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OMLETH: A multimedia guide for field trips

OMLETH is a map-based learning platform, used in formal and informal educational institutions. It features educational multimedia field trips that allow authentic, location-based mobile learning.

Introduction

Many learning contents and processes of study programs in architecture, civil engineering, and natural sciences at ETH Zurich are strongly related to environmental phenomena. However, teaching in these study programs is mostly still limited to lecture halls or flipped classrooms and decoupled from the real world outdoors. Beames et al. (2012) argue that learning outdoors brings curricula alive, helps students to understand the authentic environment and related issues, and that it encourages physical activity.
The ubiquity of context-aware mobile phones enables the design of suitable contemporary learning environments which consist of mobile education trails outdoors in the real world. The learner becomes mobile and is supposed to connect the surroundings with educational content through interactive multimedia triggered on mobile location-aware apps. This type of mobile learning is often called location-based mobile learning (LBML) (Brown et al., 2010).
Popular learning management systems are still not able to store geo-located contents, though professional technologies for handling and visualizing such content are available (geographic information systems, GIS, see Goodchild, 2011). The mobile web app OMLETH ("Ortsbezogenes Mobiles Lernen an der ETH"), funded through the Innovedum funds of ETH Zurich, bridges the gap between GIS technologies and learning management by enabling the assignment of learning contents to places (Sailer et al., 2015).

Teaching concept

The OMLETH user interface uses powerful geo information technologies[1], including interactive web map services that can show satellite, street, or topographic maps. Lecturers can easily create the content and its geospatial grounding (i.e, polygons) using the OMLETH map interface in a standard web browser. The technological capabilities offered by OMLETH leave many design choices to the lecturer. However, to enrich the genuine experience, a powerful story with a well-constructed plot structure similar to movies is required. The learning material may be represented as text, image, audio, video, or links to web resources like augmented reality applications. The trail's stations can be configured as inquiries to ask students to upload text documentations, pictures, voice, or video recordings, with the goal of processing observations and making students reflect.

[1] https://developers.arcgis.com

Questionnaire-based assessments focus on analyzing and evaluating the local phenomena and letting students mutually reflect and argue. Online communication channels can be integrated and allow students to get feedback and exchange with the teacher or peers from everywhere. The above list illustrates that with OMLETH, teaching becomes very different and customizable to the local surrounding and context.

Students perform the education trails individually or in groups with an HTML5-enabled mobile client. Navigation and access to interactive multimedia content are activated depending on the GPS position of the user's device. Students must be on-site and enter the polygon associated with the content to gain access to a particular learning activity. OMLETH collects users' movement data during their discoveries and observations. These datasets enable lecturers to have control about students' movement progress, to assist w.r.t. navigation and safety issues, and to support instructional scaffolding (Sailer et al., 2016). Further, the students can review these datasets during a de-briefing session back in the classroom. All data records of OMLETH are encoded using HTTPS during transfer. This ensures security and privacy during the transmission.

OMLETH in practice: results

Explorative studies have shown that lecturers usually allocate the different tasks on an OMLETH education trail close to each other to optimize time and the flow of learning. The trails' missions were mostly initiated with a short story and a problem statement including the learning goals. Next, tasks were often composed as group work. Some teachers chose rather open tasks to foster learners' agency (Suárez et al., 2018), others created more formative assessments or short assignments with popular web forms. Observations are mostly documented by text and photos. And finally, in-depth information was sometimes included using links to special services or external learning management systems.

A large empirical study about student achievement in secondary schools has shown that LBML with OMLETH improves the cognitive performance in written exams. The trails demand a strong commitment and the willingness of an active confrontation within the context. Learners with intrinsic subject motivation are reinforced, whereas learners without basic motivation are reluctant despite using mobile phones. The result of the qualitative evaluation shows that it depends on the situation and the design of the trail: drama-like procedures (exciting hooks followed by the problem statements, embedded in a well-constructed story with authentic tasks) as well as tasks with a high degree of self-determination (competence, autonomy and affiliation) are important for the success of LBML. Some of the participating ETH students argue that new, rich or complex theories should still be instructed in classrooms and not in long text messages on small displays. Long-term evaluations have shown positive effects on cognitive performance.

Lessons learnt

More than 100 education trails with student groups in higher education, middle school and informal settings have been carried out with OMLETH. Most of the users were novices in using their smartphones for LBML. The technical knowledge about the configuration of sensors and the use of interactive map layers were sometimes lacking and had to be introduced by the instructors.

In formal education, OMLETH has been integrated into regular lessons in many ways, such as for anchored instruction, or for transferring the gained knowledge with

formative or summative assessments. Experiments show that OMLETH plays a certain role in student achievements with slightly improved test scores. However, students' self-assessment of cognitive performance is often less positive. Lecturers guess this attitude is influenced by possible biases of their educational socialisation. Further, some students argue that educational trails consume a lot of time, and that traditional learning by lecture hall instruction is more effective. They prefer to learn the concepts and theories in classroom lectures before, and only afterwards apply this knowledge in an LBML trail. In the case of formative assessments, they appreciate the possibility of getting feedback and asking questions at any time. However, the other part of students strongly welcomes self-regulated LBML and is aware of the positive effects of self-regulated outdoor trails in both, the short and long terms.
The main lesson learned w.r.t. teachers is related to the skills needed for creating exciting education trails. In addition to technical experience and geospatial abilities, teachers also need didactical experience in creating authentic stories and meaningful tasks that are well adapted to the students' prior knowledge. Furthermore, an education trail for LBML should always finish with a classroom debriefing session to clarify open questions and to avoid failures or subjective theories. Finally, lecturers and most of the students conclude that the action-oriented and multi-sensory learning approach, as well as the long-term learning outcome create benefit for learners and make LBML sustainable.

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