärer Überblick zum Einsatz von 360°-videos in Forschung und Lehre [360° videos in empirical social research. An interdisciplinary overview of the use of 360° videos in research and teaching]. eds. J. Windscheid and B. Gold (Wiesbaden: Springer Fachmedien), 193–211.

Sunday, A., Agbo, F., and Oyelere, S. (2023). Formative evaluation of immersive virtual reality expedition mini-games to facilitate computational thinking. *Comput. Educ. X Reality* 2:100016. doi: 10.1016/j.cexr.2023.100016

Veber, M., Pesek, I., and Abersek, B. (2023). Assesment of supporting visual learning technologies in the immersive VET cyber-physical learning model. *Educ. Sci.* 13:608. doi: 10.3390/educsci13060608

Vorderer, P, Wirth, W., Gouveia, FR, Biocca, F, Saari, T, and Jäncke, F (2004). MEC spatial presence questionnaire (MECSPQ): short documentation and instructions for application. Report to the European Community, project presence: MEC (IST-2001-37661). Available at: http://www.ijk.hmt-hannover.de/presence