

Digital elementary school solution with moodlebox in a conflict zone: the case of the Central African Republic

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Abstract— The political-military crisis of 2013 destroyed the Central African education system. Armed groups occupy 80% of the territory. They often use school buildings as base camps, playgrounds as shooting ranges and transform desks and chairs into firewood. Due to insecurity, most of the qualified teachers have abandoned their posts to stay in Bangui, the capital of the country. School-age children are left to their own devices without education. This constitutes a danger to peace, security and the socio-economic development of the country. Going to school, learning to read and write is a right that all children should enjoy.

In this article, we propose a digital elementary school solution in conflict areas with moodlebox to enable these children to learn with the assistance of the teachers-parents.

The methodological approach of our solution is based on the use of raspberry pi 3 b+ on which we deploy moodle for all elementary school classes. The solution does not need the Internet or network infrastructure to work. Each student is equipped with a tablet that allows him/her to connect to the digital elementary school platform via Wi-Fi. Teachers recruited and trained in these areas provide the necessary support for children to master the digital tools for their education, and the teaching model is based on active learning. Course content is prepared by qualified teachers and integrated on the platform.

This solution contributes on the one hand to the mastery of Information and Communication Technologies for Education by primary school students in a constantly changing technological environment; on the other hand to the improvement of schooling, the consolidation of peace, security and socio-economic development, thus facilitating the emergence of good governance and democracy in Central Africa.

Keywords— Education system, conflict zone, digital elementary school, MoodleBox, active learning, Wi-Fi.

I. INTRODUCTION

In the Central African Republic, the 2013 crisis has had extremely negative effects on the education system. In 2015, according to the Education Cluster's evaluation report, enrollment rates fell by 6% compared to 2012 because schools were not functional. Among the reasons for this non-functioning were the absence of teachers (49% of cases), population displacements (31%), destruction of premises (21%) and insecurity (26%) [1]. To date, 80% of the country is under the authority of armed groups and teachers have deserted these conflict zones. The right to education is violated in conflict-affected communities. These factors have

a detrimental impact on access to education, which remains relatively nil among Central African school-age children, and thus hampers the country's socio-economic development.

To address this problem, we propose a digital elementary school solution with moodlebox in these conflict zones of the Central African Republic.

Several researchers have proposed digital learning solutions in elementary school based on digital games. This is the case of the authors in [2] who have shown that gamification in digital classes allows junior elementary school students to maintain more interest than the non-game-based approach to learning with digital resources. In [3], the authors demonstrated the effectiveness of developing a digital game-based learning system in the social programs of elementary school.

Our approach differs from these game-based solutions. First, our solution uses a raspberry pi 3 b+ box on which we installed moodle. Then, the course content for all primary classes is prepared and installed on the system. The teaching method is based on active learning. In each conflict zone where there are camps for the displaced, students are assisted by teacher-parents by accessing the platform through the tablets connected to the Wi-Fi provided by moodlebox.

The rest of this article is organized as follows. Section II describes the state of the art. Section III proposes the materials and methodology used, section IV presents the results, and finally section V provides the conclusion.

II. STATE OF THE ART

A. The situation of education in conflict zones in the Central African Republic

Thirty years after governments around the world adopted the Convention on the Rights of the Child, the right to education is being violated in conflict-affected communities in West and Central Africa [4].

The education situation in conflict zones in the Central African Republic remains dire. Inter-community violence is forcing the civilian population to set up wealthy camps protected by UN troops, leaving schools empty.

The conflict has an impact on children's education, with a significant number of children unable to attend school, either because of displacement or because schools have been closed, attacked, or occupied by armed groups. It is estimated that

31% of school-age children are no longer in school and only 49% of students' complete primary school [5].

The challenges to be overcome in order for children in the country to have universal access to education are immense. Education is the key that can enable them to draw on this strength to realize their potential and become agents of positive change. Without education, there can be no sustainable recovery, reconciliation and peace [6].

B. MoodleBox

MoodleBox is a very cheap and open source platform built around a Raspberry Pi 3A, 3B, 3B+ or 4B nanocomputer and the Moodle learning environment, the most widely used open source Learning Management System (LMS) in the world.

MoodleBox [7] is small, versatile and self-contained (no internet, no cable network, no infrastructure required). Easy to customize, the MoodleBox allows you to start digital learning directly in the classroom, even if the school does not have a Wi-Fi connection. The motivation for choosing MoodleBox is its small footprint on a Raspberry pi makes it an affordable option with the power and flexibility of Moodle, the de facto standard for open learning systems.

Today, with the MoodleBox, a portable mobile platform is on the table. It is capable of deploying a learning environment at the local level, even in areas remote from any network infrastructure [8].

C. Digital school

The digital school is a concept that reflects the vision of digitizing a school's learning and management system in order to equip students with the skills and abilities of the 21st century [9]. Today, 32.6 million children of elementary school age and 25.7 million adolescents are out of school in sub-Saharan Africa. The quality of education also remains a significant problem, but technology may be part of the solution. The ongoing digital revolution in the region has led to a boom in the testing of information and communication technologies (ICTs) in education, both in and out of the classroom [10].

Several research studies have been done on the digital school. In [11], the authors studied the experiences of integrating digital media (a combination of text, image, audio and video) into school curricula in Ethiopia. The authors in [12] showed that digital storytelling would greatly enhance the creative thinking of primary school students. Other authors in [13] presented innovative educational services managed by the Small School Alliance using a live webcasting technique combined with abundant industry resources, aimed at providing equal learning rights and globally connected learning around the world.

The results of this research have shown that the use of digital in school learning is attractive and effective.

D. Active learning

Active learning is an approach in which learners participate in the learning process by developing their knowledge and understanding. In schools, they typically do so in response to learning opportunities designed by their teacher [14].

Active pedagogy refers historically and mainly to Adolphe Ferrière who, at the beginning of the 20th century, was among the first to use the term "active school" in his publications. It is one of the bases of the new educational current. Active pedagogy advocates, as a first principle, active learning which allows the learner to link knowledge, attitudes or skills to their needs.

Several researchers have worked on active learning. The authors in [15] have achieved a remarkably improved level of results with the integration of two important methodologies in teaching and learning: Edgar Dale's action learning methodology, emphasizing the active part, and the Hermann Ebbinghaus methodology of successive repetitions to improve the forgetting curve. In [16], the authors showed a statically significant effect through better scores obtained from practical active learning stations to transform existing learning environments into flexible and active learning classrooms. In [17], the authors examined the use of the online portal (Pear-deck) for active learning pedagogies and its impact on student learning outcomes by comparing the results with traditional classes.

The results of these studies showed that active learning promotes learners' learning and autonomy, developing both knowledge and understanding.

III. MATERIALS AND METHODOLOGY

We first present the proposed architecture of our solution. Then we describe how it works, and finally we will deal with the teaching method.

A. Architecture of our solution

The architecture includes:

- a Raspberry Pi 3 Model B Plus Rev 1.3,
- a 32GB microSD card on which we have installed an image of MoodleBox Version 3.8,
- a Wi-Fi card installed on the Raspberry pi 3 b+,
- tablets allowing elementary school students to connect to the MoodleBox Wi-Fi network.

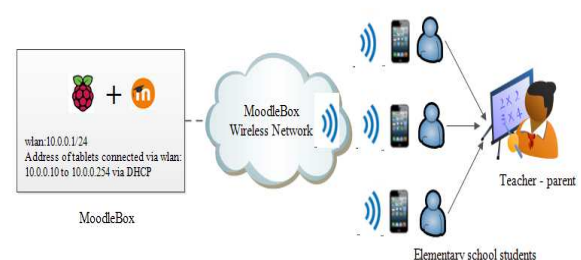


Figure 1. MoodleBox architecture

B. How it works

The proposed MoodleBox solution works without the Internet connection. It provides learning and file sharing activities without wired or wireless network infrastructure.

MoodleBox works on a client-server model. It includes the Nginx web server with PHP and MySQL. The learning platform is designed based on the image of MoodleBox 3.8.

Clients (tablets, smartphone, laptop) must connect exclusively via Wi-Fi from the MoodleBox platform in order to access the local site of the digital school using a web client. MoodleBox assigns dynamic addresses to the connected devices. Each client must have an account created on the platform for access.

However, this solution also allows routing to the Internet when the Raspberry pi is connected to the Ethernet network with Internet connectivity. In our architecture, we have not connected the raspberry pi 3 b+ to an Internet network.

C. Teaching method at the primary level

The teaching method at the primary level is active pedagogy or active learning, that is to say: learning by doing. This method makes the students actors of their learning.

The sequence that the student must follow is:

- the confrontation with a concrete problem;
- the search for information concerning this problem;
- the search for a solution to the problem,
- the evaluation of the overall approach, and in particular of the know-how.

The digital activities that accompany the courses are organized on the educational platform MoodleBox, to which the students regularly registered have access with the assistance of teachers - parents to educational resources (courses and digital exercises).

IV. RESULTS AND DISCUSSIONS

The results were produced thanks to an educational scenario integrating the platform composed of the moodlebox 3 image installed on a raspberry pi 3 b+ powered from a laptop, and a tablet as shown in the following figure 2:



Figure 2. Testing environment

The pedagogical approach is the inverted classroom, which allows for a shift from a teacher-centered model to a student-centered model. In this approach, the nature of learning activities in the classroom and at home is reversed, leading to a change in traditional learning roles. Students receive lessons

in the form of online resources on the tablet. The student completes assignments in the classroom together with the teacher, and what was previously done at home is now done in the classroom.

The initial installation of Moodlebox has only one administrator account and no courses are created. We created the users and then configured the content management (resources, activities, etc.).

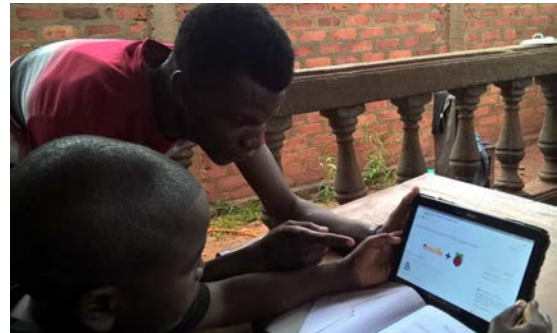


Figure 3. Assistance in using the tablet

The figure 3 showed a scenario in which an elementary school student was assisted by the teacher on the use of the tablet connected to the moodlebox digital elementary school platform. The DHCP (Dynamic Host Configuration Protocol) server built into the Raspberry Pi automatically assigned free Class A IP addresses to the tablets connected to the system.



Figure 4. Digital elementary school home screen

The figure 4 showed the home page of the digital elementary school with a mathematics course available for the first year of preparatory class.

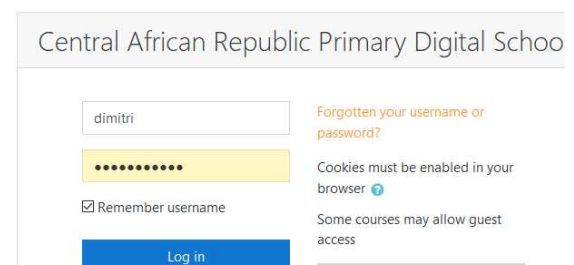


Figure 5. Login screen

The figure 5 showed the login screen allowing the student to authenticate with a username and password to access resources (courses and exercises) on the digital school platform.



Figure 6. Access to the mathematics for first year preparatory course

The figure 6 showed access to the mathematics course and quiz for the first year of the preparatory class.

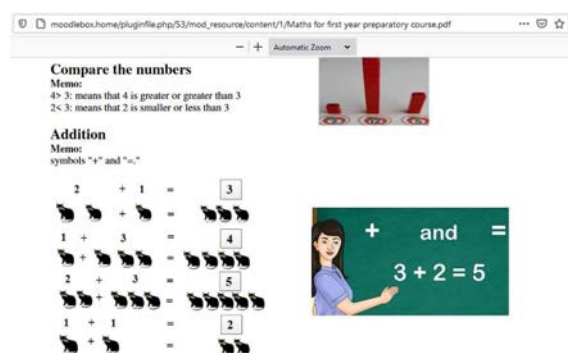


Figure 7. Displaying the math course on the tablet

The figure 7 showed that the student accessed the mathematics class. This course is about number comparison and addition.

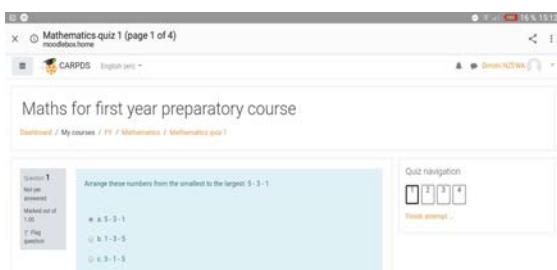


Figure 8. Mathematics quiz

The figure 8 showed the math quiz to be done by the student at the end of classes and in the classroom instead of doing these activities at home as in the traditional method.

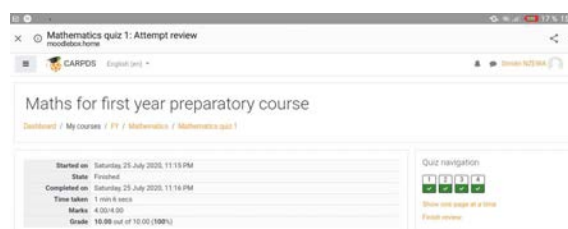


Figure 9. Mathematics quiz results

The figure 9 showed the results of the student's math quiz. These results showed that the student had 100% correct answers.

Although the integration of digital using media such as radio, web, television has been proposed in school, most of it is limited to a normal context where there is peace and stability and a connected infrastructure.

The different results above have shown that with a simple and less expensive infrastructure, we can easily deploy a digital elementary school solution to contribute to the renovation of the school and to improve its performance in conflict areas without Internet connectivity.

On the pedagogical level, moodlebox has made it possible to set up an accompanied class. The goal is to bring the students to more autonomy, creativity and collaboration.

On the technical level, moodlebox is a nomadic device independent of the Internet providing a Wi-Fi network for smartphones, tablets or computers. The student connects to this nomadic device using the Internet browser from the school's tablets or from his or her own smartphone. They can access the various resources made available by the teacher on this nomadic platform, which solves the problems of network access, Web 2.0 sites with ads or those that become paying.

Moodlebox accompanied and managed a learning process or a pedagogical path. That is to say, it has provided online training and educational materials to students following the classes. The students have a strong interaction with the system. They are able to play fun quizzes or take real exams. Course and exam creators can easily track their students' progress.

V. CONCLUSIONS

In this work, we proposed a digital elementary school solution with MoodleBox in a conflict zone in the Central African Republic. The main objective is to ensure through education that the potential of a generation of young people is not wasted in conflict zones.

At a time when several million children have been deprived of their education in certain regions of African countries such as Mali, Burkina Faso, Niger, Nigeria, Chad, the Democratic Republic of Congo and the Central African Republic, due to insecurity caused by rebellions and attacks in Boko - Haram, our solution would be indispensable first for the schooling of children and then the promotion of digital education in these conflict zones.

Future development of our solution could include the use of TVWS for high-speed Internet connectivity for elementary school in these conflict zones.

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