Routes of Geolocated Questions in Formal and Informal Learning Contexts

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***Abstract*— This paper describes three real scenarios framed in different formal and informal contexts and subject matters where mobile technologies are used to augment the physical space for assessment in situ purposes. The scenarios use the QuesTInSitu *app*, which enables the creation and enactment of routes with geolocated questions.**

***Index Terms*—m-learning, smartphones, assessment in situ, context awareness, IMS Question and Test Interoperability**

I. Introduction

Mobile technologies offer the possibility of designing different types of innovative learning activities [1]. Especial interest is being shown in educational scenarios that require the combine used of smartphones and location-based systems (LBS). Current smartphones are equipped with sensors like: QR-Code/RFID/NFC readers, 3G/WIFI, Bluetooth and GPS, functionalities that have made these devices an adequate tool for carrying out location-based learning activities [2, 3, 4]. Authors distinguish between: (1) "*everywhere/everytime activities*" these activities benefit from the ubiquitous mobility that smart phones have; and (2) "*Located/Situated/Context-aware/In Situ*" activities which have to take place in a specific physical space related with the educational resources.

This paper presents three real scenarios where a system, named QuesTInSitu [5], has been particularly used to support assessment *in situ* using smartphones and GPS. QuesTInSitu is a software implementation based on the IMS Question and Test Interoperability and Google Maps to support assessment *in situ* (see Fig. 1). "Assessment *in situ*" refers to a type of activity where the questions of a test have to be answered in front of a related real location (*in situ*) having into account the contextual information of the environment. QuesTInSitu focuses on assessment activities that cannot be practiced without mobile devices and where the educational resources are dependent of specific real locations. During the edition of the route-test each QTI question is associated with a real geographical coordinate. When the student is in an area near the indicated coordinate, the question appears on the screen of the smartphone. Therefore, students need to be located *in situ* in the correct place because, in order to understand and answer the question, they will need to interact with the real environment (observing, touching, talking with people, etc.). In an assessment *in situ* activity students put into practice transversal abilities such as exploration, spatial and observation skills, in addition to the specific knowledge related with the content of the test.

Fig. 1. QuesTInSitu: an app for supporting assessment *in situ*

QuestInSitu provides an authoring tool that enables teachers (or other roles, including students, depending on the educational scenario) to create geolocated questions and tests (routes). Then, students while using the QuesTInSitu mobile *app,* share (transparently, "without knowing") their geographic position. When they are placed in the specific positions pre-defined by the teacher, the questions are visualized automatically. Moreover, teachers can monitor, in real time the students' progress (locations, punctuations achieved).

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II. Scenarios in Formal and Informal Learning Contexts

Diverse experiments have been carried out in different formal and informal real educational scenarios (bachelor, university, and senior learners), in diverse subject matters (urbanism, artistic history, botany, literature). They show how QuesTInSitu activities can be applied in formal and informal learning contexts (see Table 1).

TABLE I
SUMMARY OF THE THREE QUESTINSITU SCENARIOS

Learners	Context	Topic
Bachelor	Formal – Secondary School	Urbanism, Geography, History Art
University	Formal – University Degree	Botany
Elder learners	Non-formal informal – Lifelong Learning center	Literature

QuesTInSitu has been used with bachelor students of a formal educational context, a secondary school. The teachers designed routes of questions related with the concepts studied in class in the different subjects. In Discovering Barcelona! six routes where created to reflect about the urbanism of six different districts of the city of Barcelona. Students interacted with the environment, talked with the citizens and observed details of the architecture and the street furniture with the objective of solving correctly the questions [5]. In the same educational level, students from other public school did a route created by their teacher with the objective of assessing their knowledge about art history of the city of Girona. In this case, students had to solve the maximum questions (of a total of 70) geo-located around all the old town of Girona (see Fig. 2).

Fig. 2. Discovering the city of Girona

Another example of formal learning is the case of a botany professor who used QuesTInSitu with her university students to answer questions *in situ* observing the Barcelona botany garden. The goal was to facilitate a scenario enabling students to put in practice their skills in a real botany environment. Students' in situ desired actions included finding, touching and measuring specific plants. The students had to identify specific plants and interact with them when questions appeared in specific parts of a botany garden. They could use their class-notes (see Fig. 3), books or Internet web-pages to solve the questions.

Fig. 3. Assessing Botany *in situ*

The last scenario was carried out with a group of senior learners (average of 70 years old) formed by members of a literature group. These learners participate in a lifelong-learning center focused on non-formal learning courses and informal learning activities. Their interest was to use QuesTInSitu to create two routes of questions (answered by two different teams) with the aim of proposing questions about facts of a literature novel set in a district of Barcelona. The activity allowed them to observe with more realism the facts and areas cited in the novel and answer questions created by their peers (See Fig. 4).

Fig. 4. A literature adventure with elder learners

III. Conclusion

The results obtained in the evaluation of the experiments show how teachers were able of assessing specific and transversal higher-order skills, promoting the practice of real-life tasks. The experiments also show that, the combination of: diverse technologies (smartphones and GPS), adequate learning environments (e.g. a city for learning town-planning concepts, a natural park for learning botany …) and the use of enriched information (e.g., the physical objects, web2.0 maps, QTI questions) for representing and interacting with question-items and tests, leads to more authentic and formative assessment scenarios.

As future work, we plan to deeply evaluate the results of these scenarios in order to analyse the educational benefits of this type of activities in different types of learning scenarios, and the factors that teachers have to take into account when designing assessment *in situ* activities and routes.

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REFERENCES

[1] Jeng, Y.-L., Wu, T.-T., Huang, Y.-M., Tan, Q., & Yang, S. J. H. *The Add-on Impact of Mobile Applications in Learning Strategies: A Review Study.* Educational Technology & Society, 13 (3), 2010, pp. 3-11.

[2] Hwang, G., & Chang, H. *A formative assessment-based mobile learning approach to improving the learning attitudes and achievements of students.* Computers & Education, 56, 2011, pp. 1023-1031.

[3] Liu, G., & Hwang, G. *A key step to understanding paradigm shifts in e-learning: Towards context-aware ubiquitous learning*. British Journal of Educational Technology, 41 (2), 2010, pp. E1-E9.

[4] Pérez-Sanagustín, M., Ramirez-Gonzalez, G., Hernández-Leo, D., Muñoz-Organero, M., Santos, P., Blat, J. & Delgado-Kloos, C. *Discovering the campus together: a mobile and computer-based learning experience*. Journal of Computers Networks and Applications, 35 (1), 2011, pp. 176-188.

[5] Santos, P., Pérez-Sanagustín, M., Hernández-Leo, D. & Blat, J. (2011). QuesTInSitu: From tests to routes for assessment in situ activities. Computers & Education, 57 (4), pp. 2517-2534.

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