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Teacher-Student-Environment Interactions in Fieldwork Through 360-Degree Camera

Abstract

The 360-degree camera is a relatively new technology that might become an effective tool for the development of students and teachers and overall educational improvement. As "normal" video provides a maximum 130-degree perspective, it could not offer a complex capture of education. This paper presents a way to use a 360-degree camera during two different modes of trainee teachers' fieldwork and proposes how to evaluate this form of education in terms of teacher-student-environment interactions by identifying the occurrence and duration of each type of interaction. It is evident that the type and intensity of interactions affect fieldwork significantly and may lead to different depths of learning.

Keywords: *fieldwork, 360-degree camera, interaction, reflection*

Introduction

Video studies provide images of real-life education settings (Flewitt, 2006). They are useful for both pre-service and in-service teachers to make in-action-reflections and thus improve their teaching skills and students' learning. Video can also be useful to analyse students' behaviour during the learning process.

360-degree video is a relatively new approach to creating video content. The recording output is a panoramic video with a 360×180-degree viewing angle that captures everything that happens around the camera. The viewer's ability to decide where to look at any moment is new and represents a significant innovation compared to "ordinary" cameras. This paper focuses on the use of 360-degree cameras to capture a different kind of interactions during fieldwork, as only a few studies thus far have used video for the evaluation of fieldwork. Loeffler used photo

documentation (2004) to express the meaning of fieldwork experiences. Lloyd et al. (2018) and Smith (2019) recorded and analysed what children saw, heard, did, and touched during outdoor learning; however, they used standard body-worn cameras. The author is not aware of any previous usage of a 360-degree camera for fieldwork evaluation.

Theoretical Background

Fieldwork has been considered for many years to be a very powerful educational strategy for understanding today's world (Balderstone, 2006). It is mainly because students gain first-hand experience (Nicol, 2007). It has also been proven that students' direct interaction with nature drives learning (Činčera, 2021). Students who directly observe and experience relevant phenomena gain understanding and subject knowledge (Hope, 2009). Moreover, students' enjoyment of fieldwork education leads to deeper learning (Scott & Boyd, 2016).

On the other hand, research has not yet described how the students interact with the environment to gain first-hand experience. The student-teacher-environment interaction so typical of outdoor education, in which the student uses the surrounding space to understand the subject matter in a specific context (thematic, regional, practical, etc.), has not been captured yet. There is no interaction with the environment in the classroom since the classroom itself does not provide the student with enough stimuli for learning. This thesis is confirmed by international research (Remmen & Frøyland, 2015; Richardson & Murray, 2017), which states that student's behaviour in the field is often different from their behaviour in the classroom. It may be due to the environment, which is completely different from that in the classroom and plays an equivalent role in outdoor education as all other aspects of teaching (methods, forms, means, etc.). Furthermore, the teacher-student relationship may change in an informal environment (Oost et al., 2011). It is the starting point for processing a 360-degree video study of outdoor education.

Although many aspects of outdoor education at different levels of the educational process are already described in the literature, Bednarz et al. (2013) recommended that more research be done on fieldwork and its impact on learning, skills, and practices. A video study is an innovative method to evaluate different situations happening during outdoor education. The results of the video study can be used by teachers for self-reflection, as teachers sometimes have difficulties confronting, analysing, and evaluating their own practice (Walshe & Driver, 2019). It may further be used for innovation in leading fieldwork and to analyse students' behaviour during the presentation and demonstration of the curriculum.

Research Methodology

Aim of the Study

This work intends to contribute to the discussion about using 360-degree cameras during teachers' practice. It follows up on the study of Walshe and Driver (2019), who were among the first researchers describing how using 360-degree video supports student teachers' reflection on teaching activities. The research gap is primarily based on the relative novelty of the technology used, which has been described in some fields to date (Argyriou et al., 2017; Gänsluckner et al., 2017; Hebbel-Seeger, 2017; Snelson & Hsu, 2020).

Even though we know fieldwork has been considered a powerful instructional strategy because students gain first-hand experience, we do not know the importance of direct interaction with the environment. This paper aims to evaluate student-teacher-environment interactions during fieldwork.

We start from the assumption that the environment offers countless opportunities for different interactions that support teaching and learning (Fig. 1). The kind of interactions is determined by the curriculum. That means that teachers and students behave differently in subjects outdoors, and behaviour is determined by the subject's content (for example, arts, biology, and geography). The subjects'

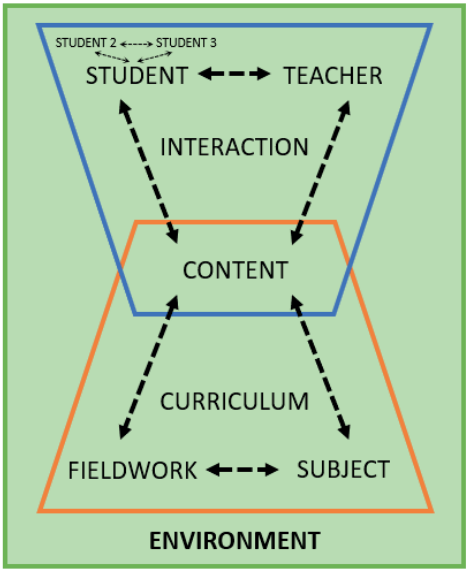

Figure 1. The Scheme of the Processual Part of Outdoor Education (Muzikant & Svobodová, 2021)

content can also determine teacher-student-environment interactions. However, this is more complicated, as the interactions are also affected by teachers' and students' personalities.

Type of Fieldwork and Participants

This paper presents a way of using a 360-degree camera during two different types of pre-service teachers' fieldwork exercises. These exercises differ mainly in the teacher's role during instruction.

Fieldwork 1 (FW1) was attended by 47 trainee geography teachers in their second year of study in the Department of Geography at Masaryk University under the guidance of two teachers. Students formed one group, led by teachers. An objective observer (the author of this study) recorded the video. Fieldwork 2 (FW2) was attended by 22 trainee teachers in their fourth year in the same study programme under the guidance of two teachers. After the teacher provided initial information about the day, students were divided into four or five-member groups, departing in 10-minute intervals to fulfil the assigned task. In FW2, students worked in groups around a given task. The teacher was present only when the assignment was given (in the classroom) and at the route's last stop (in a sand quarry). These were the only times that the students interacted with the teachers. Therefore, the video was taken by an assigned student during the group work.

Data Collection and Limits of 360-Degree Camera

To capture the videos, we used a Garmin 360 camera. All participants in both fieldworks were informed and agreed to be recorded. Four situations were recorded during the FW1, in which a teacher described, explained, or showed geographical phenomena to students in a particular place. FW2 was recorded as students navigated a 4.5 km route through geocaching. 17 situations were analysed. The students' movements from place to place were not recorded, as the 360-degree camera encountered two major limits.

The first limit was the capacity of the battery, which lasted for about one hour of recording, which is insufficient for a video study of fieldwork. It can be solved either by using additional batteries or by recording only some passages in the field. In our case, we focused only on recording the teacher's or students' activities and did not record them moving from place to place since no teaching or learning activity occurred while they were moving. The second limit was the recording quality in terms of video and audio. High-quality video requires a large-capacity

memory card. The large data files created are subsequently demanding on computer hardware. Sound quality is dependent on the weather. For example, in windy weather, the sound is difficult to hear. The possible solutions are to position the camera, so it is less exposed to adverse weather conditions or to add an external microphone.

Data Analysis

The analysis was performed by repetitively replaying the videos and coding all monitored aspects. Using categorical systems, it is possible to identify occurrences (event sampling – the observer records the code when he sees the phenomenon) and durations (time sampling – exact time interval).

First, we analysed verbal interaction, followed by nonverbal interaction with the environment (Frøyland et al., 2016) – see Tab. 1. We analysed teacher-student interactions in terms of total time (how long they talked) and technical terms mentioned in the teaching process. To classify teacher-student-environment interactions, we adapted three levels of interaction first introduced by McClain and Zimmerman (2016): observing, pointing, and tactile investigation. The interaction with the environment was evaluated on two levels: (1) what didactic means and media were applied for interaction (materials and samples provided by nature, measuring instruments, ICT, GPS, map, multiple media together, etc.) and over what time; (2) what activities were performed with the didactic means and media.

Table 1. Matrix of Teacher-Student-Environment Interaction

	student	**environment**
teacher	speaking (one person) discussion controlling cooperating	observation pointing investigation other
student	speaking (one person) discussing cooperating	

Research Results: Teacher-Student-Environment Interaction

FW1: Closed Teacher-Led Fieldwork

During FW1, four learning situations were recorded; the total recording time was 2,569 seconds, during which the teacher lectured for 2,015 seconds (78.4% of the total time). The major teacher-environment interaction during the teacher's speech involved pointing to different places in the landscape and describing them. The teacher demonstrated specific phenomena (e.g., showed a particular rock) for only 60 seconds (2.3%). The students only observed places the teacher referred to in the landscape and took notes. 237 seconds (9.2%) were dedicated to asking and answering questions; most of that time involved students thinking about answers. Only five students tried to answer (see Fig. 2, left). 204 seconds (only 7.9%) were devoted to student activities. It included drilling the soil sample (i.e., investigation). However, only one student drilled while the others observed. Students had few opportunities to speak with each other or interact with the teacher or environment. The environment acted only as a "backstage" for teaching; almost no student-environment interaction occurred.

The teacher's specific activities included lecturing, pointing, asking questions, and demonstrating. Students' activities included answering questions, observing, drilling a soil sample (in one student's case only), observing soil samples, taking notes, and reading maps. Instead of drilling and observing the "live landscape", students performed activities like those normally done in the classroom.

Analysing the videos made it possible to quantify the number of technical terms the teacher introduced during his speech. During the 42 minutes recorded, the teacher introduced a total of 134 technical terms; he led students to discover unknown phenomena based on their previous knowledge 9 times. Opportunities for active student involvement of students were sporadic. It is unlikely that the students remembered all the terms the teacher used, as people remember only approximately 5% of what they hear.

FW1 shows a teacher approaching the fieldwork in a way in which his role is dominant. Students had limited opportunities to participate in the lesson; they were more or less consumers of knowledge. The teacher used the outdoor environment as a "live" image to describe several phenomena. This form of outdoor education strengthens the link between education and the outdoor environment; however, it does not offer much learning "through" the outdoor environment or direct experience through outdoor activity.

FW2: Active Inquiry, Learner-Based Fieldwork

During FW2, 17 short fieldwork situations were recorded, in which students worked to fulfil 5 tasks in a five-member group. The video was stopped each time students moved to fulfil the task, which is why there are more captured situations than there were tasks. The total time recorded was 1,086 seconds. Of the total recorded time, only 43 seconds (4%) show the teacher giving instructions. In the next 170 seconds (15.6%), the teacher commented on the presentation of a student activity involving land art in a sand quarry. During the remaining 873 (80.4%) seconds, students worked independently.

This FW gave many more opportunities for student-environment interaction. Students actively interacted with surrounding objects – they drew a panoramic sketch and estimated the width of a pond (Task 1). Then they found information about the protected area on an information board (Task 2). Later they identified the rocks using thematic maps and measured the height of the rocks (Task 3). Their final task was to create land art from the sand (Task 4). During the activity, they used their cell phones with GPS to orient themselves, find information, and take photos (Task 5).

Students had to interact verbally to discuss the assigned task at the place where they found the cache. All the tasks also required non-verbal interaction, mostly indirectly with human-made objects (reading the information table, pointing to where they estimated a width). Direct interaction with the surrounding landscape was limited to touching the rocks and sand. The students also interacted with their cell phones to find information and take photos, and they wrote their findings on a worksheet provided by a teacher. Thus, the teacher influenced students' activity indirectly by assigning tasks.

For FW2, the quantification of terms was based on an analysis of work terms used by the students in the videos. These were then compared with the terms that the students used in the worksheet. Students worked with a total of 45 terms. The coordinates for geocaching and the worksheet served as providers of information, but students solved the tasks independently (so-called "learning by doing" or "deep learning"). It is presumed that the students will remember more terms from this FW, as people remember approximately 75% of what they practice.

Comparison of FW1 and FW2

In FW1, the teacher was the dominant actor. He was situated in front of a group of students. Compared to the classroom, the outdoor environment provides many sensory stimuli to students. Teachers should use them to support the teaching process and students' learning. However, in the FW1 video, the teacher uses only sight stimuli – he describes the view from the hill on which they are standing. Almost no other interaction with the environment was recorded. There was also no interaction among students. A similar lesson could be taught in the classroom with the use of photos or videos.

The FW2 video is quite different. Students worked in small groups, and the interaction among them was indispensable. The teacher was not directly present during their activities; however, he was near them and had influenced student-environment interaction by designing the tasks. The students used mainly sight stimuli but differently than in FW1 – they had to find information or make their own measurements. They also had more opportunities to investigate and touch the environment. This kind of interaction did not occur in FW1. The difference between interactions is shown in Tab. 2 and Fig. 2.

Table 2. Time Distribution of Teacher's and Students' Activities During FW1 and FW2

Type of Interaction		FW1: % of time	FW2: % of time
Teacher-student interaction	teacher's lecture/instructions (i.e., speaking)	78.4	4.0
	teacher-student discussion (i.e., discussing)	9.2	15.6
Teacher-student-environment interaction	teacher's demonstration	2.3	-
	student activity	8.0	80.4
	other	2.1	-
	total	100.0	100.0

FW2 shows a different approach to outdoor education than FW1. It is focused on student work; the student is an active inquiry-learner. The role of the teacher is coaching and controlling. This form of outdoor education should be used for students who already have experience with outdoor education and have mastered the skills needed for the exploration approach.

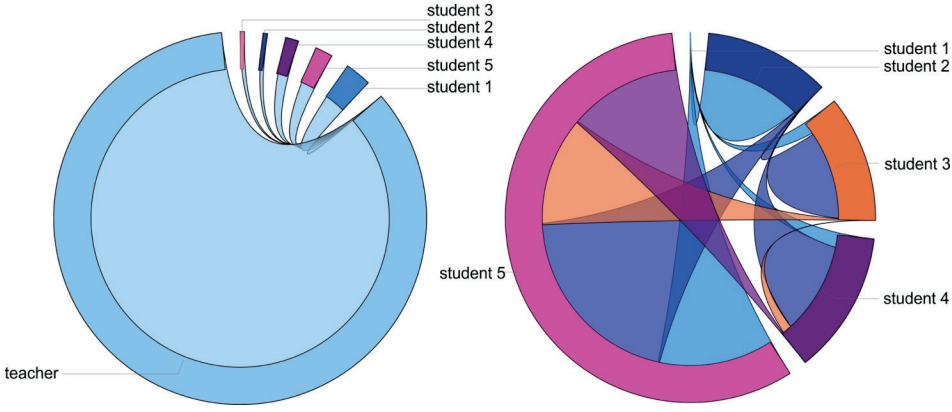

Figure 2. Teacher-Student Verbal Interaction: FW1 (left), FW2 (right)

Discussion

Over the last 50 years, teaching strategies for outdoor education have evolved from traditional field trips through field research to inquiry-based learning, which reflects different views on teaching and learning. One aspect that continues to evolve in outdoor education is how teachers and students play different roles (Oost et al., 2011).

This paper shows two extreme approaches to fieldwork teaching – in the first case, the teacher´s role is dominant, and students are pure consumers of knowledge (Oost et al., 2011). Verbal and non-verbal interactions and the links between education and the outdoor environment are minimal (Edwards-Jones et al., 2018; Rozenszayn et al., 2010). This kind of fieldwork can hardly lead to deep learning (Scott & Boyd, 2016; Entwistle & Ramsden, 1983). If the teacher reflects on this fieldwork, he should re-think this approach to focus less on learning "in" an environment and more on learning "through" the environment (Higgins, 1995).

The second fieldwork seems to be correctly set. Students learn by doing, and the work is focused on students' own inquiry. However, a further qualitative analysis is required to reveal the real impact of this teaching through direct interaction.

Conclusions

The paper uses the 360-degree camera video study method to evaluate student-teacher roles. It also provides a possible method to evaluate teacher-student attitudes by analysing the time devoted to different activities and the terms used. Until now, this kind of evaluation has been impossible due to the absence of an appropriate technological tool.

All the findings of this study can be used for easier and more advanced use of the 360-degree camera – not only outdoors but also in classroom education. Future research can focus on comparing classroom and outdoor educational approaches – comparing activities and communication between teachers and students and among students. Analysing the footage can help teachers innovate in their teaching processes and better understand students' work.

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