ORCHESTRATING AN UBIQUITOUS LEARNING SITUATION TO IMPLEMENT EFFECTIVE AND EQUAL LEARNING IN PANDEMIC TIMES: CASE STUDY OF MARGINALIZED REGION IN NORTH AFRICA

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ABSTRACT

The COVID-19 has impacted education all over the world, especially many African countries where the experience of the pandemic has been distressing. While the need for distance learning was clear from the outset of the pandemic, achieving effective reach to learners was more complex, multifaceted and challenging task, facing to many issues: Closing equity and adapting and using technologies for hybrid learning that engages pupils. Early childhood and primary level students are seen to be most likely to be disadvantaged by the crisis and least likely to be able to access the technologies required for learning. These problems faced governments worldwide but has been particularly severe in most African countries where there is a wide disparity in technology use and access for the 'elite and for less advantaged pupils mostly in rural areas. his paper describes the first stage of a study that aims to characterize the ubiquitous learning scenario for marginalized regions and challenges brought by the COVID-19 pandemic to the Tunisian primary education context. This scenario aims to enhance learners to embrace change, learn, and keep attached to the learning process by interactive SMS based game. This scenario has been tested on the second level of science education in six Tunisian elementary schools in a rural region. A preliminary analysis showed that the proposed learning activities motivate Tunisian pupils who become more closer to learning than before. The experience should be generalized in the other Tunisian regions and classrooms.

KEYWORDS

Ubiquitous Learning, Pedagogical Continuity, Marginalized Region, Equitable Education

1. INTRODUCTION

As technological development facilitated the access to information, ubiquitous learning - technologically mediated learning that occurs regardless of time and space - provides learning able to overcome geographical barriers and to level the field for students generally disadvantaged in access to education.

In this sense, creative solutions implementing ubiquitous technologies and techniques have emerged to provide learners (students or pupils) and their ecosystem (parents, teachers, etc.) with the facilities and resources needed to engage in and successfully complete the learning process.

These ubiquitous scenarios enhance interaction and provide effective learning to pupils anywhere and anytime Yahya, et al., (2010) across ubiquitous communication channels and tools such as cell / smart phone, closed-circuit television etc.

However, the needs and contexts of educational agents – teachers, learners, and parents and their access to technology, Internet, and digital literacy, may have a major impact on the processes of going digital, and therefore cannot be ignored.

In fact, during the COVID-19 pandemic, Tunisian transition to distance learning has not been the same in different primary and secondary schools. In fact, online learning has required adjustment at different levels by both teachers and learners to adapt to new learning styles with focus on active learning and technological support required for delivery of teaching.

Many extensive problems remain, including the lack of internet connectivity in some locations, especially rural ones, and the competing needs among family members for the use of home technology.

According to the investigation done in eLearning Africa & EdTech Hub (2020), Educational TV and radio are seen as the most important technologies for sustaining learning for learners at the primary level in these countries. However, it was quickly clear that, for most learners, these unidirectional communications approaches were not always the answer. They couldn't interact and evaluate their achievement.

In this sense, to ensure continuous learning during ongoing crisis or long holidays, this paper provides a reflection on the challenges fostered by ubiquitous learning and the permeability of contexts, faced by learners in rural region during the COVID-19 confinement. It describes a mixed learning scenario which combines educational radio program with the use of cell phones to respond to SMS – Quiz game. This scenario has been tested on the second level of six Tunisian primary schools in a rural region. A preliminary analysis showed that the proposed learning activities motivate Tunisian pupils who become more closer to learning than before. The experience should be generalized in the other Tunisian regions and classrooms.

This paper will be structured as follows. Section 2 gives an overview of ubiquitous and online learning scenario in time crisis related works. Game based ubiquitous learning scenario for competencies' enhancement description and a conceptual supporting framework are given in section 3. Section 4 presents the research context and methodology adopted in this article. We describe and discuss different experimentation and results in section 5. Finally, conclusion and perspectives are given in section 6.

2. BACKGROUND AND THEORETICAL FOUNDATION: UBIQUITOUS AND ONLINE LEARNING IN TIMES OF COVID 19

Ubiquitous learning, also known as Context-aware Ubiquitous Learning, integrates wireless communication, sensing, and mobile technologies which ensure learners across real, digital, and gamified activities to be more attached to the learning process Guettala, et al., (2021).

According to Mishra, et al., (2013), Ubiquitous learning process is characterized by:
- **Permanency:** The learning process remains continually until the learners purposely eliminate it.
- **Accessibility:** The learning process should be available whenever the learners need to apply it.
- **Immediacy:** The learning process should be retrieved by the learners whenever needed.
- **Interactivity:** The learners should have the possibilities to interact with peers, teachers, and experts efficiently and effectively through various types of media.
- **Context-awareness:** The environment had to be adaptive to the learners' context.

In the literature, several proposals have been advanced to deploy ubiquitous learning paradigms, especially during crisis time.

The authors in Simoes, et al., (2021) propose adaptation to virtual learning in the introductory course of biological engineering. These adaptations involve several changes to enhance interaction and learners' engagement. Due to technological disparities, synchronizing and interacting with learners were complicated. In several courses, a pre-class Question-Answer session was conducted, which initiated group discussions between the students and professors.

Siripongdee, (2020) defines a smart Blended Learning with IoT-based framework as a new normal of educational technology especially in time crisis. Therefore, this study proposes to consider 2 types of contexts:
- The classroom context with important parameters that can be detected by IoT devices.
- The personal context with personal parameters that can be detected by personal devices or wearable devices which are able to be identified, to collect and process personal data to report and track the students' status and learning processes.

A critical study is presented by Hassan, et al., (2020) that discuss Indian teacher's perspective about this mode of learning, challenges and issues faced by them in migration to online platform, experience about online tools/platforms used for instructional delivery and their suggestions to improve the process for effective teaching. Several issues such as connectivity coverage, learning motivation, teachers' competencies (ICT competencies required to teaching-learning design, social competencies, ability to accept teaching process' changes) etc. are discussed. Professional support and guidance to educators and enhancing learning context and infrastructure are the most relevant recommendations proposed by the authors.

García-Alberti, et al. (2021) demonstrates the impact of the sudden shift in the teaching-learning strategies in time of the global health emergency in higher education. This study concludes that online learning could be beneficial in some aspects and difficult in deployment in other aspects, especially students' engagement and motivation. discuss the adequate forms of evaluation.

By studying different proposals of ubiquitous learning, we can conclude that these ubiquitous learning scenarios couldn't be deployed in the African context particularly in the Tunisian's Context due to wide disparity in technology use and access for the 'elite and for less advantaged pupils mostly in rural areas. In the other hand, educational radio is seen as the most important technology for sustaining learning for learners at the primary level. However, it was quickly clear that, for most learners, these unidirectional communications approaches were not always the answer. They couldn't interact and evaluate their achievement.

For this reason, we propose, in the following section, a game based ubiquitous learning for competencies' enhancement, a novel form for the classical scenario adopted in African countries.

3. GAME BASED UBIQUITOUS LEARNING SCENARIO FOR COMPETENCIES' ENHANCEMENT

3.1 The Ubiquitous Learning Scenarios Design

A pupil is learning, when he is acquiring knowledge through interaction and through active participation not through passive recipient.

Based on this hypothesis, we need to allow learners to be in active environment which should be adapted to their learning context and constraint (internet and network coverage, level of competencies). That's why we hybridize educational radio channel with SMS-Quiz game (with parent cell phone) to ensure interaction.

The aim of the learning situation was to enhance scientific reasoning competencies, as well as communication competency. That's why we choose Arabic and Mathematics lessons to be aired on a national radio station.

The learning situation was planned during 4 months (from the February to May 2022). Involved teachers deliver gamified structured lessons on selected disciplines which target approximately 300 children in the rural region. Radio lessons for pupils à 4th level primary education was planned three times in a week. SMS Quiz were sent to pupils daily to keep them attached. Pupils should send the number of correct answers. The SMS Server was developed to indicate whether the pupil's response is correct or not. An intelligent repetitive remediation was planned to low progress learners. The scenario design is depicted in Figure 1.
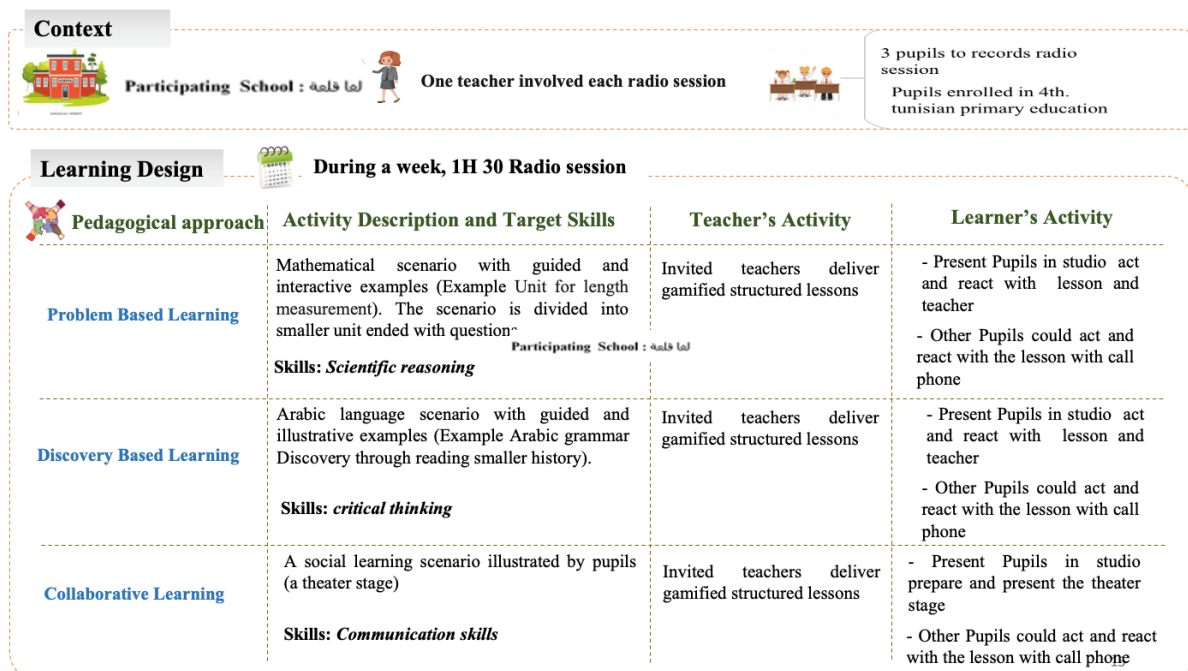

Figure 1. Graphical depiction of the ubiquitous learning scenarios design

We organized various stakeholder meetings as part of planning for introduction of the distance learning initiative. We also organized discussion platforms on Radio and social media to engage the general public.

3.2 Conceptual Learning Analytics Framework

We conceive and orchestrate various elements together in an integrative conceptual framework for ubiquitous learning environment (see Figure 2) to provide a structure for analysis to recommend strategically enhancements, a common language to stimulate further engagement.

In this project, the study of collected data produced by the interaction of pupils and teachers with the proposed learning scenario, interests not only learners and educators themselves as decision-makers, but also researchers, analysts, designers, administrators, and policy makers and so forth.

As we are dealing with a wide range of contexts and we are aware of how important to fully explore the user's requirements throughout the process of designing contextual based recommendation, the study of the variety of users, their different learning problems, and their intended purposes take a prominent place among our research challenges.

To answer different stockholders' needs, we propose a multi objective and contextual framework which corporates three basic components. The first component is the intelligent SMS server which stores pupils' response and provides them adequate replay and remediation.

The second component is the explainable recommendation across intelligent dashboard which enables a dynamic production of different effective recommendation to explain integrated visualization needs expressed by each user in a wide variety of contexts.

To add semantic information, qualitative (questionnaire survey and interviews) and quantitative data (SMS response) are gathered and integrated together to generate visualization components, user descriptions and different data/indicators.

Hence, each generated dashboard should provide, on the one hand, a set of indicators gathering that facilitates the links between the data and the visualization objective.

On the other hand, it should provide adequate visualization components to maximize the value of this relevant set of data to be visualized at the right time.

These set of dashboard components (chart, user description etc.) will act as a semantic framework for storing contextual information required for generating an adaptive and explainable recommendation.
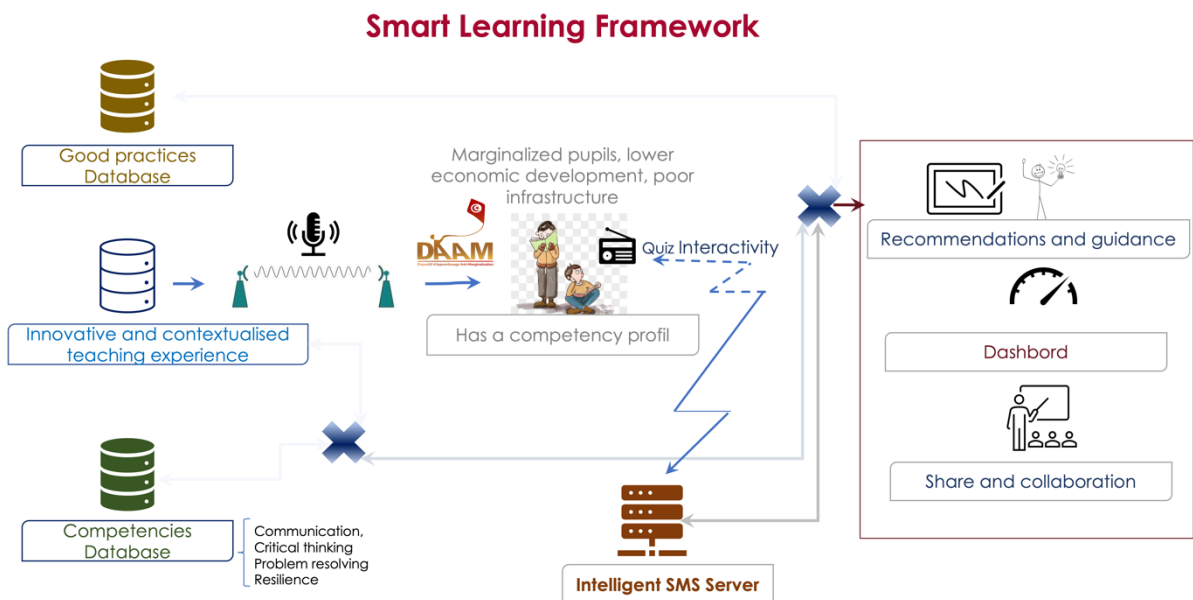

Figure 2. Conceptual Learning analytics Framework overview

4. RESEARCH CONTEXT AND METHODOLOGY

This case study was carried out in public primary-education schools located in marginalized Tunisian region (North of Nabeul, Tunisia, North Africa). This region is rural with limited internet and network coverage and poor economic infrastructure. In these regions, the lack of continuous supervision and guidance after school are highlighted and the dropout rate is higher.

4.1 Research Context

- **Participants:** A purposive sample of courses was chosen to provide rich insights. Courses were chosen based on being those that are most adequate to enhance the development of scientific reasoning competencies. Pupils enrolled in 4th primary year have been invited to participate. Academics teachers working different schools and contributing to the above courses have been kindly asked to collaborate in the study as depicted in Figure 3. The total number of participants is around 400 participants (100 teachers and 300 pupils) for 6 months.
- **Study Duration:** The study is proposed over 06 months from January 2022 till June 2022. The study duration has been proposed based on the duration of the AUF Covid 19.2 project and based on the assumption that pupils enrolled in 4th primary years are likely to succeed to the next level at the beginning of September 2022
- **Ethics**: Ethical approval for this study has been obtained from:
- National educational ministry to conduct pilot learning experience
- Pupils 'parent to allow them to participate in the ubiquitous learning experience. An explanatory statement will be provided and written consent to participate will be obtained from all parents who their pupils participate in the ubiquitous learning experience

Figure 3. Different stockholders working on the ubiquitous learning scenarios

4.2 Methodological Approach

A convergent mixed methods research design Creswell, et al., (2007) is employed using both quantitative (Response to SMS-quiz) and qualitative data (Pupils and educators' feedback through open ended questions in the survey Pupils and educators' interviews), which will be collected longitudinally analyzed and interpreted together. Figure 4 depicted the research methodology.

The aim of this study is to evaluate the impact of the change to teaching and learning approaches, including online education and changes to work-integrated learning, during the COVID-19 pandemic. More specifically the study will answer the following research questions:

- *How have the teaching and learning approaches been received by pupils*?
- *How effectively did teachers adapt to the transitioning teaching approaches and what factors influenced their adaptability*?
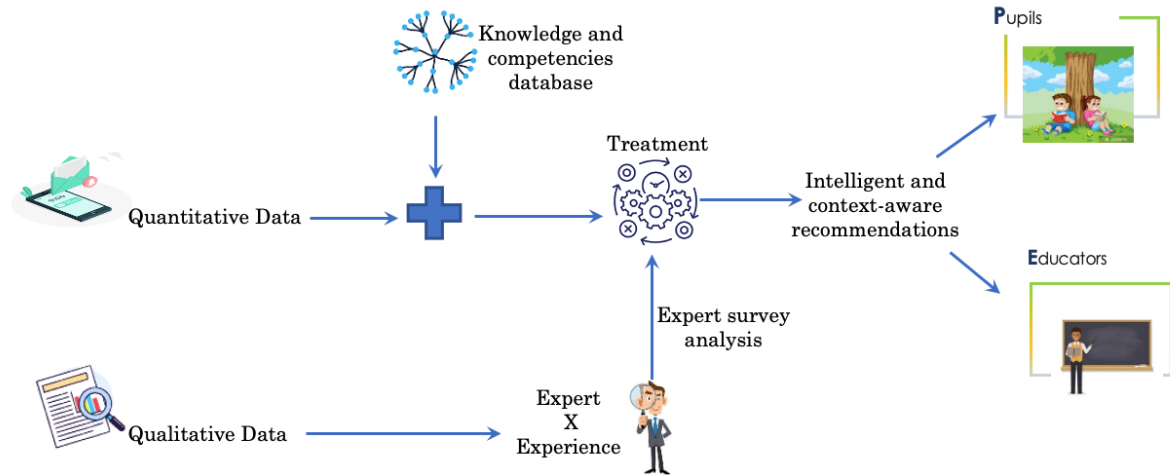

Figure 4. Methodological approach

5. RESULTS AND DISCUSSION

The learning situation was successfully carried out. The first part in DAAM project was achieved. The field investigation is in progress. Thus, we present, in the following section, preliminary quantitative analysis.

5.1 Preliminary Analysis and Results

To assess the learning outcomes achieved through ubiquitous learning scenario, quantitative data relating to pupils' performance and engagement, is summarized, and presented using descriptive statistics.

Effectiveness and efficiency related to the learning scenario deployment were deduced from pupils' interaction with the SMS- Quiz extracted from the server database.

The enactment measures used for the assessment of pupils' involvement are as follows:
- To evaluate effectiveness: we used the completion rate percentage (complete %)
- To evaluate efficiency: we used the average time and the average score (for quizzes)

Table 1. Pupils'performance and engagement result deduced from their response and interactivity to SMS-Quiz

	Easy Level SMS (30 questions)	Medium Level SMS (30 questions)	High Level SMS (30 questions)
Number of evaluated learners		287	
Completed (%)	90%	70%	30%
Avg. Score	15,5	10	NA
Min Score	2/30	4/30	3/30
Higher Score	30/30	29/30	25/30

5.2 Discussion

The results of this experience and involved teachers' interviews indicate that pupils are more motivated and engaged in learning process.

As perspective to this project, generalizing learning experience through intelligent learning platform is proposed. Teachers are motivated to be trained in IT technologies and active pedagogy strategies to remediate to their technical difficulties in using online platforms and delivery of instruction as well as in creating e-content adapted to limited internet coverage.

Based on this research study and after considering the challenges faced by teachers, there are some recommendations that can help in effective ubiquitous teaching. We conclude that there is need for professional training of teachers with emphasis on the deployment of active pedagogies methods and on the use of ICT tools in creating, sharing, disseminating content and use of online modes of teaching learning process.

6. CONCLUSION AND FUTURE DIRECTIONS

During Pandemic proliferation, many Tunisian children, as well as African ones, do not have fairly access to the technologies needed for home-based learning and often have limited means to continue their education.

In rural regions, quality of education remains poor with a higher rate of dropout and a fewer rate of children demonstrating developed life skills and 21st century competencies. Therefore, keeping learners, especially pupils, positively engaged with learning has been critical during and after the time of COVID-19.

Mitigate the impact of the pandemic on learning is the main objective of the ubiquitous learning scenario through a radio program and gamified learning activities for children to ensure continued learning during ongoing crisis or long holidays.

This article describes the first stage of a DAAM project that aims to deploy an ubiquitous learning scenario for marginalized regions with limited internet and network coverage to the Tunisian primary education context. This scenario aims to enhance pupils and teachers to embrace change in teaching-learning process by keeping pupils attached to the learning process by interactive SMS based game and enhancing educators to adopt active learning pedagogies.

This scenario has been tested on the second level of science education in six Tunisian elementary schools in a rural region. A preliminary analysis showed that the proposed learning activities motivate Tunisian pupils who become more closer to learning than before. Teachers are open to ICT and pedagogical training. As future direction, qualitative data will be semantically integrated to the recommendation system to enrich recommendation.

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