Exploring the Significance of 360-Degree Video Technology on Fieldwork Learning in Higher Education: Students' Perspectives

Leandro Navarro Hundzinski[1], Fathima Assilmia[1], Keiko Okawa[2] and Le Thao Chi Vu[3]
[1]*Global Research Institute, Keio University, Japan*
[2]*Graduate School of Media Design, Keio University, Japan*
[3]*Faculty of Policy Management, Keio University, Japan*

Keywords: Fieldwork Education, 360-Degree Camera, 360-Degree Video.

Abstract: This paper discusses the use of 360-degree cameras in two distinct fieldwork learning activities in higher education. This study aims to identify specific contributions of 360-degree video and its relation to the fieldwork learning process, from the perspective of students and when compared to other tools and methods for data collection. A mixed-methods approach was utilized to understand students' learning process, obtaining data by survey, analysis of results from in-class activities, and observational analysis. In total, 83 students participated in these activities. The two activities showcase how 360-degree video can be utilized by students in relation to fieldwork activities, to collect data and to back their claims with evidence. By investigating common themes on self-reports written by the students, the unique contributions of 360-degree camera on field observation and subsequent approaches to data analysis are highlighted when compared to other tools and methods. The understanding of these unique contributions points bring us closer to identifying specific learning components for the design of educational programs that can benefit from this technology.

1 INTRODUCTION

Fieldwork can be considered a fundamental activity in developing real-world experience in higher education. It is a multilayered practice in which students develop observational skills, evidence-based mindset, critical thinking, and social awareness. Considering its versatility, developing a fieldwork mindset based on the practical application of research methods can be a challenging task for students.

To address this, fieldwork education blends topics and components of several different areas of human knowledge. This includes utilizing new technologies, such as 360-degree cameras, which in turn might allow data to be captured in different formats and that lead to different interpretations. Thus, this research aims investigate the benefits enabled by 360 technology during field observation and as a versatile and rich media format for fieldwork.

This research aims to address the following question: What are the unique contributions of 360-degree video technology on higher education students' fieldwork learning, especially when compared to other tools and methods available to collected and process field data? To address this, we will focus on the specific impact of these technologies based on the student's perspective. As mentioned by (Fedesco et al., 2020), much of the existing literature related to field-based learning in higher education focuses on specific subjects. We consider a multidisciplinary approach to fieldwork learning and for the application of these technologies instead, which might illustrate different uses than those in more specialized subjects.

The activities in this research took place in a higher education class at Keio University, Japan. The class called Asia Workshop aims to facilitate students' first-hand observations of problems and encourage original interpretations of collected data. The topics covered aim to be expansive and students come from different undergraduate courses and countries.

2 LITERATURE REVIEW

2.1 Fieldwork as a Learning Practice in Higher Education

As described by Pole and Hillyard (2016), fieldwork is a "total experience aimed at capturing meaning".

Hundzinski, L., Assilmia, F., Okawa, K. and Vu, L.
Exploring the Significance of 360-Degree Video Technology on Fieldwork Learning in Higher Education: Students' Perspectives.
DOI: 10.5220/0012707200003693

In *Proceedings of the 16th International Conference on Computer Supported Education (CSEDU 2024) - Volume 1*, pages 526-533
ISBN: 978-989-758-697-2; ISSN: 2184-5026

As such, this nature of fieldwork is aligned with the requirements for experiential learning to take place (Fedesco et al., 2020; Haipt, 1982; Lai, 1999).

The structure of fieldwork in higher education often provides a precious opportunity for students to reflect on their experiences, inducing learning based on self-reflection (Konishi, 2020). Self-reflection is a fundamental step in the process of experiential learning, as described by Kolb's et al. (2001) Experiential Learning Model: from a Concrete Experiences that leads to a Reflective Observation. Considering students' reflections on field experience, Takahashi et al. (2020) conducted a qualitative based on post-fieldwork reflection sheets, in which first-year university students' answers were analysed and 100 most frequently used words extracted. The authors found links between fieldwork activity with a "sense of discovery" (understand, know, and feel) and "encounters with people" (community and person), emphasizing students' experience in observing and understanding their surrounding environment during fieldwork (Takahashi et al., 2020).

By stimulating self-reflection, fieldwork galvanizes students with a self-driven need to improve themselves. Ito and Igano (2020) corroborate this argument, emphasizing that when self-evaluating, students felt improvements in critical thinking, problem-solving skills, and adaptability after joining the fieldwork programs. This positive development of transverse skills has been observed by several researchers concerning experiential learning (Villarroel et al., 2020). Student's perspective of improvement from participation in field activities plays an important role in their confidence. The increase in confidence, for example, can improve students' participation, and enjoyment in learning, give an experience-sharing mindset and increase their interest in goal-seeking (Akbari and Sahibzada, 2020).

2.2 Enhancing Field-Based Learning by the Use of Technology

When incorporated into fieldwork, technology can enhance learning by improving teaching strategies (Welsh et al., 2013). Lundmark et al. (2020) emphasize that students have a positive outlook on the use of technology during fieldwork activities, increasing their overall confidence. Those values are well-perceived by fieldwork education research, and the design and implementation of new modes of fieldwork activities with the usage of technology are frequently developed (Cliffe, 2017; Minocha et al., 2018).

Traditional fieldwork methods, such as ethnography, are seeing constant transformation with technological development. As Wieser (2015) states, "Technology as a tool for ethnographic fieldwork may act as a bridge between the objectivity of an event and the subjectivity in which this event was perceived, as both perspectives scaffold the construction of an account on processes of knowledge transformation". This illustrates how technology and traditional fieldwork methods can complement each other, instead of playing opposites. Ahlin and Li (2019) further discuss how information and communication technologies currently push for a reconsideration of the practice and concept of fieldwork, deeply influencing what can be considered a field site and how fieldworkers capture and see data from the field. Technology can enable fieldwork to be virtualized, enabling activities in a context beyond difficulties to access the field, but by structuring a different type of field activity (García-Comendador et al., 2022)).

As synthesised by Maskall et al. (2007), innovative technologies can be used in the context of higher education fieldwork. The foundational aspects are also perceived in recent technologies and new solutions, highlighting the continuous integration of technology and fieldwork over the years:

- Enhance students' preparedness.
- Connect the field to important information that can be accessed remotely.
- Capture and record events in the field in new formats.
- Be integrated in post-fieldwork assessment.

2.3 360-Degree Cameras: Capturing the Field

Commenting on the features of 360-degree video, Feurstein (2018) argues that it reduces the complexity of creating virtual environments, facilitating the adoption of this type of technology in educational settings. The 360-degree camera allows for capturing multiple viewing angles and perspectives, both for audio and video, while providing an engaging, realistic, and interactive output in the 360-degree environment (Lampropoulos et al., 2021). This feature of 360-degree video can provide excellent benefits in fieldwork, as its characteristics are relevant to observation and data collection in the field.

Tan et al.'s (2020) in-depth analysis of 360-degree video for teaching and learning is deeply linked to an understanding and appreciation of multimodal resources (language, text, gesture, etc.) and their connections to meaning in different contexts. The inclusion of 360-degree content for teaching-learning

is also believed to bring authentic and realistic scenarios for learning, provide opportunities for multi-perspective observation to take place, and enable individual learning (Rosendahl and Wagner, 2024). This is especially significant in the context of fieldwork, where many different elements contribute to forming a whole perspective on different fields and areas of knowledge.

Several researchers and educational institutions have utilized 360-degree pictures and videos to showcase field sites or disseminate field information for field workers. For example, the Stanford Doerr School of Sustainability (n.d.) established a platform where students can access field information by utilizing 360-degree images within a navigable virtual map. The Kyoto University ASEAN Centre (n.d.) utilizes 360-degree video shots in various fields, sharing them for viewing and navigation as a visualization of remote fieldwork activities.

Research on the use of 360-degree cameras in ethnography proposes a potential use of 360-degree cameras in fieldwork and data analysis (Tojo et al., 2021). Tojo et al. (2021) mention that the technology helps ethnographers focus on their subjective observation while the camera captures the objective data of the main situation and the surroundings in a less intrusive manner than conventional video recording. Another study on teacher-student-environment interactions used 360-degree video recording as the data collection method, and the author emphasizes the benefit of using this technology in observing complex interactions, in this case, educational settings (Svobodová, 2023). This could not be achieved with conventional recording, which offers a limited recording perspective. From the perspective of data analysis after collecting data in the field, Tojo also suggests that it can offer the opportunity for collaborative analysis and reinterpretation (Tojo et al., 2021).

3 DESIGN

3.1 Context

The two fieldwork activities to be described in this paper took part in the context of the higher education classes, one in 2022 and another in 2023. Two activities were held as a part of a fieldwork-education-oriented class called Asia Workshop, at Keio University, Japan.

Both activities aim to incorporate the practice of fieldwork to develop core research skills (observation, interpretation, substantiation, presentation and storytelling), together with transverse skills (critical thinking, teamwork, problem-solving skills, adaptability, multicultural interactions).

All participating students are undergraduate-level higher education students. In total, 83 students, from several different countries in Asia. They participated in the following activities with 360-degree cameras:

- Activity 1. Capturing the campus and Virtual Reality (VR) Viewing with 27 students at Asia Workshop 2022.
- Activity 2. Capturing the campus and in-depth data analysis with 56 students at Asia Workshop 2023.

For the activities, each student in the groups had their own tools/methods to do data collection on the field. This means, each student will have a unique method within that group to collect evidence.

3.2 Activity 1: Capturing the Campus and VR Viewing

This activity was conducted on two separate days, in mid-October of 2022. On the first day, students were separated into groups and asked to go around the campus and search for “Signs of Fall”. In total, 9 different groups were formed, with 27 students participating in this activity.

Figure 1: Student recording the field with a 360-degree camera.

While the topic was simple, students were asked to have sharp attention and detail, utilizing different methods for data collection. This was their first practice in data collection and field observation. The methods/tools that the students used to capture field data were:

- Note-taking.
- Sketching.
- Taking pictures and/or videos with a smartphone.
- Recording video with a 360-degree camera.

Each student in the group used a unique mode at the field, meaning, that in each group, there were no repeated forms to capture data from the field. Before going to the field, students wrote what they expected to see when searching for the "signs of Fall" on campus. After returning from the field and into the classroom, students were able to share the unique data types they captured with each other to draw their conclusions from. After discussion within their groups, their insights and findings were shared to all groups in class.

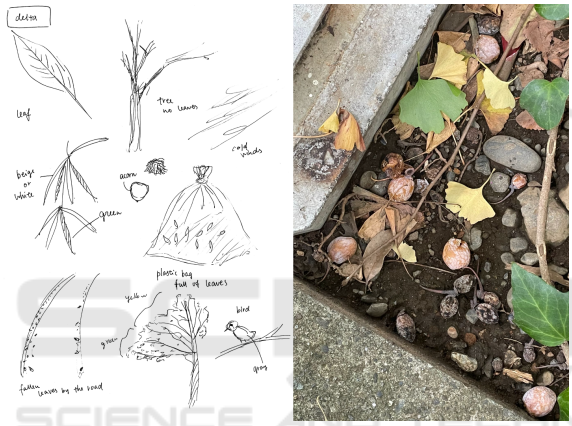

Figure 2: Different data collected from the same observation, by two different students within the same group.

Students self-reported their impressions on the data gathering activities on the first day. They reported on what they found in the field that was different or not covered by their initial imaginative exercise of imagining the field. To analyse their results on this first day, we analysed the different types of tools they collected in the field, and how they described the findings (new signs of autumn). Interestingly, there was a certain similarity on how the students described their findings based on the tools/methods that they used on the field.

By categorizing the self-reports from students using the same tools/methods, some common points or tendencies became apparent. For example, students utilizing 360 cameras on the field referenced more to sounds and less tangible perceptions, such as sensory information. Table 1 compiles these common self-reported themes listed by students from different groups that were using the same type of tools/methods to collect data on the field, highlighting different perceptions:

Table 1: Common self-report themes based on tools/methods for data collection in Activity 1.

Tools / Methods	**# of students**	**Common self-report themes**
360-degree Video	9	Focus on concepts (flavour, changes in clouds and sky), sounds (loud birds, crunching leaves, crickets) and environmental conditions (humidity, smell)
Photos (Smartphone)	9	Changes of state over time, with an emphasis on change of colors on leaves and leaves falling from the trees
Sketches	8	Visual details, such as passersby's outfits and tangible objects like fallen leaves and mushrooms
Notes	1	Sensation and feeling ("feeling cold")

While this comparison might include personal and subjective perspectives, the common self-report themes could indicate a specific benefits of unique forms to observe and collect data. Understanding the different nature and value of each tool/method can contribute to finding specific focuses and contributions. This could assist in highlighting the potential of 360-degree cameras in the fieldwork setting, without disregarding the usefulness and intrinsic value of other data collection methods.

On the second day of the activity, which took two weeks after the first part, students were able to revisit the materials they collected and watch their 360-degree video footage on Meta Quest 2 VR headsets. Students reported their impressions of the field based on the data they could reanalyse on the second day, and then compared with what their original impression was on the first day. This enabled them to understand how each format of collecting data assisted in their understanding of the field.

Overall, students highlighted the new findings they saw and perceived with the footage in VR, especially focused on how they could look at things from different angles, helping to notice: the number of leaves on the ground, clothes those passing around were wearing, sky coloration, sounds of animals and wind. Students reported different impressions about the experience.

Referring to the sense of presence, one student "VR allows you to experience the physical environ-

ment and brings back vivid memories of the field.". Another student said they could see "high parts of trees which I could not see with my own eyes", showcasing one of the potentials of 360-degree cameras. A third student reported on how they could capture nuanced information that was helpful afterwards: "The video captured the tone of how people respond, facial expressions, and body language. Some people were rubbing their hands which shows the autumn's temperature. I remembered the interviewee's answer, but not so much about people's expressions."

Students' findings from this activity illustrates some of the values of 360-degree content for fieldwork. By analysing the data afterwards, they could enrich their findings. However, it is also important to highlight the shortcomings of the technology, such as details not being clear enough. These difficulties should be considered when utilizing 360-degree video, as in this case other tools, such as traditional photography, could be better on specific situations where different aspects need to be emphasized.

3.3 Activity 2: Capturing the Campus and In-Depth Data Analysis

For the first day of activity 2, 11 different groups were formed, with 56 students participating on two separate days in mid-October of 2023. Just like activity 1, on the first day, students were separated into groups and asked to go around the campus. This time, however, the analysis of the field was more nuanced, instead of focusing on a simpler topic to enable the analysis of the different capturing tools and methods. For activity 2, students went to their field on the campus and looked for evidence that would indicate that their campus is: a Japanese, an Asian, or a Global campus.

Figure 3: Students exploring the campus in Activity 2.

The textual data on Figure 4 below are not all clearly readable, but were kept as is to keep visual fidelity on how it was captured by the students:

Figure 4: Example of different data types presented by students, showcasing evidence of global elements on campus.

The notes refer to road mirrors, street signs, jasmine plant, wifi router from cisco, roundabout). The other data are from different students within the same group, which were collecting data on the same location and shows what was captured by photography, sketching and with the 360 camera.

In total, 49 out of the 56 students participated in data collection in the field. The absent students worked online with their group analysing the captured data and presenting it to the class. Table 2 expands on the data presented on Table 1. It draws the data from students self-reports on their field experience on campus, describing their findings based on the data they collected to find evidences for the fieldwork focus (is the campus Japanese, Asian or Global).

Table 2: Common self-report themes based on tools/methods for data collection in Activity 2.

Tools / Methods	# of students	Common Self-Report Themes
360-degree Video	11	Cultural atmosphere, visual and sensory perception, nature and surroundings
Photos	11	Objects as cultural artifacts, architectural styles, visual documentation of campus life
Video	11	Multilingual environment, how buildings are utilized (people behavior on spaces), culture in motion (students eating with chopsticks, fallen autumn leaves being cleaned).
Notes	11	In-depth analysis and descriptive details, personal reflections and interpretations
Sketches	5	Cultural objects, clear identified items and information associated with the sketch (pictogram, distinct shapes or objects)

While this analysis of common points can have some biases from the individual students experiences with utilizing the tools/methods to capture data, they seem to indicate an overall direction in which the students perceive the field by using different approaches. Particularly on how students feel on the field while capturing data with 360-degree cameras, students that used these devices tended to focus more on their sensory perceptions, overall atmosphere and surroundings. This unique point associated to these devices highlight a possible potentiality in utilizing it on the field when compared to other options (such as photos being more focused on visuals and tangible things, traditional video focused on motions, notes focused on in-depth and personal interpretations, and sketches transmitting visual, simplified interpretative data). These initial distinctions can provide directions for future research and for the design of more tailored fieldwork learning experiences for students.

For the second day of the activity, the students would have one week in between to analyse their collected data and reach their conclusions. Like activity 1, each student group also utilized different tools/methods to capture the field. This time, however, they utilized those different types of data to help them formulate their findings in a group activity, by merging all data collected within their groups. In total, 11 different groups were formed, with 56 students participating in this activity.

All 11 groups utilized 360-degree video content to revisit the field and find extra evidence, linking it with the other data types. The groups did not need to follow specific guidelines on how to use the data, so each group had their own approaches. Some groups used the 360-degree video to show the field in real-time during their presentations, guiding the audience while navigating and describing specific cuts and short scenes. Other groups shared screenshots of the 360-degree data, while others just freely described how the 360-degree data contributed to their own findings and fieldwork experience.

The results of this activity were centered on students' presentation on the second day, and how they utilized different data formats to gather evidence and reach a conclusion about the research question (if the campus was Japanese, Asian, or Global). Most of these were self-reports from the students during the presentation session and their explanations of how they utilized the data

The following remarks from students during the presentation represent their personal experiences with the 360-degree camera, and how they feel this type of technology contributes to their field exploration process.

Finding New Information. Several groups reported finding new things that they did not notice before when watching the 360-degree footage. One specific mention is how one group noticed the brands of cars in the parking lot and noticed that many were imported. This led them to further investigate the footage and make claims related to international components on campus.

Seeing Others in the Field (and Themselves). One student utilizing the 360-degree camera reported that she felt she was able to look at what her teammates were doing during the data collection process, as the 360-degree video recording process was quite passive (she just kept recording everything). As mentioned by her, she only paid attention to that because the type of technology allowed her to do it. Afterwards, she revisited the 360-degree video and was able to look at herself as well, and how she behaved during the data collection process. This unique aspect of 360-degree cameras enables the fieldworkers to see themselves during the data collection process, which can lead to

unique interpretations and analyses of the field activities. She mentioned a feeling of having "behind-the-scenes" from the footage.

Privacy Concerns. One of the students raised the concern of feeling guilty when shooting because, with the 360-degree camera, she was capturing everything around, including people who might not want to appear in the video. This means that people and all surroundings are captured in the video, and the student realized this. This raises an important point, as the content might need to be filtered for public sharing.

4 FINDINGS

The design of fieldwork activities for students to collect evidence on campus with different tools/methods enabled us to highlight different perceptions on the applicability and usefulness of 360-degree video for fieldwork learning.

Tables 1 and 2 provide a direction to better understand the nuances and applicability of each tool and method in fieldwork. While this paper focused on exploring the significance of 360-degree video technology, other tools and methods also have their own unique contributions for fieldwork learning in higher education. This became apparent when comparing the students' self-reports and could point to a direction that needs to be further researched. Understanding the unique benefits and limitations of each mode could help to improve the design of fieldwork learning activities for students.

Another point to be considered is on how students felt natural observing the field while using the 360-degree cameras. There was a general consensus from students utilizing these cameras that they were able to capture things that they were not realizing, on their "blind-spots" to directly refer one of the student's feedback to the class. This lead to a mindset of digging deeper into the data collected on the field, as the students themselves were looking forward to watch the 360-degree video footage. However, it is important to consider that there were differences on how the students perceived it in the activity 1 (2022) and activity 2 (2023) based on the second day of the activity:

- Activity 1 - VR viewing of 360 footage: Students within the groups only had time during the class to explore the 360 footage and draw new associations. The fact that each student needed to take turns to use the Meta Quest 2 devices, as well as to get used to it, also made it more difficult for them to focus on the footage itself. Many were focused on the novelty of experiencing it in VR, or simply immersed on the experience of viewing it with while controlling it with their heads and finding audio queues around the scene. They could still find new information or strengthen their claims, but there was a layer of novelty and fun connected to the VR experience itself.
- Activity 2 - One week to analyze the 360-degree video with other data and presentation: Students were able to present a great amount of data extracted from the 360 video to showcase and demonstrate their findings. They could also share it easily with everyone in the class by structuring their presentations. Different groups chose different approaches on how to show the 360-degree video. Some of them used it as a guided tour during the presentation, others took screenshots, and others made shorter pre-edited videos to show only one perspective of the 360 video.

  In this sense, it is possible to consider that two different criteria need to be considered for the fieldwork learning experiences. First, on how the students will utilize the 360-degree devices on the field itself to capture data. However, after that, the activity design needs to consider what type of output and follow-up learning outcomes are more relevant, which will direct the type of interactions students should have with the captured data. While this might happen for the other tools and methods as well, it might be worth taking special consideration with 360-degree media, as the nature of the consumption completely changed they way students engaged on the post-fieldwork analysis, as reflected on the differences between activity 1 and activity 2.

5 CONCLUSIONS

This paper discussed 360-degree cameras and videos in the context of fieldwork learning activities in higher education, focusing on how the technology is perceived and utilized by students. Two different activities were conducted, where 83 students were involved in fieldwork activities taking place on the university campus. The results from students' perspectives on 360-degree video and the usage of 360-degree cameras on the field point towards a beneficial relationship between the technology and fieldwork learning experiences on the students' perspectives. By listing common self-report themes, this research aimed to identify specific scenarios and usages of the 360-degree technology. Distinguishing the it from other tools and methods can assist future designs of field-

work learning experiences.

Additional activity designs should be included and explored to establish a more robust link between 360-degree technologies and students' fieldwork experiences. With this consideration, this study identified directions for further research to take place and explore its benefits to fieldwork learning.

Furthermore, while this paper was focused on the insights obtained from students' participation in the fieldwork activities, future research might benefit from combining lecturers' viewpoints as another point of analysis.

REFERENCES

Ahlin, T. and Li, F. (2019). From field sites to field events. *Medicine Anthropology Theory*, 6(2).

Akbari, O. and Sahibzada, J. (2020). Students' self-confidence and its impacts on their learning process. *American International Journal of Social Science Research*, 5(1):1–15.

Cliffe, A. D. (2017). A review of the benefits and drawbacks to virtual field guides in today's geoscience higher education environment. *International Journal of Educational Technology in Higher Education*, 14(1):1–14.

Fedesco, H. N., Cavin, D., and Henares, R. (2020). Field-based learning in higher education: Exploring the benefits and possibilities. *Journal of the Scholarship of Teaching and Learning*, 20(1).

Feurstein, M. S. (2018). Towards an integration of 360-degree video in higher education. In *Proceedings of DeLFI Workshops 2018 co-located with 16th e-Learning Conference of the German Computer Society (DeLFI 2018)*, pages 1–12. CEUR Workshop Proceedings.

García-Comendador, J., Fortesa, J., Pérez, M. R., Estrany, J., Canals, B. S., and Bey, J. M. P. (2022). Capacidad de las tic para virtualizar el trabajo de campo teoría y práctica desde la geografía. *HUMAN REVIEW. International Humanities Review/Revista Internacional de Humanidades*, 14(6):1–13.

Haipt, M. (1982). Experiential learning techniques in fieldwork. *Improving College and University Teaching*, 30(3):130–132.

Ito, H. and Igano, C. (2021). International fieldwork as skills development: an exploratory study. *Journal of Geography in Higher Education*, 45(3):417–434.

Kolb, D. A., Boyatzis, R. E., and Mainemelis, C. (2014). Experiential learning theory: Previous research and new directions. In *Perspectives on thinking, learning, and cognitive styles*, pages 227–247. Routledge.

Konishi, N. (2020). A review of international field trips: Adding value to the learning of and preparing for global human resources in japan. *Journal of Policy Studies*, (61):71–80.

Kyoto University ASEAN Center (n.d.). Kyoto-asean virtual fields. https://www.oc.kyoto-u.ac.jp/overseas-centers/asean/en/virtual-fields/, last accessed on 2023-12-28.

Lai, K. C. (1999). *Geographical fieldwork as experiential learning: a multiple case study of secondary school field trips in Hong Kong*. PhD thesis, Queensland University of Technology.

Lampropoulos, G., Barkoukis, V., Burden, K., and Anastasiadis, T. (2021). 360-degree video in education: An overview and a comparative social media data analysis of the last decade. *Smart Learning Environments*, 8(1):1–24.

Lundmark, A. M., Augland, L. E., and Jørgensen, S. V. (2020). Digital fieldwork with fieldmove-how do digital tools influence geoscience students' learning experience in the field? *Journal of Geography in Higher Education*, 44(3):427–440.

Maskall, J., Stokes, A., Truscott, J. B., Bridge, A., Magnier, K., and Calderbank, V. (2007). Supporting fieldwork using information technology. *Planet*, 18(1):18–21.

Minocha, S., Tilling, S., and Tudor, A.-D. (2018). Role of virtual reality in geography and science fieldwork education.

Pole, C. and Hillyard, S. (2015). *Doing fieldwork*. Sage.

Rosendahl, P. and Wagner, I. (2024). 360 videos in education–a systematic literature review on application areas and future potentials. *Education and Information Technologies*, 29(2):1319–1355.

Stanford Doerr School of Sustainability (n.d.). Instructional resources - virtual field trips. https://fieldeducation.stanford.edu/virtual-field-trips/, last accessed on 2023-12-28.

Svobodová, H. (2023). Teacher-student-environment interactions in fieldwork through 360-degree camera. *The New Educational Review*, 71:78–89.

Takahashi, Y., Nakazawa, S., and Sasaki, H. (2020). Study of reflections on university fieldwork courses: The characteristics of learning content of students who visited disaster-affected areas. *Journal of Disaster Research*, 15(7):959–968.

Tan, S., Wiebrands, M., O'Halloran, K., and Wignell, P. (2020). Analysing student engagement with 360-degree videos through multimodal data analytics and user annotations. *Technology, Pedagogy and Education*, 29(5):593–612.

Tojo, N., Oto, T., and Niida, S. (2021). How ethnographic practices are reconfigured with 360-degree cameras. In *CHIRA*, pages 115–122.

Villarroel, V., Benavente, M., Chuecas, M. J., and Bruna, D. (2020). Experiential learning in higher education. a student-centered teaching method that improves perceived learning. *Journal of University Teaching & Learning Practice*, 17(5):8.

Welsh, K. E., Mauchline, A. L., Park, J. R., Whalley, W. B., and France, D. (2013). Enhancing fieldwork learning with technology: practitioner's perspectives. *Journal of Geography in Higher Education*, 37(3):399–415.

Wieser, C. (2015). Technology and ethnography–will it blend? technological possibilities for fieldwork on transformations of teacher knowledge with videography and video diaries. In *Seminar. net*, volume 11.