Requirements for Supporting School Field Trips with Learning Tools

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Abstract. This paper attempts to identify the key requirements for learning tools that facilitate learning processes both in formal classroom settings and on outdoor field trips. For that purpose, a qualitative study has been conducted that consisted of interviewing ten teachers from two different states of Germany. The study showed that field trips are a combination of formal and informal learning and could be better facilitated by utilizing heterogonous learning technologies based on particular stages of a field trip. This study suggests a list of requirements for learning tools that facilitate field learning in multiple domains.

Keywords: Mobile learning, Collaborative learning, Learning technologies.

1 Introduction

Fields trips represent an established learning and teaching mode in education. One of the main focuses of mobile learning is to facilitate field trips and informal learning. Although numerous examples [1, 2, 3, 4] of mobile learning have addressed the requirements of field learning, most of them have some limitations. For instance, many of proposed tools were domain specific and deeply contingent on specific learning scenarios, e.g., museum visits. Furthermore, they often strongly depended on a particular learning theory and presented lack of flexibility for integrating or switching between various learning theories (or teaching approaches). As field trips are often an integration of informal learning elements into formal learning, combining mobile technology and in-class learning technologies (e.g., interactive whiteboards and tables) would certainly be beneficial. Integrating the heterogeneous landscape of these technologies seamlessly into learning processes would present an excellent opportunity to facilitate both learners and teachers. Thus, we tried to reexamine the requirements for integrating various learning technologies in field learning. For that purpose, we conducted a qualitative study that was comprised of interviews with school teachers. We analyzed the results through framework analysis and in the light of scientific literature. This paper reports on results of this study. We identified a list of requirements for learning tools that bridge this gap between in-class and field learning.

2 Literature Review

10 years ago, a review of field learning strategies was presented in [5]. The authors identified the following key factors for effective field trips: 1) longer outdoor

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experiences, 2) well designed preparation and follow-up work, 3) use of a range of learning strategies, 4) emphasis on the role of facilitation for the learning process, and 5) a close link between field trip aim and practice.

With respect to deploying mobile learning technology on field trips, the majority of tools that have been reported on in literature focused on facilitation in a specific learning domain (e.g., history [3] or social studies [4]) In addition, researchers focused on designing technology-based facilitation for incorporating a particular learning theory or teaching method (for instance, serious games) into mobile learning. Wu and fellows [3] presented a system intended to help fifth grade students with learning historical and cultural contents through treasure hunting activities during a field trip. Chee and fellows discussed a similar approach to help high school students (approx. aged 15 years) with citizenship learning through a game-based activity [4]. Both examples demonstrated the effectiveness of serious games in enhancing learners' engagement in the given situations and domains (social studies), but these tools might not be helpful in other domains and for other field learning scenarios.

Vavoula and fellows [1] took a more flexible approach for facilitating field trips. They developed a system that allowed learners to gather data through mobile devices while information was automatically sent to a website which the learners could review later. The system facilitated various stages of field trips and could be used in various educational domains. Although they provided the flexibility for incorporating other computers through a website, the potential of in-class technologies was not fully exploited in the approach. Giemza and fellows [2] presented a system for supporting field trips. The system facilitated various stages of field trips (preparation, on-site data collection, and reflection after the field trip) and incorporated an authoring interface that allows for defining certain trips with specific tasks, student groups, devices and locations. This system followed a generic approach for the technical support for field trips with mobile devices and personal computers, but the role of in-class technologies (e.g., electronic whiteboards) was not explicitly considered in the approach.

In summary, many existing learning environments aiming at facilitating field trips were either focused on supporting certain on-site activities of field trips, or were specialized for a particular domain. Moreover, in-class technologies were not fully integrated with mobile devices which prevent a seamless flow of learning activities before and after field trips. This was the motivation for us to reexamine field trip activities and to identify their technology-related requirements.

3 Qualitative Study

The goal of this study was to investigate the key parameters of field trips, teaching strategies, learning goals, and the role of technology from the teachers' perspective.

3.1 Design

The study was comprised of semi-structured face-to-face interviews with 10 teachers: a basic protocol with general questions was given, but in some cases, more specific

questions were required for further discussion. All the participating teachers employed field trips regularly. The teachers came from four schools in two states of Germany. Eight of them were female and two were male. Their teaching experience ranged between 6 and 32 years. The domains taught by these teachers ranged from natural sciences to social sciences. The profiles of teachers are summarized in Table 1. All teachers volunteered to take part in the interviews, which took between 20 to 30 minutes. The interviews were audio recorded and later transcribed. Interviews were conducted in the teachers' respective schools by the first author of this paper. Data was analyzed through framework analysis. Data was coded using textual codes and categorized into thematic framework (charting).

Table 1. Profile of teachers participating in the study

No.	Gender	Experience	Teaching Disciplines	Grades
1	Female	13 years	English, Geography	9 to 12
2	Female	13 years	Physics, Mathematics	9 to 12
3	Male	14 years	Computer Science, Sports	9 to 12
4	Female	10 years	Computer Science, Mathematics	6 to 12
5	Female	20 years	German, English, French	5 and 6
6	Female	16 years	German, French	5 to 11
7	Female	32 years	Biology	5 to 12
8	Male	6.5 years	German, Political Studies	5 to 12
9	Female	19 years	Chemistry, Biology	5 to 12
10	Female	18 years	Chemistry, Biology	5 to 12

3.2 Key Issues Identified by Framework Analysis

The main themes that emerged from the analysis of data are as follows:

1. **Nature of the field trips.** The nature of the trips depended strongly on the relevant subject, grade and teacher's disposition and enthusiasm and on available resources. On average, the teachers who participated in this study had two or three field trips per academic year in their respective fields. In case of visits to local places, the excursions normally took between a half and a full day. Intra-city field trips took from one to three days. Abroad excursions were generally longer in duration, ranging from seven to fourteen days. The main theme or learning objectives of a particular field trip were always related to the school curricula.
2. **Visited places.** The common places for school excursions were museums, exhibitions, observatories, universities' laboratories, data centers, and work places (e.g., factories and mines), places of geographical, ecological and historical significance such as botanical gardens or historical land marks. Local and intra-city trips were more common and frequent than excursions abroad.
3. **Pre-trip preparation.** All field trips were succeeded by pre-trip preparations. The preparation included introductory lectures, distribution of helping materials, trip agendas and work sheets, and discussions. The extent and duration of these pre-trip

activities varied depending on the nature of intended trip. These activities ranged from one lecture session to several weeks of preparations.

4. **On-site activities.** In general, the activities during a field trip could be divided into two categories: *Observation* and *Exploration*. In museums, aquaria, observatories, and production facilities, learners followed the observation strategy. *Observation* was generally facilitated by detailed descriptions given by a teacher or a site representative. Learners collected data in form of pictures and videos using their mobile devices. On the other hand, in the *exploration* mode, learners actually performed some experiments on their site of visit, e.g., laboratories and natural habitats of particular plants or animals. These activities included learning to use the equipment and facilities available in laboratories, collecting samples of particular species or objects, and taking various atmospheric measurements.
5. **Teaching strategies.** Teachers employed several teaching strategies to engage learners in outdoor activities: *teacher-guided* and *unguided* visits. During a *teacher-guided* visit, teachers provided direction as well as well assistance during the whole course of excursion. During excursion, in addition to provided descriptions, teachers encouraged learners to read labels, to refer to helping materials provided by teachers or information (paper or multi-media) provided by the site representatives. On the other hand, *unguided* visits were more flexible in nature. Learners followed observation or exploration strategies but received little or no guidance from teachers. For instance, teachers merely pointed out the resources, but the learners were encouraged to complete a task by researching themselves. Teacher-guided trips were conducted more frequently than unguided trips.
6. **Follow-up activities.** In most cases, follow-up activities were held after the field trips. Learners had homework assignments, in-class discussions or presentations of their experiences during the field trips. Some teachers emphasized more on post-trip activities than others. In some extreme cases, teachers arranged field trips either very early or very late in curricula. In case of an early trip, teachers referred back to a particular field trip as they advanced in the course (e.g., Teacher No. 1), while a late trip generally had extensive pre-trip activities but limited or none follow-up work (Teacher No. 3).
7. **Evaluation.** The most commonly employed technique of evaluation after a field trip was providing a homework assignment or an in-class group task. Peer review had also been employed by some teachers. In some cases, no particular evaluation was carried out after a field trip (Teacher No. 2, 4 and 5) - even though, as stated, the trip did have a curricular relevance and were not just aside activities.
8. **Learning goals.** All participants of this study agreed that field trips had multi-fold impact on the whole learning process. One main objective had been enhancing learner's understanding of a particular theme by providing learners "direct" and "first-hand" knowledge (expressed by teachers 1, 7, 8, and 9) and helped them to create a link between knowledge gained in class and in real world (Teacher No. 6). Teachers had also observed that field trips had a positive effect on learners' behaviors and on their social skills and communication abilities (Teacher No. 3 and 6). Most of the teachers also made sure that the learners had fun during their trips.

9. **Collaborative learning.** A very important aspect of a field trip is collaborative learning. All teachers reported that learners worked in groups not only for on-site activities, but also for preparation and follow-up activities. They engaged in group discussions, reviewed, re-arranged their data together, and presented their findings in groups. These pre and post-trip activities always used some form of technology (e.g., desktop/laptop, electronic whiteboards). Teachers reported that for in-class activities, learners generally worked in groups of 3 or 4 participants, but for on-site activities the group size varied between 3 to 8.
10. **Computer support for field trips**. Teachers and learners both utilized various technologies in various stages of field trips. They searched resources on the web, collect data using their mobile devices, used computers to review and re-arrange their data, and presented their work on a projector. But there was usually no good organization or scaffolding of all these activities. Another factor was the teachers' preference. While some teachers encouraged the use of technology, others pointed out some disadvantages associated with the use of devices. Major concerns included learners' distraction from the intended learning goal, students' lacks of skills regarding a particular system and concerns about negative impacts of computer use on some skills, e.g., grammar in case of language (Teacher No. 1), and about additional workload in form of maintenance of devices (Teacher No. 5).

4 List of Requirements for Learning Tools

The themes that emerged from the interview data show that the practice of field trips largely followed established strategies, but the way of employing learning technologies was not consistent. Teachers and learners took advantages of learning technologies but that practice was largely based on individual preference, and there was little organization or integration of the employed tools. While technology is available to facilitate both formal and informal learning, we have drawn a list of requirements for learning tools intended to support field learning.

1. **Specialized support for each stage of field learning.** As field trips are integrated into formal learning and take places in various locations, specialized support is required depending on physical locations, nature of the learning tasks, underlying learning theories, number of participants, and intended activities. A single technology might not be able to address all these issues in any given situation. Rather, an integrated approach drawn on various technologies would certainly be beneficial where the particular task is facilitated by most suitable technology - i.e., devices with larger displays for group work, mobile devices for on-site data collection, and personal computers (laptops and tablets) for individual assignments where keyboard input is essential e.g., essay or report writing.
2. **Seamless integration.** The incorporation of multiple technologies needs to focus on providing facilitation without introducing additional complexity. That demands for an easy incorporation of new devices, automatic synchronization and easy data sharing between all devices along with the added value of devices' features.
3. **Support for multiple learning theories and strategies.** The literature review and our study results showed that field trips often comprised multiple combined learning strategies, so learning tools should be flexible in this regard.

4. **Support for administrative activities.** Distribution of helping materials, worksheets, plans for on-site activities, and trip schedules are essential tasks for effective field trips. Such administrative tasks might have little pedagogical underpinning but still play a vital role in both formal and informal learning and should be considered in facilitation systems for field learning.
5. **Teachers' control and preference.** The tools should also allow teacher's overruling and give him flexibility. As the teacher is the main facilitator in traditional school field trips, a teacher's judgment on when and where and to which extent learning tools should be used is very important.
6. **Evaluation support.** Learners' assessment is an important aspect in formal learning. Field trips comprise features of both formal and informal learning, and a specialized support for learning assessment should be provided by learning tools used in field trips. This is not possible with existing tools.
7. **Ease of use and training.** The learning tools should be easy to learn and easy to use. Ease of use is a general requirement for any interactive system but it is especially critical for learning tools so that the student's focus is on the themes of the trip and their learning, and not on finding out how to use the tools.

5 Conclusion

This paper presented the outcomes of a qualitative study that aimed at finding requirements for learning tools to facilitate learning both in conventional classroom settings and on field trips. We conclude that facilitation tools for field learning should incorporate heterogeneous technologies, provide seamless integration between various technologies, be flexible to incorporate various learning methodologies and preferences, provide control to teachers, support evaluation, and be easy to learn.

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