GET OUT! - HELPING TEACHERS ORCHESTRATE OUTDOOR GAME-BASED LEARNING ACTIVITIES

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ABSTRACT

Outdoor learning activities are very time consuming for teachers to prepare and difficult to manage, especially when the activity takes place in a non familiar environment for instance zoos. M-learning could help teachers to conduct outdoor education by involving learners in the creation and orchestration of artefacts (game). For that it is necessary to know how to arrange, orchestrate and monitor such diversified forms of learning in a systematic and technical manner. In pursuit of these goals to reduce teachers workload and share part of the orchestration load to students a case study was conducted where 9 students and 3 teachers participated. Together with the teachers and the Zoological Gardens pedagogues, the activities were planned, where the learner could acquire the knowledge through playing and creating the tracks, consisted of location points with assignments. The created activities were also tested in practice to determine their suitability for use in real life learning conditions. For creating activities and learning at the Zoo, SmartZoos app was used. It is a game based learning app where users move from one location to another with the guidance of their phone and in specific location points tasks open that learners need to fill. Students were divided to groups and every group was followed by an observer who took notes about occurring problems and time spent using the phone. Students and teachers evaluated their experience by answering questionnaires, additional interviews were conducted with the teachers to get a deeper understanding of their perspective to sharing orchestration load with students and how they managed the groups at the zoo. The results of this case study show that students were successfully engaged in the planning and creating learning artifacts stage, reducing teachers workload and planning time for this outdoor learning activity. The main issues that teachers brought out were group managing, communication with students for example following students movement, having access to students work or results and assessment.

1. INTRODUCTION

Educational institutions can provide resources for teachers to plan, orchestrate, and support co-operation and creativity. For example, computer technology has several functions for helping orchestration (Kollar et al., 2011), although the use of technology always challenges a teacher's work (Arvaja et al., 2009). The effectiveness of m-learning in outdoor learning has been studied previously, various ways have been proposed to reduce the burden of orchestration (Lai et al., 2015; Munoz-Cristobal, 2017), but in all of these studies, the main creator and designer of the learning process is a teacher. Crompton et al. (2017) points out that in most m-learning studies students are ready-made consumers of knowledge and are not exploiting the full potential of mobile devices. Ishtaiwa et al. (2015) survey showed that m-learning has different uses, but tends to focus on certain activities. Crompton and others (2017) have further pointed out that a large proportion of m-learning studies have been conducted in a formal education environment, that is, in a classroom or school district. The use of m-learning in a non-formal environment (Crompton et al., 2017), for example, in a park, a zoo, and a botanical garden, should be explored. Goal of this study is to explore the challenges of orchestration while outdoor learning and how the used SmartZoos app is supporting teachers to orchestrate the activities.

2.1 Orchestration

Several intellectuals have used the word "orchestration" to design and manage real-time classroom activities, learning processes and teaching activities (Gravier et al., 2006; Dillenbourg & Fischer, 2007). An orchestration does not indicate that the lecture is more intense or that the teacher has to make a show. Orchestration is more like the meaning of "teacher's central constructivism". Students need to learn through activities, but teachers have a role as manager in the whole scenario (Dillenbourg & Jermann, 2010). Prieto et al. (2011) has suggested 5+3 aspects in his literature review about orchestration that have emerged from different studies. These aspects are planning/design, management, awareness/assessment, adaption, roles, theory, pragmatism and synergy. These aspects can be helpful for planning evaluation for orchestration process and tools (Prieto et al., 2011). Due to the high workload of teachers, it is difficult to put in place new methods and tools that would be needed to implement the new learning pathway. The solution would be to reduce the burden on teachers' orchestration, for example by allowing for applications where a large proportion of the planning would be distributed to students.

2.2 Instrumental Orchestration

Instrumental orchestration is defined as the intentional and systematic organization of various digital artefacts by the teacher to guide students (Drijvers et al., 2010). In instrumental orchestration, three elements can be distinguished: didactic design or how different means are related to the environment; the way in which the teacher decides to use the didactic design and the didactic presentation, or how the selected didactic design and presentation are actually used, such as how to link student questions to the context or how to cope with emerging problems (Drijvers et al., 2010).

Coordinating the academic environment of an IT environment in recent years has been a source of interest in research communities engaged in studying technology learning (Dillenbourg, Järvelä & & Fischer, 2009; Roschelle, Dimitriadis & Hoppe, 2013). Since the first problem faced by teachers in carrying out such activities is the creation and preparation of a scenario, several studies have recommended the use of a special environment that allows linking all other tools in one place (Munoz-Cristobal et al., 2014; Ternier et al., 2012) . In these environments, however, there are restrictions on orchestration: 1) most variants have limited or even no opportunity to regulate the flexibility of students' work; this is especially important in the case of the use of librarianship environments that may require partial orchestration burden for students (Sharples, 2013); 2) many environments do not allow the integration of technologies that teachers already use, which reduces the use of these methods by teachers (Cuendet et al., 2013; Prieto et al., 2014); 3) most environments do not allow the use of surrounding or context where learning takes place which is an important factor in achieving unobtrusive learning (Milrad et al., 2013).

In addition to the limitations described above, in the case of out-of-school education, the real dispersal of students must also be taken into account, which makes it very difficult for the teacher to monitor and support the learning process. In order to solve this problem, it would be wise to develop a technological solution that helps orchestrate learners in dispersed environments.

2.3 SmartZoos Learning App

M-learning could help teachers to conduct outdoor education by involving learners in the creation and orchestration of artefacts (game). For that it is necessary to know how to arrange, orchestrate and monitor such diversified forms of learning in a systematic and technical manner. In pursuit of the goal to reduce teachers workload and share part of the orchestration load (in this case planning) to students, a game/based outdoor learning app was used. That solution is still in the development process and the case study describes the first piloting of the app called SmartZoos. SmartZoos is location based game developed for the use at the Tallinn, Helsinki and Stockholm Zoos. It is a game based learning app where users move from one location to another with the guidance of their phone and in specific location points tasks open that learners need to fill. Users can create activity items themselves. In the creation process it is possible to choose from different types of questions like information, one correct answer, multiple correct answers, freeform answer, match pairs, make an embedded content question or photo task. It is possible to set also other parameters like language, distance from location point from how far the task opens, location of the task.

SmartZoos app was used in this pilot as a support tool for orchestrating outdoor learning. It provides a frame and a structure for activities conducted outside and helps to set learning goals and sequence of the activities (Figure 1).

Figure 1. Screenshot from SmartZoos app of one track created in the TallinnZoo. Questionmarks mark the location of different tasks

2.4 Method

Conducted case study is part of a research which follows design-based research. Current paper describes one piloting under investigation. This piloting session focused on testing the suitability of the SmartZoos app for outdoor learning, investigating participators attitudes and experience and what are the future possibilities for developing this app. For the data collection both quantitative and qualitative methods were used. Students attitudes and experience were measured with questionnaires which contained open-ended questions, Likert-type scale questions for the attitude and multiple answers questions for background and experience questions. Observers followed student groups and gathered information about occurring problems and time spent using the phone by filling in questionnaire as often as needed. Teachers were interviewed to study their attitude and experience using SmartZoos game for outdoor learning. In pursuit of these goals a case study was conducted where 9 students and 3 teachers participated. Together with the teachers and the Zoological Gardens pedagogues, activities were planned, where the learner could acquire the knowledge through playing and creation of the tracks.

Participators were 9 10th graders from one Tallinn school and three biology teachers who had experience in using SmartZoos. The activities took place in two days. On the first day students came to the Zoo and were instructed how to use SmartZoos app and how to play. Students were divided into 3 groups. Groups were followed by observers, who filled in forms about group engagement to the phone and problems they faced during the activity. Students completed the tracks and afterwards gathered at the last point to fill in the feedback form and to get instructions for a homework task. As a homework, every group had to design one track for the next. They were instructed that they have to create some questions themselves but they also can use already existing questions. The next time they came to the zoo all groups had managed to create one track. Before going to play they filled in feedback form about creating a track. As they were already familiar with the game they only chose tracks and didn't need any more instructing. Students met after finishing the tracks and gave each other feedback and shared their experiences about other students created tracks (Figure 2).
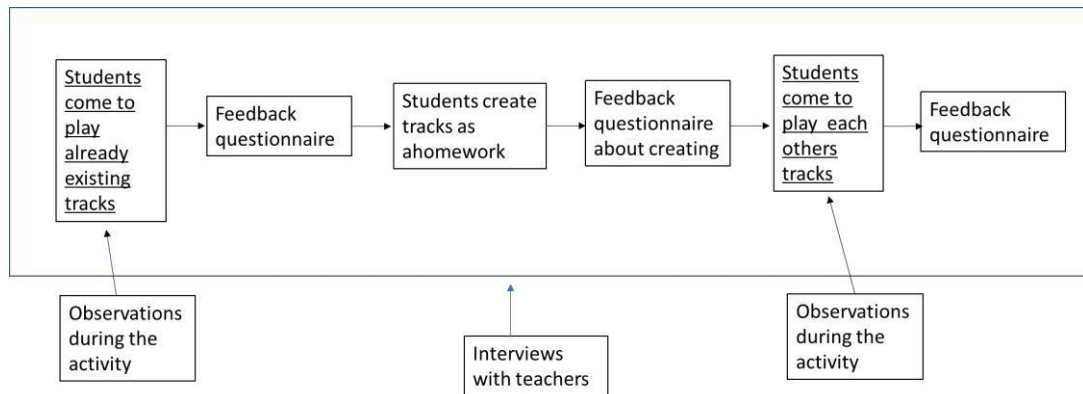
Figure 2. Case study design conducted at the Zoo

2.5 Results

2.5.1 Students Feedback

From 9 students who participated in this case study 3 were girls and 6 were boys with age 16-17 years. 3 of the students used Samsung smartphones, 4 iPhones and 2 did not use their own device for game but teamed up with somebody else. Most used browsers for the game were Safari and Chrome, one student used Explorer. Many students faced technical challenges while using SmartZoos. 4 students stated that their phones showed wrong location, 3 of the students marked that they had problems while opening the game and only 2 students stated that they had no problems with using the app. 4 students who had problems tried to find the solution on their own and 3 of them just ignored the problem and continued the game.

Students attitudes to the first activity where they played tracks created by Zoo pedagogues, were mostly positive. 7 students marked that they liked the game, 1 was neutral and 1 didn't like the game. The students would like to use the game again (6 would use again, 2 neutral and 1 wouldn't use again) but were satisfied with the game itself (5 satisfied, 4 neutral). Some students were excited to use this game but others were more neutral (exited 4, neutral 4, not exited 1). 8 out of 9 students found that used app was helpful for learning. Most of the students found that the game was easy (easy 6, neutral 1, complicated 2) and interesting (interesting 7, neutral 1, boring 1) and that they had enough time to observe the animals (had enough time to observe 5, neutral 3, did not have enough time to observe 1). But not so many students marked that app was easy to use (easy 4, neutral 5).

Students also had some problems while creating the tracks as a homework. Most problematic for them was to mark the location for activity items, because they didn't know the Zoo very well. Overall the attitude for creating tracks activity was positive. Students thought that creating tracks was easy and that they liked to create tracks themselves. All the participating students stated that they have gained knew knowledge during this activity. They also didn't think that creating the tracks would have been very time consuming.

In general we can say that students enjoyed using the SmartZoos and found it interesting. Also it was good to note that students didn't mind creating tracks themselves and that they found they learned while using SmartZoos.

2.5.2 Interviews with Teachers

Interviews were conducted with 3 teachers who had experience with using SmartZoos with their students for both: playing and creating. The answers were grouped and categorized into 8 categories based on orchestration aspects Prieto (2011) defines in his 5+3 orchestration framework (Prieto et al., 2011). The formed categories were planning/design (planning, often referred to as learning design), regulation/management (issues related to class, time, workflow and group management),

adaptation/flexibility/intervention (changing and adapting the design/plan to both the local context of the classroom and the emergent occurrences during the enactment of learning activities), awareness/assessment (awareness of what is happening in the classroom and within the learners' minds, assessment), roles of the teacher and other actors, pragmatism/practice, alignment/synergy and models/theories. The aim of conducting the interviews was to get a deeper understanding of what is teachers attitude to using this kind of outdoor learning game, what kind of support would teachers need to reduce the orchestration load and what are the challenges for teacher in every orchestration aspect.

At the beginning of the interview some questions were asked about their attitude and previous experience in using technology for learning. Teachers have same goals for using mobile devices in their lessons. They want to make use of already existing students devices, make lessons more interactive or making students to self-study. Schools have more equipment than before which is giving more possibilities.

Teacher 3: *"There are new tablet sets at the school, we only had one laptop set before. Two tablets sets and WiFi router. And it goes well, I use much more this year. We also have technical support at school who checks if everything is okay, batteries full and programs installed. If the technological side is okay, then it goes nicely."*

They all use smartphones in their lessons for example electronic tests, searching for information. They also have used mobile devices in outdoor learning, for example plant and lichen determinants and Avastusrada (location based game similar to SmartZoos) to make discovery tracks around the schoolhouse or park. There exists big motivation to use more technology in outdoor settings but there are certain limitations for example location, weather and a lot of work with preparation.

Design: Time allocation for preparing outdoor learning activities is time consuming. Teachers point out that preparing outdoor activity at the Zoo is even more time consuming, because teacher needs to visit the Zoo, needs to find the animals and study what information is available at that location and then prepare the questions. They also mention that the time expenditure depends on how well the teacher knows the Zoo. If you are more familiar than it takes less time.

Teacher 3: *"Teachers will need 2 days for preparation. One day for walk and planning at the zoo, the other day for completing the track. Teachers would prefer already composed tracks most likely."*

Teachers suggest that the questions and tasks should already exist beforehand to make the preparation easier. Questions should contain meta-info about the grade and topic to make the finding easier, so it would be possible to filter. They also suggest that there is a need for a place where to change experiences and ideas with other teachers like a forum or the possibility to evaluate tracks so that other users would know what kind of tracks to choose. They refer to similarity in social media, that good rating is trusted. Teachers point out that it is necessary to give a possibility for students to create the questions and tracks. On the one hand that takes away the need to prepare and on the other hand it gives students the chance to be creative.

Teacher 3: *"Good that students create, but the question is how correct these tasks are."*

As a best design for this kind of outdoor learning activity teachers suggest a project day type of solution where students create the questions and tracks directly at the zoo and play each others tracks later. The activity would be longer for students but at the same time it would free teacher from preparing the tracks and questions.

Management: In outdoor learning activities it is difficult to keep track on students progress and especially in very dispersed settings it is difficult to support and help students. From the group management perspective teachers liked the possibility to track students activity. The other feature that they all mentioned but at the moment is missing from the SmartZoos app was communication. Teachers would like to have the possibility to contact students easily on the field.

Teacher 2: *"I'm responsible, I have to know that they are safe. It is very important. Would be good to see where they are.*

Teachers note that completing the track takes students at least 1-2 hours. Also they added that before starting the activity there is a need to explain how to use the app which adds 15-30 minutes.

Adaption: Under adaption category were gathered teachers experiences with adapting with the sudden changes while outdoor learning. For example some conditions change, or teacher wants to add some relevant information or activity. It is important that environments that support orchestration would enable fast changes. Teachers mentioned that in SmartZoo it is easy to change questions, so teacher can interrupt and change tasks or information quickly which helps to adapt the activity to the current situation.

Teacher 2: *"Once I was too busy to go there and I used only website. And they didn't find the answers. You have to put much effort into it, but you can change questions here easily."*

Awareness/assessment: Teachers answered questions about being aware of student's progress in outdoor learning activities while using SmartZoos. Came out that they don't have overview of what students are doing but in their opinion it is important to monitor students work progress. They also want to give feedback to students while they are in the creating process to support and guide them. But one teacher also notes that it is not good to monitor too much, students creativity and joy will be restricted.

Teacher 1: *"I have no idea what students are doing, and if they are doing at all. "*

Teachers found that SmartZoos at the moment is not supporting assessment because teachers don't have overview nor access to students work. They also mention that it is not important to know where the students are more important is the possibility to give feedback and assess. This goes for both playing and creating. Teachers want to be able to interrupt students for guidance and support to avoid misconceptions.

Teacher 3: *"Right now it is not supporting assessment. I don't see summary report. I don't know how students performed. It is not possible to grade. They can play and complete... well.. they played...so? nice? How did you like? liked! What did you learn? I only get to know if I ask them afterwards. "*

Roles: Sharing orchestration load to students and by that also giving the role of a teacher partly to students, is is greatly supported by teachers. They see it as a more effective way of learning. But at the same time they also note the risks with the quality of the information provided by students and the possibility of students not taking the task seriously.

Teacher 1: *"If students make the questions then it is much more effective learning."*

Pragmatism/practice: One of the biggest questions while arranging outdoor learning with mobile devices is either to use students or school/institutions devices. Teachers admit that when using students devices there should be someone helping, because there will be many technical questions with different device models and settings. They also emphasize that students age is important to keep in mind. There are more possibilities for older students. Mostly because they already have better phones and access to unlimited data. Younger students often don't have those possibilities so in that case it would be important to look for other options, for example it would be good if Zoo or some other institution would offer their own digital devices or if possible use school equipment. This would give teachers more confidence, because they will know that everything works.

Teacher 3: *"At least you know that battery is full and everything works. GPS works, browser is updated."*

At the same time they also note that it can be tricky to use school devices, because it is not possible to borrow the tablets for a long time or there is no possibility to use mobile internet. Goals related with using technology in the lessons are mostly derived from curricula. Developing students digital competences were mentioned several times by all teachers. Teachers see it as a very important part of learning and try to find different ways to use digital technology in the classroom.

Teacher 3: *"Nowadays the digital competences development is very important. when students can create games on their own then that is a big plus."*

Theory: Under theory category are assembled attitude and belief regarding using mobile devices in outdoor education. Teachers attitude is positive and supportive. They mention that best place to learn nature is in nature and it is important to emphasize using different senses, discussions and discovery while learning. As a positive side to using mobile devices they point out motivating, support for students natural need to discover and purposeful use of device.

Teacher 3: *"It is a very big plus that students can investigate and try themselves."*

They also agree that creativity is something that students should do more, but for what they don't have very many possibilities. Same is with playing, they say it keeps students motivated, so it is good to have possibilities where fun and learning go together.

Allignment/synergy: From the orchestration perspective it is very important that different environments and activities would be combined smoothly and would support each other. From the interviews we can say that SmartZoos enabled the combining of physical and virtual space, helping students to learn and engage more. Teachers liked that the SmartZoos activity was fun and engaging and that there was a possibility for competition.

Teacher 2: *"I like that students are active and need to show initial. Guys were engaged. I was surprised. One was facetiming with boyfriend but others were engaged... It was fun, like Pokemon Go. Boys liked it. Even though there were problems with GPS, it was still fun for them. It was like catching the Pokemon. "*

3. CONCLUSION

The goal of this case study was to explore the challenges of orchestration while outdoor learning and how the used SmartZoos app is supporting teachers to orchestrate the activities. Students feedback for the activities conducted were positive. Most of the students claimed that they liked the game, would like to use this kind game again and were engaged in the activities.

Teachers were positively minded about using this kind of learning tool and setting. They provided important insight to what kind of support they would need while orchestrating outdoor mobile activity. All the teachers agreed that planning and designing the outdoor learning activity takes a lot of time, even days if teacher is planning to go to some new location. Puzzle piece like task items that teachers can combine themselves was suggested. The other idea was to plan the activity so that the students would create the tracks on the location. That design would minimize planning but then teachers would like to have the possibility to access students creating process. Teachers would like to have access to finished student works for assessment. Neither of those features were provided in the used app. Teachers admitted that they would like to have a possibility to communicate directly through the app to students that are dispersed around on a big area.

The results from this case study showed that pedagogical design needs to be reconsidered. The choice of methods should be analyzed and rearranged keeping in mind already existing studies (Drijvers, 2010; Lai, 2015; Munoz-Cristobal, 2017). Design where students visit the Zoo on two separate days and create the tracks at home is not practical from time, money and teaching perspective. Technical solution needs to be completed and supplemented with functionalities that would support the orchestration from teachers perspective and students learning and creation process. If this tool could successfully be used in activities where more responsibilities are given to students(Munoz-Cristobal, 2014). From awareness, assessment and management perspectives it is necessary to add learning analytics features for teachers.

The aim of this case study was exploratory and the idea was to explore and illustrate the problem of orchestrating outdoor learning. Because of the small sample size, there is no possibility to generalize the results. These findings are good start for developing a tool that would support teachers while planning, conducting and sharing orchestration load in outdoor learning.

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