

EPFL

**E-learning
project in
fragile
contexts**

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E-learning project in fragile contexts Final report

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Acronyms and abbreviations

ACL	African Cities Lab
SDC	Swiss Agency for Development and Cooperation
DESI	Digital Economy and Society Index
DNS	Domain Name System
EPFL	École polytechnique fédérale de Lausanne (Swiss Federal Institute of Technology in Lausanne)
EXAF	Excellence in Africa (EPFL research centre)
AI	Artificial Intelligence
MOOC	Massive Open Online Course
SDG	Sustainable Development Goal
STEM	Science, technology, engineering and mathematics
ICT	Information and Communication Technologies
WEQ	Website Experience Questionnaire

Authors

The “E-learning in Fragile Contexts” project was co-financed by the Swiss Agency for Development and Cooperation (SDC) as part of its programme contribution to Unité association. The project was implemented by the EXAF-EPFL (Excellence in Africa - École polytechnique fédérale de Lausanne) team.

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Summary

This report describes a project implemented by EXAF, which aimed at proposing e-learning solutions adapted to contexts with poor Internet connectivity.

This report relies on an inception report, written after the first phase of the project. The objectives of the first phase were to identify the characteristics and needs of our target audience (Unité's partner organisations³) and to evaluate the main existing technical solutions (involving software, infrastructure, or best practices) to enable the deployment of e-learning solutions in fragile contexts.

The technical solution suggested in the inception report is based on the development and use of a web application for compressing and optimising educational files. The use of a nano-computer was also suggested as a way of creating a local intranet network where Internet connectivity is too weak for e-learning. Three pilot projects were also identified and selected to practically test the components of the technical solution.

These three pilot projects in Côte d'Ivoire, in Egypt and in Kenya, made it possible to assess the digital teaching solution developed in different contexts (the pilot project in Côte d'Ivoire was the most fragile context, while the project in Kenya represented the easiest context). The assessment of the relevance and effectiveness of the various components of the technical solution by the research centre Excellence in Africa (EXAF) team was complemented by an inclusive

and participatory approach with users to assess their satisfaction towards the proposed solution. We were able to compare the results of our own observations with their feedback to improve and adapt the implemented technical solution. This also confirmed that the solution does have a tangible impact to reduce inequalities.

This report highlights the lessons learnt from the pilot projects, as well as the prospects for the future development of our solution, for example to disseminate the solution to other audiences or to improve its usability. More generally, our main mission was to ensure that the impact of this technical solution contributed to the Sustainable Development Goal (SDG) #4, which promotes fair access to quality education for all. Based on the findings of the partner associations involved in the pilot projects, as well as on our own observations, we can confirm that this objective has been fully met.

³ Unité is an association of 13 Swiss organisations active in development cooperation for the exchange of people.

1. Introduction

Unité is an association of 13 Swiss organisations active in development cooperation for the exchange of people. They aim to contribute to the implementation of the 2030 Agenda by strengthening the capacities of partner organisations to fight multidimensional poverty in the global South in favour of local populations and to improve the framework conditions for development.

EPFL in Lausanne, is one of the world's leading universities specialised in science and technology, hosting students, professors, and staff from more than 130 countries. As a public institution, EPFL focuses on three missions: teaching, research and innovation. It collaborates with a large network of partners, including other universities and institutes, secondary schools, high schools, companies, political circles, and the society, to have a real impact on society, both nationally and globally.

Unité has joined forces with the centre Excellence in Africa (EXAF) to develop a technological solution that will enable people in geographical areas with little or no internet connection to access educational content remotely. This issue is at the heart of the concerns of the EXAF research centre, which promotes excellence in research and digital education on the African continent.

The “E-learning in fragile contexts” project consisted in two main phases. The first phase carried out research (literature review) to identify and evaluate technical solutions that could provide an easier access to education for people with little or no Internet connection. As part of the first phase, we also analysed the characteristics and needs of the target audience, particularly partner organisations of Unité. This first phase has been described in a dedicated report (EXAF 2022), and only the main findings have been summarised in the present report. The second phase focused on the development of a technological solution involving various elements (hardware and software).

After an introductory section setting out the context of the project, this report describes the development and testing of the technical solution in real-life situations through three pilot projects. The lessons learned from the pilot projects are described and analysed, regarding the technical deployment of the solution components and the consequences in terms of reducing inequalities. This analysis is based on the reports provided by the partner associations subcontracted to carry out the pilot projects.

1.1 Information technologies on the African continent

Because of the growing importance of information management, information, and communication technologies (ICT) are now major springboards for economic growth in both developed and emerging countries (United Nations. Economic Commission for Africa; et African Information Society Initiative (AIS) 2008). Information is nowadays a strategic resource, and ICT are its main vectors (African Union, 2020).

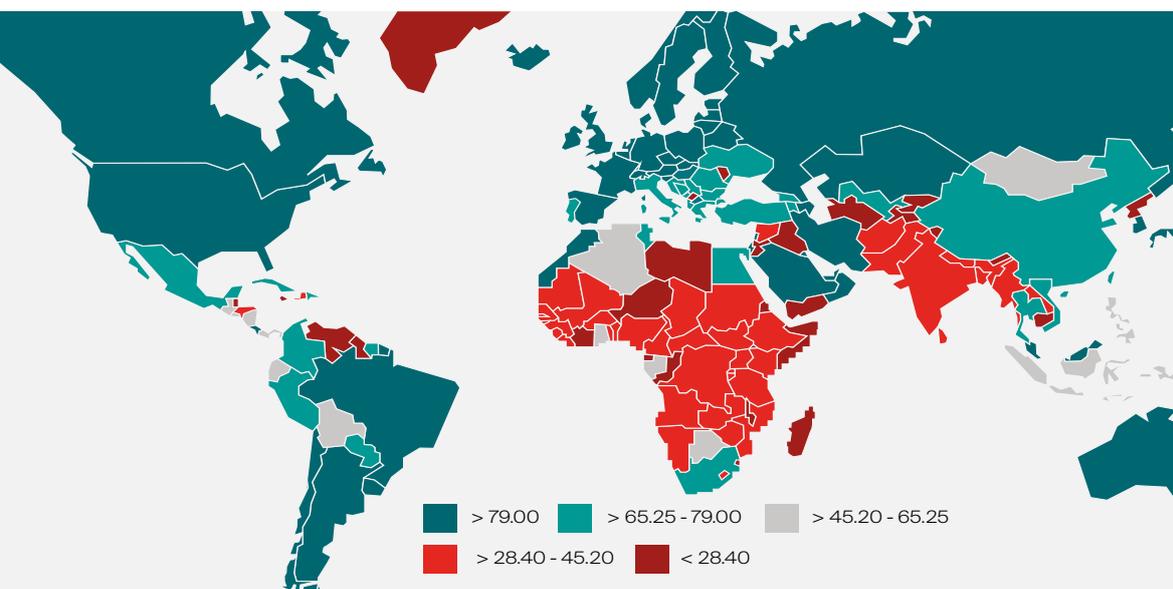
In Africa, ICT can play an essential role, particularly in the fields of education and vocational training. They have become a decisive factor in development, and even a prerequisite for it (European Investment Bank 2021). However, despite their potential, ICT are still largely under-exploited on the African continent. For example, only 30% of

the population of sub-Saharan Africa (Figure 1) had access to the internet in 2020 (World Bank Group 2022).

As described in the preliminary report of this project (EXAF 2022), numerous applications already demonstrated the potential of digital technologies in Africa. It's especially visible in urban areas, where ITC can support the development of public policies and contribute to economic growth (Chenal et al. 2021). One issue that remains unresolved, and which is of great importance in this project, is the widespread use of digital technologies in areas that are less connected than cities, to avoid the creation of 'digital deserts' (Wang 2020).

ICT can play a major role in achieving the SDG #4: "Ensure equal access to quality education for all and promote opportunities for lifelong learning". Distance learning can enable people to

Figure 1
Percentage of the population connected to the internet (Source: adapted from World Bank Group 2022)



receive training and obtain a diploma without having to travel to a training centre to attend classes. This is particularly important in certain regions where it is difficult or impossible to provide face-to-face teaching.

In the African context, remote education can be extremely valuable and could help to overcome some of the limitations of traditional teaching. For example, e-learning could overcome, at least partially, the issue of shortage teaching staff in African academic institutions, where classes are often overcrowded, sometimes with more than 1000 students (Yelemou, Some, and Kielem 2018).

As described in the inception report of the E-learning in fragile contexts project (EXAF 2022), numerous studies have been carried out to analyse the benefits of learning via video. For example, (Nadeak and Naibaho 2020) identified the benefits of learning through audio-visual media:

1. The video attracts attention.
2. It encourages concentration.
3. It generates interest in class.
4. It creates a sense of anticipation.
5. It relaxes or energises learners.
6. It can make teaching more attractive.
7. It can make images easier to remember.

Video is not only useful for children's learning. It can also be useful for adults.

1.2 Potential solutions

The inception report by EXAF (2022) classified the solutions found in the literature into three categories: hardware solutions, software solutions and bandwidth management solutions (Table 1).

Among these solutions, bandwidth management was set aside, because it involves managing a fixed intranet network within an institution, which was not the core focus of the project.

Among the hardware solutions, nano-computers were identified as the most promising solution. Today, a solution based on a network supplied by satellites is too expensive for the project's target audience, while solutions based on infrastructure development (e.g., 4G or 5G) are not relevant in this context.

Several software solutions had been considered and could have been suitable. Among these, a web or smartphone application for compressing educational files was favoured. Such an application could also contain advice and tutorials for distance learning. Although smartphone applications are very popular, particularly because they are so user-friendly and easy to use, they also have disadvantages in terms of accessibility. For example, it is impossible to consult a smartphone application from a computer, and the smartphone application must be available in several versions depending on the brand of phone on the market (e.g., Android or iOS application). The main advantages of a web application are its flexibility, the possibility to relatively easily convert it into a smartphone application, and the open access to the application's source code.

Categories	Potential solutions
Hardware solutions Chapter 3.2.1	<ul style="list-style-type: none"> ■ Satellite Internet (page 23) ■ Mini/nano computer, e.g., Raspberry Pi (page 26) ■ 2G,3G,4G and 5G development (not described in this report)
Software Chapter 3.2.2	<ul style="list-style-type: none"> ■ Local server, intranet, DNS, etc. (page 27) ■ Moodle lite (page 29) ■ Moodlebox (page 29) ■ Optimising files with a web application (page 31) ■ Optimising files with a Telegram Bot (page 37)
Bandwidth management Chapter 3.2.3	<ul style="list-style-type: none"> ■ Optimising source files (page 41) ■ File formats, e.g., svg, png, html (page 41) ■ Intranet management (page 41) <ul style="list-style-type: none"> ▪ Server security, firewall and virus protection ▪ Catalogue available on intranet ▪ Operating files available on intranet. ▪ Monitoring of network usage ▪ Blocking of certain pages. ▪ Prioritise bandwidth on certain networks.

Table 1

Classification of the main solutions that can facilitate e-learning in fragile contexts. N.B.: The page numbers and chapters indicated in this table refer to the initial report (EXAF, 2022).

Less restrictive than creating a smartphone application, developing a Telegram Bot could also be a relevant option. Outputs can be very similar than a web application (file compression, best practices, and tutorials). Teachers who do not have a learning platform or laptops would be able to send lesson videos via their smartphone.

As the tools offered by Telegram are open source, this option also offers a degree of flexibility, with the possibility of modifying the Bot and using it on different devices (phones, tablets and/or computers) and operators (Android, iOS, Windows, Linux).

1.3 Target audience

The solution was tested in three different contexts. The needs of the target audience were identified in the initial report using questionnaires and semi-structured interviews.

As a result, our target audience generally has limited and fragile access to the Internet, with frequent power cuts, as well as limited access to technological tools such as smartphones. In addition, our target audience often has little or no budget to improve their connectivity. To meet user needs, five main Personas were identified in the inception report (EXAF 2022), based on typical learner profiles:



Mouhamadou (Persona 1) is a 15-year-old student in a rural school with no Internet connection, no smartphone, and no computer.

Maureen (Persona 2) is a refugee living in a camp who owns a smartphone but no computer.

Rania (Persona 3) is an unemployed young woman living in a rural area who attends face-to-face medical courses. She owns a smartphone whose use is limited by the high cost of Internet data.

Musa (Persona 4) is a healthcare assistant who lives in a small town where the Internet is relatively slow and trainers lack the skills to master e-learning platforms.

Finally, **Céleste (Persona 5)** is a PhD student in computer sciences who lives in a large urban centre and owns both a smartphone and a laptop with a good Internet connection. She also works for a local educational association but lacks the resources and long-term vision for distance learning.

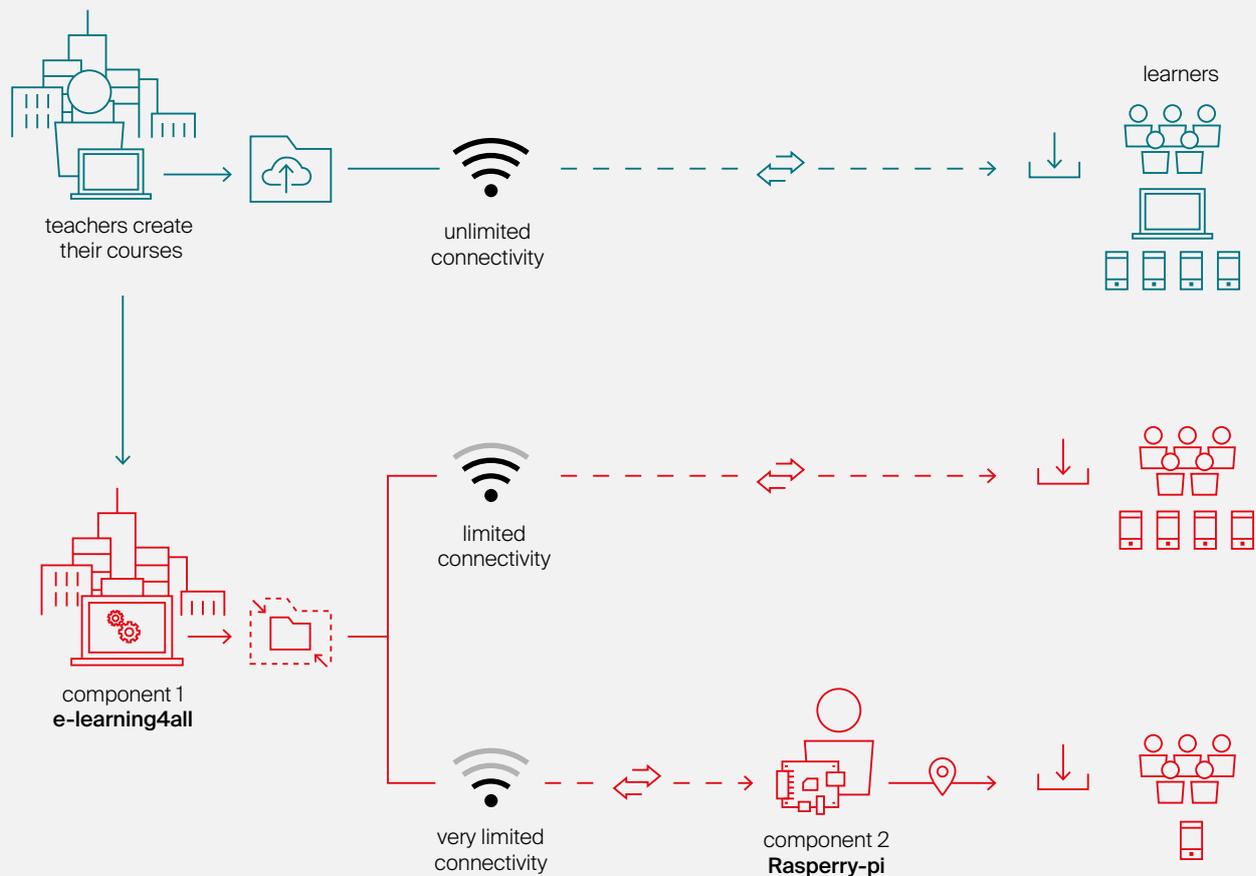


Figure 2
Articulation of the
chosen technical
solution

1.4 Articulation of the chosen technical solution

Based on the analysis of the users' needs, a technical solution comprising several complementary components has been developed (Figure 2).

After having analysed the various possibilities offered by the information and communication technologies, EXAF finally decided to develop a web compression application called “e-learning4all”.

As shown in figure 2, this application forms the basis of the technical solution proposed as part of the “E-learning in fragile contexts” project. Indeed, in all the contexts studied during our analysis of the target audience, the need to

reduce the size of pedagogical files was imperative for several reasons.

Firstly, by enabling trainers to send lighter files to their learners, the reduction in bandwidth usage means lower connection times and costs. This is illustrated in the second line of the figure 2, where learners can receive the remote material prepared by the trainer, even with a limited internet connexion and at an affordable cost.

In some of the situations experienced by partner associations of the association Unité, a compression tool was not sufficient to enable distance learning. This was particularly true in the two pilot projects where EXAF teams tested the solution. In such situation (e.g., third row of figure 2), it would have been

impossible to share online courses, because the trainees often don't have the capacity to download the pedagogical material, even extremely small course files. Our analysis demonstrated that the trainers often have a better connectivity at home. They could therefore create pedagogical content at home, compress it and upload it on a numerical device.

EXAF's solution therefore included a second component using a nano-computer to create a local intranet at the training site. In this case, someone must physically bring the nano-computer on site (often the person delivering the training himself), which may raise questions about the "distance learning" aspect of this solution. It should be noted, however, that the timeframe is not the same as for the face-to-face training. With our solution, the trainer only must visit the site occasionally, for example once a week or once a month. It's even possible to come only at the beginning of the course and share all the content at once. It is also possible to entrust the nano-computer to someone who needs to visit the trainees for a completely different reason.

Amongst nano-computers, the Raspberry Pi brand was selected for two main reasons. Firstly, the Raspberry Pi is an inexpensive and easy-to-use computer. In addition, it's very energy-efficient, and can run on a portable battery or USB power supply. These two elements seemed essential in the contexts encountered during this project.

While remote sharing of educational files may seem virtually impossible to implement in very fragile contexts without hotspot, the ability of trainees to read/view these files is not guaranteed either. In some situations, encountered by the partner organisations of the association Unité, several students (e.g., siblings) must share a cell phone of average quality and therefore with a limited memory (see line 3 in figure 2). If educational content is shared over a long period (e.g., a month), it is also essential to use the application developed (component 1) to save memory in the receiving devices available to our target audience of learners.

It was also offered to install a Moodle instance on the nano-computers, to make it easier for students to learn how to create online courses. A Moodle instance is a version of the open-source Moodle software installed on a server, enabling the creation and management of online courses. Moodle also offers an offline option. Students can download course content for later access, even without an Internet connection.

A third component had been considered, but was ultimately not implemented, as it was only marginally efficient in our context. It consisted in developing a Telegram Bot, which could have been an alternative to component number 1 (compression tool and support for advice, tutorials, and best practice guides).

1.5 Pilot projects



Côte d'Ivoire

The project in Côte d'Ivoire was considered the most vulnerable of the three. In fact, in the target village, connectivity is very poor, the electrical network is unstable and there is a lack of equipment available to screen courses remotely. To cope with these additional material difficulties, in addition to the Raspberry Pi, tablets were made available for the learners.



Egypt

The pilot project in Egypt was considered as slightly less fragile than the one in Côte d'Ivoire. However, some of the learners we should have met were illiterate and lacked the means to view online courses. For these people, the impact of the technology can be indirect, with a specific focus given to train those in direct contact with them. An e-learning training strategy for trainers was put in place to optimise the benefits of the proposed technology.



Kenya

The pilot project in Kenya was very different from the other two ones. The pilot project took place exclusively remotely. The level of education of the learners was high, with good capacity in terms of both hardware and Internet connection. However, as in Egypt, the target audience sometimes works with a more precarious public.

The main objectives for these pilot projects were:

1. The first objective was to test the various components of the technical solution in real-life situations and to confirm or invalidate their effectiveness in contexts of fragile Internet connection.
2. The second was to collect information to improve the technical solution.
3. Finally, the third objective was to ensure that the developed technical solution was in line with the overall objectives of the project, meaning that it could contribute to ensuring inclusive and fair quality education for all. More specifically, it was necessary to ensure that the solution reduces (rather than increases) inequalities in access to education.

In parallel with the technical development of the chosen solution, a sociological analysis was conducted to evaluate its potential reduction of socio-demographic inequalities. To this end, a questionnaire was designed and proposed to the users of the solution.

The questionnaire was based on the concepts of capability, digital divide and the Digital Economy and Society Index (DESI).

The socio-demographic analysis explored the following aspects:
 The sample and its socio-demographic and socio-professional characteristics
 Inequalities in Internet access
 Impact of the solution on socio-economic inequalities
 Impact of the solution on the digital divide (digital inequalities)

For this study, a questionnaire in two parts was created. The first part of the questionnaire is based on the capability approach, the digital divide concept and the Digital Economy and Society Index, while the second part is based

on a standardised Website Experience Questionnaire (WEQ). Overall, the first part of the questionnaire aimed to better understand the social context of our target audience, while the second part focused on the interaction between users and the tools offered (the description of these questionnaires can be found in [Appendix 2](#)).

In addition, we also conducted interviews with participants in the pilot projects and asked our various partners to complete a mission report to assess the direct and indirect impacts of our activities.



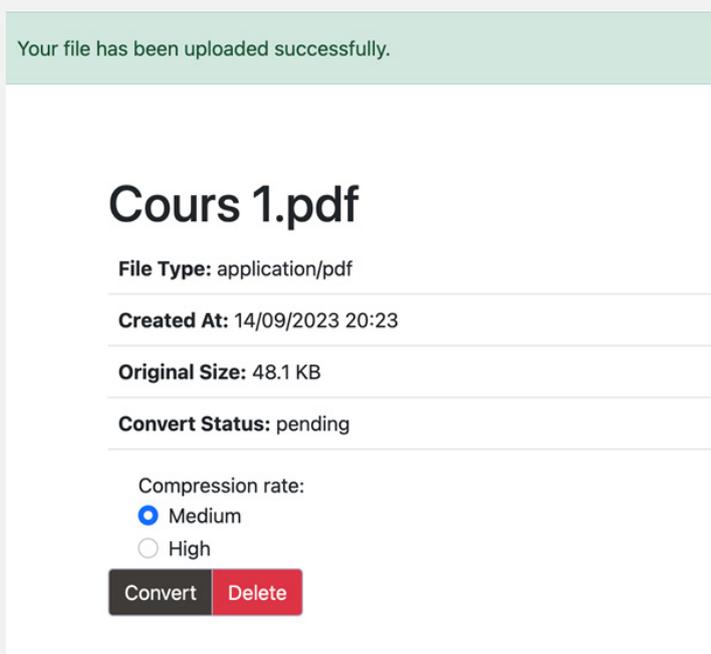
see [Appendix 2](#)

2. Results and discussions

2.1 Web application - Compression

The inception report (EXAF 2022) had already introduced the compression tool, capable of compressing videos with a gain of around 50%. Currently, the tool can compress video files, images and PDFs. Two levels of compression are available: medium and high. Indeed, users can keep controlling over the quality of compressed files, particularly when it is necessary to maintain a minimum resolution for certain images (e.g., for radiology training). On the reverse, trainers using the tool can also choose higher compression, as illustrated in Figure 3.

Figure 3
Screenshot of the
web application
(compression section)



We used this tool ourselves to create the course material available to trainers and on the online site (see below). These include courses on optimising teaching in low bandwidth environments, as well as a course on setting up a Moodle instance on the Raspberry Pi.

File compression reduces the size of files and the amount of bandwidth needed to transfer them. Two types of compression are available: lossy and lossless. Lossy compression may cause data loss, but users cannot detect it. Lossless compression preserves information identical to that in the source file. As mentioned in the inception report and described in section 1.4 of this report, data compression not only reduces connection costs for transmitting and receiving distance learning courses, but also facilitates storage on learners' receiving devices.

A few minor problems were identified when using the application in pilot projects. These were reported to the development team and corrected immediately. After an initial version in English, the web application has also been translated into French. Users can now choose their preferred working language.

Currently, the compression tool is only available online. However, this can involve challenges of use when the Internet connection is very weak, as it was noticed during the pilot projects

carried out in Côte d'Ivoire and Kenya. In such situations, it would be useful to offer an offline version of the tool, even if this means having to download the application. This step (downloading the application) can take up a lot of time and bandwidth, which is an issue in a context of low connectivity (see chapter 3.1). Despite this additional requirement, the benefits are very important, as once the tool has been downloaded, it can be used without the need for an Internet connection.

2.2 Web applications - best practices and tutorials

Two tutorials have been created and made available on the web application (Figure 4):

The first tutorial, "Reducing bandwidth for learning", contains elements to optimise the creation of courses to reduce their size. For example, the

best formats for videos and images are recommended according to users' requirements (Figure 5).

The use of the compression software developed by the EXAF research centre is also recommended. We used it ourselves on these tutorials, optimising all images and videos before including them into the course. If the course has been downloaded, most of the videos can be viewed without an internet connection, apart from two or three that have not been added due to copyright issues. In these cases, web links to the videos are provided. The use of the compression tool has reduced the size of the entire tutorial from over 100 MB to 37 MB.

Figure 4
Web application tutorials

Good practices

Tutorial 1
Create a course

Tutorial 2
Moodle and MoodleBox

Tutorial 1: Reduce Bandwidth for Learning

1. [Tools to reduce data](#)

2. [Best Image format](#)

3. [Different Image format](#)

4. [EXAF Optimisation Tool](#)

5. [Best Video Format](#)

6. [Best Text format](#)

7. [Flipped Classroom](#)

Download
Click to download a moodle cours

2. Best Image format

• Summary:

Description	Best for	Size	Example
SVG	Logos and icons	Very Light	
JPEG	photographic images	Medium Light	
PNG	images that require transparency	Medium	
GIF	Simple short animation	Medium Light	

Figure 5

Screenshot of the course
“Reducing bandwidth for learning”

Tutorial 2: Moodle and MoodleBox Tutorial

1. Préparation 2. Essentielle configuration 3. How to create a course Click to download a moodle cours

Download

This tutorial aims to help you during the installation and configuration of your Raspberry Pi as well as to teach you the bases for creating a Moodle course inside the MoodleBox

1. Préparation

- How to create a Raspberry Pi Imager
 - Install a Raspberry imager



Figure 6

Screenshot of downloadable
tutorials

Figure 7

Screenshot of MoodleBox tutorials

▼ Préparation

📄 PAGE Mark as done
Comment créer une image raspberry

📄 PAGE Mark as done
Se connecter à la MoodleBox

📄 PAGE Mark as done
Comment créer un compte (Enseignant ou Apprenant)

▼ Configuration Essentielle

📄 PAGE Mark as done
Comment changer la langue?

📄 PAGE Mark as done
Comment créer un compte (Enseignant ou Apprenant)

Similar results were obtained for the “Moodle and MoodleBox” tutorial, which describes how to install Moodle on the Raspberry Pi nano-computer and then create courses on this platform. The size of this tutorial, which mainly contains explanatory videos, has been reduced from more than 100 MB to 34 MB. Figure 6 shows the structure of the preparation, with mini tutorials on how to create a MoodleBox image on the Raspberry Pi, how to connect to the MoodleBox and how to create accounts.

An adapted version of these two tutorials is also available for download so that they can be imported into Moodle (see figure 7), which offers more functionalities than the online version. An IT specialist could therefore offer Moodle Boxes already containing these two tutorials to partner associations, as we did in our two pilot projects on the ground.

2.3 Telegram application

Developing a Telegram interface as a ChatBot was initially considered. To avoid unnecessarily complicating the pilot projects and given the tight deadlines between the development phase and the testing phase, this option was ultimately not implemented. This second interface would probably have been too much, as our target audience already had a lot of new information to understand. The addition of a second interface for the compression tool would undoubtedly have been counter-productive and would have hindered the acceptance of these new technologies.

Although the web application is very user friendly, a Telegram interface could attract a public more familiar with technological tools on smartphones rather than on computers. This could be the subject of a second stage of development, perhaps involving the use of artificial intelligence tools.

2.4 Purchase of equipment

Raspberry Pi

Initially, the partner organisations of the association Unité were requested to purchase the hardware, but this option was finally abandoned due to a lack of time. Two Raspberry Pi 400 were therefore bought for a total amount of CHF 254.- CHF (CHF 127.- each), as well as a Raspberry Pi 3B+ for CHF 195.-. Even though the kits were complete (with SD card, charger, and case), these prices were higher than expected, due to the economic context that prevailed at the end of 2022. Indeed, the shortage of computer

hardware caused by an unfavourable global economic context (the end of the pandemic, the challenge to source computer components, etc.) also affected the price of Raspberry Pi. In 2021, Raspberry Pi prices ranged from CHF 30.- to 60.-, depending on the model (Gariffo 2023), while they exceeded CHF 100.- by the end of 2022.

To deal with this relative stock shortage, the use of other nano-computers available on the market was considered as an alternative. For example, the Orange Pi is very similar to the Raspberry Pi, but basically does not feature a WiFi module, which is essential for creating a hotspot. In addition, unlikely to the Raspberry Pi, the Orange Pi is not officially supported by the MoodleBox, which was also crucial. The announced return to a normal situation regarding the manufacturing of the Raspberry Pi reinforced our decision to select it. Despite the acquisition difficulties that happened during the preparation of the pilot projects, the Raspberry Pi probably remains the best option.

Microprocessor-equipped nano-computers such as the Raspberry Pi have performed perfectly during the pilot projects. This solution promises even greater dissemination, thanks to the lower manufacturing costs of these microprocessors. Although we have focused on the benefits in terms of training, these nano-computers have great potential as mini-servers, which could go some way to alleviating the current difficulties on the African continent, with interesting characteristics



see Appendix 3

in terms of cost and energy consumption. On the Compression Tool page, we created a tutorial for set up a MoodleBox on a Raspberry Pi, thinking that this solution might be suitable for most users. However, some start-ups like Beekee  offer similar solutions that could be of interest if you look for a turnkey solution, with long-term technical support.

Tablets

Initially, the Ivorian pilot project partner was also asked to purchase tablets. Hardware purchase proposals included a Lenovo Tab 10 and a Galaxy Tab A7 Lite. Finally, the tablets were bought in Switzerland for financial reasons. We were able to buy more powerful tablets in Switzerland (Galaxy Tab A8) than those offered by our Ivorian partner (Galaxy Tab A7), for the same price.

Figure 8
Working session on the first day of the pilot project in Egypt



2.5 Pilot project in Egypt

The three-day pilot project in Egypt was organised according to specific objectives (see Appendix 3). The first day involved the collaboration of two engineers and two content creators (see Figure 8). The aim was to enable each stakeholder to test the technology and create e-learning courses using the tools provided. The day also provided an opportunity to answer questions and demonstrate some operations.

A tutorial for online teaching with a limited internet connection was initially presented. This introduction was an opportunity for participants to better understand the tools used during the day (Raspberry Pi, Moodle) and to have a first interaction with the content as a learner. This was an important step in appropriating the technology progressively. The simultaneous presence of content creators and engineers led us to focus on the management aspects of the platform, rather than on setting up the Moodle image.

After this introductory part on the tools, the trainers were able to create digital training courses using the tools presented by the project team. The material was at their disposal, and they could ask for help if they needed it. They progressed at their own pace in creating the courses. Project-based learning is a highly effective pedagogy, as it enables learners to produce content that will be put to concrete use (in this case, the next day, Figure 9). It therefore encourages them to quickly appropriate with the tools



Figure 9
Second day of the pilot project in Egypt

offered by Moodle. Whenever needed, learners could count on the MoodleBox set-up tutorial and the presence of the educational engineer to help them. Figure 8: Working session on the first day of the pilot project in Egypt

At the same time, two engineers were present and invited to watch the videos and ask any questions they identified as important. Globally, the content creators asked questions about using the platform and creating content on Moodle, while the engineers focused more on the operational aspects of the platform, such as the management of users.

The second day was devoted to presenting the technological solution to the hospital's management team and several staff members. Several presentations were made, during

which we introduced EPFL and the association Unité. However, the most important presentation was made by our Egyptian colleagues, and it focused on the content prepared the day before. All participants had a smartphone, and most had created an account the day before, enabling them to connect to the Raspberry Pi and download the content in offline mode. In addition, the distance learning course also included a short quiz to enable learners to self-assess their understanding of the presentation. Teachers can also access the results of such quizzes and analyse them to better understand which elements were successfully assimilated or, on the contrary, which created problems.

The course introduced was in Arabic and had a relatively simple structure. It was divided into three topics, each comprising

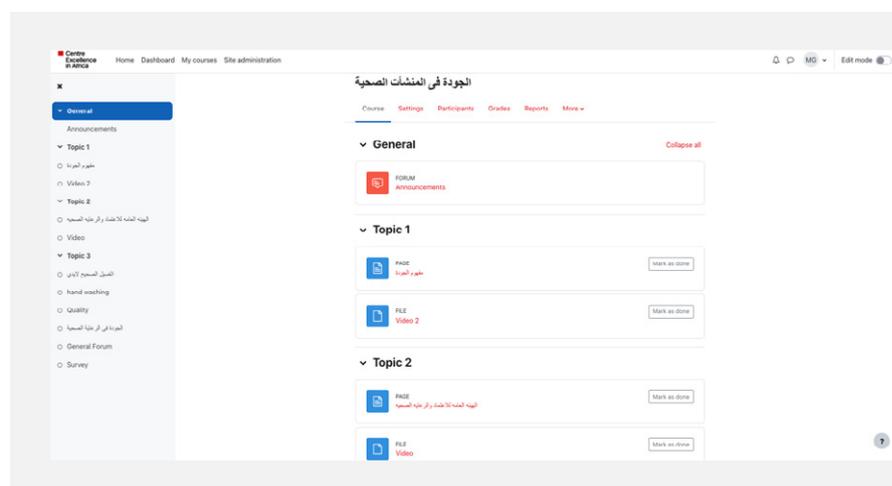


Figure 10
Screenshot of the Moodle Box, course prepared in Egypt.

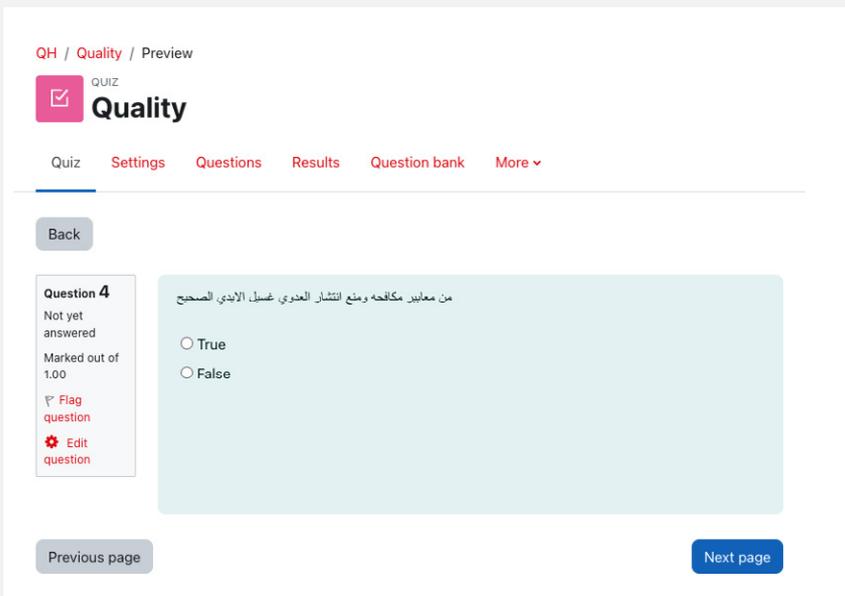


Figure 11

Screenshot of the MoodleBox, quiz prepared in Egypt.

a theoretical part in written form and an accompanying video. (Figure 10)

After the introduction, the trainees were asked to complete the Website Experience Questionnaire (WEQ). We also had open discussions about their experiences, their insights and possible future uses of these tools.

The third day was devoted to collecting feedback on the technologies used and

discussions on their implementation. With the engineers, we also discussed the various stages involved in setting up a MoodleBox. Top management also mentioned that they plan to use these technologies to train their own staff, who could forward on the benefits to further learners.

Figure 12

End of the second day of the mission



Satisfaction survey

Table 2 shows the results of a questionnaire analysis based on the WEQ questionnaire. The results are presented in the form of descriptive statistics, with the average, the standard deviation, and the median (50%), for each criterion. It is important to highlight that, in the Egyptian context, the WEQ focuses more on the MoodleBox solution, which will not be the case in the Kenyan context (see section 2.7), where only the web application was tested.

In summary, users found the technical solution easy to use and its structure generally clear. The information provided was considered relevant and easy to understand. Users also found the technical solution visually appealing, in general. The “best” strengths were the ease of use (4.26), the layout (4.21) and the understanding (4.14) elements. The three elements that can still be

improved are the structure with an average of 3.70, the hyperlinks and the relevance - both with an average of 3.86 and the completeness - with an average of 3.93. Standard deviation is low throughout the data set, implying that the results are robust and that a consensus exists on the various indicators.

Assessing the impact of the technical solution on reducing inequalities

A questionnaire collecting socio-economic information about the people using our technical solution (see Appendix 1) was also submitted in Egypt. The analysis population is made up of 23 respondents. The age structure of the sample shows that most respondents in Egypt are aged between 30 and 40 years old.

Particular attention was paid to ethnicity, the migration status, and the disability



see Appendix 1

Table 2

WEQ results for Egypt. Note: Opinions were measured on a five-point scale, where 1 represents the most negative opinion and 5 represents the most positive (negatively worded items were reversed).

Category	Criteria	Average	Standard deviation	Median
Navigation	Ease of use	4.26	0.63	4.17
	Hyperlinks	3.86	0.52	3.88
	Structure	3.70	0.20	3.75
Content	Relevance	3.86	0.60	3.83
	Understanding	4.14	0.55	4.17
	Exhaustiveness	3.93	0.57	3.83
Introduction	Introduction	4.21	0.74	4.17

within the sample. In the Egyptian sample, 26% of respondents were not born in Egypt, 28% were from minority ethnic groups and 10% had a disability. The levels of education and income of the trainers were also assessed. Most of the respondents (86%) had completed university studies. In the case of Egypt, the people who tested the technical solution tended to be trainers. Their family incomes ranged from 2,100 to over 7,000 Egyptian pounds per month.

To represent inequalities in Internet access, the questionnaire also assessed the frequency, number of hours and quality of users' Internet connection. To the question of Internet use, 44% of respondents answered, "a lot", while 56% quantified it as "a great deal". A third of the sample estimated that they were connected for more than 10 hours a day. This frequency of connection can be explained by their status as senior managers within the care units, good connectivity within the establishment itself, as well as increased use in the exercise of their function (the people who responded to the questionnaire are used to giving training courses within or outside the hospital). On this occasion, half of respondents rated the quality of their Internet connection as neither good nor bad, while 38% rated it as good and 12% as extremely good.

For the Egyptian sample, our analysis did not reveal any major inequalities in Internet access according to socio-demographic variables and salary. However, only those living in urban areas indicated that they had an extremely

good connection. According to the results of the questionnaire, the technical solution developed by EXAF and the association Unité has a potentially very positive impact on access to quality education (SDG 4). It would also substantially improve three other Sustainable Development Goals: access to health (SDG 3), access to employment (SDG 8) and the reduction of inequalities (SDG 10). These pieces of information derive from open-ended questions for which respondents were able to detail their answers, and to project themselves by estimating the potential impact of our technology on their regular learners.

According to the survey carried out among trainers in Egypt, the technological solution developed as part of this project will have a very positive impact on the integration of digital technologies into their daily lives, enabling them to provide quality education to as many people as possible.

In addition, respondents also described the various aspects of the lives of local populations (both trainers and learners) that could be impacted by the technical solution, whether in the short or long term (figure 13). The most popular response was logically "Quality Education", with a percentage of 64%, but other aspects were also mentioned by over 40% of the respondents, such as access to health (57%) and improved quality of life (43%). Surprisingly, "Employment and access to work" scored only 29%, while the last two options, "Knowledge of my rights" and "Leisure", were chosen by 21% and 7% of participants respectively.

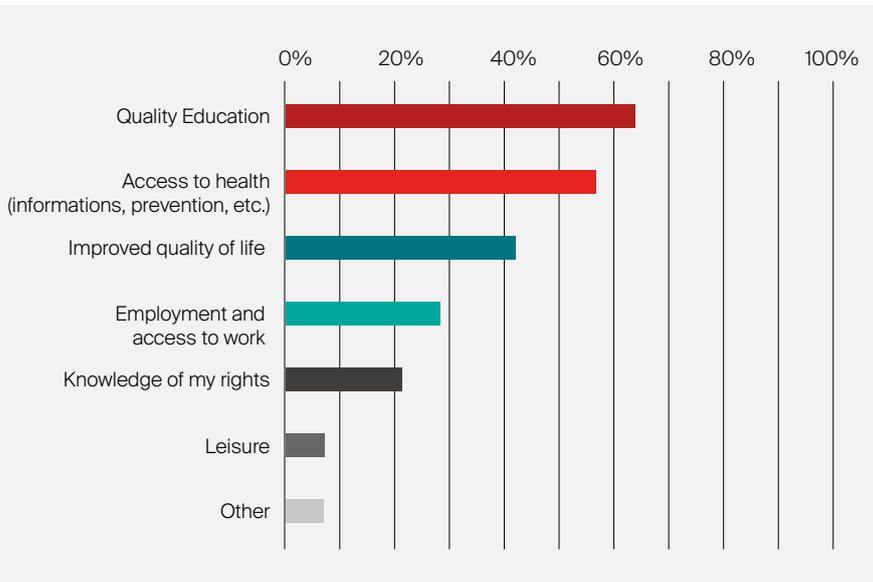


Figure 13
Potential impact of the technological solution, according to trainers in Egypt.

In absolute terms, 71% of respondents consider the impact (on all aspects) of the technical solution developed by EXAF to be rather positive, while 29% consider it to be extremely positive. Not a single person expressed a negative opinion in our survey, suggesting that the impact of EXAF technological solution is widely perceived as beneficial.

2.6 Pilot project in Côte d'Ivoire

In Côte d'Ivoire, the technical solution was tested in a secondary school in the town of Azaguié, approximately 40 kilometres north of Abidjan (see Appendix 4). The physics and chemistry teacher shared the course content in advance, so that we could think about how to optimise distance learning. Given that only around 25 to 30% of students had a device for accessing online courses (exclusively smartphones, often obsolete), the Moodle application was also installed on tablets made available for the institution. The teacher did the same for students who had access to a smartphone.

The first day (Figure 14) was devoted to setting up the course in close collaboration between our team and

the teacher. The teacher contributed with his expertise in terms of content, while the EXAF team contributed with the know-how in using the Raspberry Pi/Moodle solution and providing the compression tool. The main objective was to digitise a physics course using the solutions offered.

The objective was achieved, but there were a few challenges caused by how using such a technology in a fragile context. For example, very poor Internet connectivity sometimes made it difficult to compress documents, as it was then impossible to upload some of them to the platform itself. In addition, the frequent power cuts forced us to work autonomously, using an external battery (power bank or laptop).



see Appendix 4

Figure 14:
First day of pilot project in Côte d'Ivoire (creation of online courses)



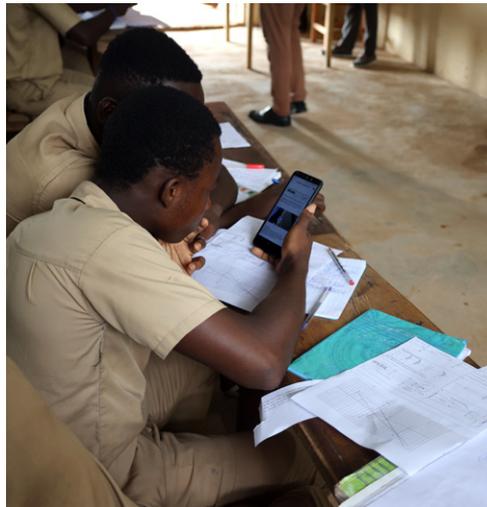
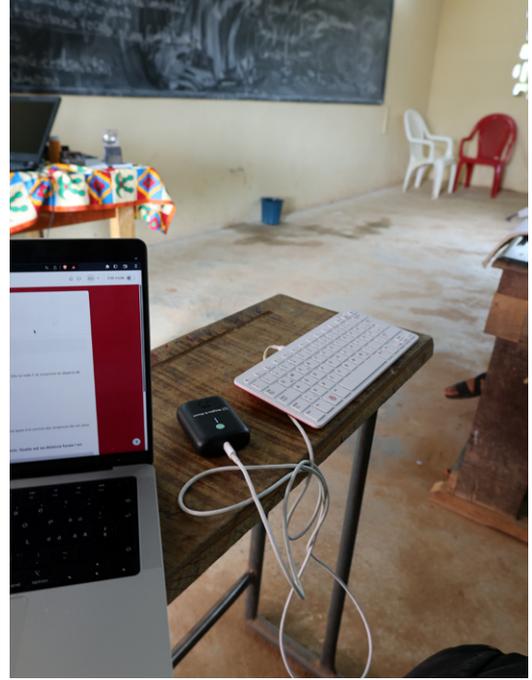


Figure 15
Using the digital solution
in the classroom (pilot
project in Côte d'Ivoire)

The second day of our activity (Figure 15) took place in the classroom. Students were grouped by two or three, with one smartphone or tablet per group. The process of creating an account was then explained, which many students found difficult due to their lack of knowledge with digital tools. Some of the younger students, for example, had difficulty understanding concepts such as the “e-mail address”, and needed a relatively significant support. Nevertheless, the students were able to efficiently use the digital learning solution

The third day of the activity with the teacher and his students was divided into two parts. In the first part, we gathered feedback and information from the students about their use of

the new tool and their review on the possible implementation of MoodleBox in their daily school activities. We also interviewed the teacher and the principal to discuss their interest in these approaches and the possible improvements. We were able to incorporate their feedback to address students’ needs and optimise the effectiveness of digital teaching.

In the second part of the day, we carried out two further training sessions. The first was given to the IT team to make sure that they knew how to solve any hardware issue that might arise in the future. The second tutorial was an interactive session, where the teacher asked any questions, he had about the tools.

Globally, it was a productive day, and we gained valuable information from the feedback we received from the students, the teacher, and the management team. This information will help us to further improve the tool and ensure that it addresses the needs of students and teachers in an extremely fragile context.

Satisfaction survey

After completing the project, we conducted an interview with the teacher to collect his feedback on the tools we introduced to his class that week. We began by asking him about his experience with the Raspberry Pi and the MoodleBox, and whether he thought they would be useful to students in the future. He said that he found these tools invaluable for all his students, and that once he became familiar with their use, he would use them to make his courses more dynamic and offer learners a new way of learning, including the ability to review remotely (or learn remotely should a situation such as that experienced during the COVID-19 pandemic arise again).

Next, the teacher evaluated the compression tool according to different parameters: clarity of language, attractive design, easy-to-understand information, amount of information available, ease of use and navigation through the various

tabs. He replied that he fully agreed with the clarity of the language and the ease of understanding of the information provided by the application. He agreed that the web application provided sufficient information and found it easy to use, with a clear home page directing him to the information he needed. Finally, the teacher assessed the usefulness of the application and the hardware solution. A score of 8 out of 10 was awarded.

Assessing the impact of the technical solution on reducing inequalities

In addition to collecting feedback from the teacher, a survey of the students was also conducted to get their insights on the use of technology in the classroom. We initially planned to give the standard questionnaire (see Appendix 1) but, given their young age, we opted instead for an open discussion and oral questions.

As shown in Table 3, around a third (21/58) of the students claim to own a smartphone, while a further 13 could, in theory, use a parent's smartphone to follow distance learning courses. Consequently, in the case of a 100% e-learning course, a solution would have to be found to enable the remaining 24 students to follow the course, for example by the school making tablets available on loan. Globally, the students were receptive to



see Appendix 1

Table 3
Information
gathering survey

Questions	Girls (out of 30)	Boys (out of 28)	Total (out of 58)
How many children own smartphones?	12	9	21
What is the breakdown of children whose parents own a smartphone and could lend it out for educational purposes?	8	5	13
How many children have Internet access at home?	9	11	20
How many children would like to take lessons or do exercises at home?	30	28	58
How many children prefer to take their lessons with their teacher face-to-face?	3	0	3

Table 4
WEQ results for Kenya

CATEGORY	CRITERIA	AVERAGE	STANDARD DEVIATION
Navigation	Ease of use	4.11	0.45
	Hyperlinks	3.90	0.25
	Structure	3.87	0.20
Content	Relevance	4.0	0.42
	Understanding	4.11	0.58
	Exhaustiveness	3.94	0.44
Introduction	Introduction	3.83	0.40

these innovations and welcomed the adoption of these new technologies. Only three students expressed doubts about digital teaching. It should be emphasised that this insight is to be considered cautious, as it is difficult to assess the extent to which the children dared to answer this last question frankly.

The critical feedback from participants (teacher and students) regarding digital teaching is encouraging for the project, as it enables us to question our approaches and work on improving the proposed solutions. This feedback has been useful in solving problems and improving the overall student experience.

2.7 Pilot project in Kenya

In December 2022, the Principal of North Coast Medical Training College was approached to participate in a pilot project for e-learning in fragile contexts. North Coast Medical Training College agreed to participate in the project, testing the application and providing feedback. The report sent by this institution ([Appendix 5](#)) describes and analyses the comments made by those who tested the application.



see [Appendix 5](#)

Satisfaction survey

In Kenya, only the web application has been tested by our partners. They prepare and run daily training courses in the medical field. Six out of nine people responded to the questionnaire (Table 4), following a training session for trainers led by an IT specialist who had worked extensively with the application. She also provided us with valuable tips for improvement.

High scores for ease of use, hyperlinks, structure, relevance and understanding suggest that the web application is efficient and easy to use. The high score for completeness indicates that all necessary information is provided in the application. The lower score given for introduction suggests that some users find that the visual appearance of the application could be improved. This is important, as an unclear or unattractive layout can make using the application less pleasant and more difficult for users.

As the relatively low standard deviations indicate, the answers are consistent and there is little disparity between the assessment of the different aspects of the application.

3. Recommendations

The pilot projects confirmed the relevance and usefulness of the developed solution.

Indeed, all have been crowned with success, and the Unité partner associations that have worked with EXAF have been enthusiastically convinced by the technical solution proposed. From the point of view of the lessons learned from the pilot projects, the selection seems extremely relevant today, even if an even more difficult context was an option (Burkina Faso instead of Côte d'Ivoire).

For security reasons, such a choice would have meant having to deliver our training within the capital (Ouagadougou), then letting the teacher(s) move around to create a local intranet with the Raspberry Pi, giving learners the opportunity to download the courses. With such a *modus operandi*, it would have been less obvious to understand the challenge of working with extremely weak connections, which sometimes prevented files from being uploaded to the compression application. Similarly, our fieldwork in Côte d'Ivoire validated the choice of the Raspberry Pi as a hotspot, as the very frequent power cuts confirmed the importance of being able to connect the nano-computer to an external battery or laptop to ensure a stable power supply. We probably would not have been able to seize this information in an international hotel in Ouagadougou, equipped with a back-up generator.

Another lesson learned from the pilot project in Côte d'Ivoire is the need to anticipate the creation of user accounts on Moodle Box. This step can be very time-consuming in a fragile context characterised by the digital acculturation of learners. Fortunately, this step only needs to be taken when the platform is first used. Once students have logged in with their credentials, they can then access the platform without having to recreate a new account.

These conclusions were also drawn by our partner in the Egyptian pilot project. Here too, the proposed solutions are of great interest to local communities with problems of Internet connectivity and access to electricity. Once the benefits of these tools are understood by the communities, they can imagine potential usage scenarios. These solutions can be adapted to different contexts, such as academic training or training for teenagers. The only constraint to their use is having smartphones, but this can be solved by distributing tablets and working collaboratively, as done in Côte d'Ivoire.

On another note, the pilot project in Kenya enabled to improve the compression tool itself. Indeed, numerous improvements were made possible thanks to comments and feedback from users.

According to our mission partners, a technical solution based on distance learning can contribute to universal access to quality education, considering that educators are properly trained and able to forward the positive effects. According to our partner in Egypt, such a solution has the potential to reduce gender inequalities. In addition, it aligns with a perspective of balancing social justice and contributing to a more inclusive, egalitarian, and fair environment. It is pretty the same from our partner in Côte d'Ivoire, who noted that the interactive exercises available online enable some rather introverted students (for example, because they come from very modest backgrounds) to practice without fear of judgment from their peers.

The pilot projects and this report demonstrate the feasibility of the technical solution envisaged and developed by EXAF in fragile contexts, with the results of the pilot projects proving that the proposed solutions can be successfully implemented in contexts where internet connectivity and access to electricity are limited.

It is expected that this report will encourage other organisations to explore these solutions to address training needs in similar contexts.

3.1 Compression web application

As mentioned in chapter 1.2, the results indicate that the visual of the web application site could be improved to make it more attractive. Visual can also be an important factor for people less familiar with technology, and we therefore consider this an important element to consider. Indeed, an attractive presentation can help to make the site more accessible and encourage use by a wider range of users. EXAF worked on this aspect during the 2023 summer. The screenshots that are illustrating the present report show the updated version of the application.

In addition, the possibility of creating an offline version of the web application would make it easier to use in extremely fragile contexts, where even the teachers do not have enough network to upload his course files to the online application. Creating an offline version of the web application would require about 4 to 6 months.

The problem with such an adaptation is that, in this case, the compression software itself will have to be

downloaded, and will be heavy. We are convinced, for example, that the network available for the pilot project in Côte d'Ivoire would not have allowed such a download. However, solutions can be explored, for example by physically going to a location with an excellent connection (e.g., in a nearby town) or by physically bringing the application to the most fragile contexts, for example on a USB stick. Bringing already configured micro-computer (with the Moodle application installed) would be an alternative. However, we do believe that it's more suitable and sustainable to develop the capacity of beneficiaries, so they can benefit from further assets (for instance, the installation of Wikipedia on a Raspberry).

Adapting the application in the form of a Telegram Bot could also be a relevant option for the future. Such an adaptation would fulfil somehow an analogous function for teachers who do not own a learning platform or even laptops, but who would still like to make use of e-learning solutions, for example by sending course videos via their smartphone.

Finally, the implementation of Artificial Intelligence (AI) algorithms could greatly improve the compression process, while preserving the quality of educational files as much as possible.

⁴
The code is available on:
[https://e-learning4all.
app/sourcecode/](https://e-learning4all.app/sourcecode/)

3.2 Distribution

The distribution of the tool is a crucial step, both within user and with the development community for the evolution of the tool. Open Source⁴ is the first form of possible distribution. This will not only enable different institutions to use the Web application, but also promote its further development. Developers could come up with new backend solutions using the available frontend, or, on the contrary, propose different ergonomics while retaining the backend. In addition, the EXAF research centre and the association Unité can play a crucial role in disseminating the tool among their members and partners. These two institutions could offer this solution to many people preparing training courses in contexts where Internet access is limited, and thus have a significant impact on training in these contexts with poor Internet connection. For example, the creation of Massive Open Online Courses (MOOCs) for the **African Cities Lab (ACL)**  project could be an option.

ACL funds MOOCs focusing on urban development in Africa, covering topics such as waste management, sanitation, economic development, housing, public health, water management, access to water and gender issues. One of the conditions of the project is that all projects must be linked to the African context. The trainers working on this project would benefit from using

the e-learning4all web application to facilitate the dissemination of their content to a wider audience.

For the Moodle / Raspberry Pi solution, the next steps are to raise awareness of the mentioned tool, as many people are still unfamiliar with it. In addition, there is a need for training. We started with the tutorial on good practice in low-internet-connection contexts, but we found that the tools on offer, such as Moodle, are new to many people. While there is a lot of online documentation for these tools, support from a digital training specialist could facilitate adoption and speed up the learning process for users. To ensure a proper outreach of the technical solution, the project team coordinated two webinars in French and English. Both are available online and accessible at best convenience for users.



[Webinar in French language](#) 

[Webinar in English language](#) 

3.3 Tutorials

This pedagogical section could be extended with new courses. For example, we could develop a section on the flipped classroom, where courses are studied online before the class itself. In fact, this teaching method is much appreciated by trainees and is very well suited to distance learning. Another room for improvement would be to update the Moodle tutorials regularly to keep them up to date and add, for example, answers to frequently asked questions or missing information. We also created a YouTube channel with the tutorials. 

4. Conclusion

As demonstrated by the pilot projects, the concept of digital education is poorly developed in Africa and represents an innovative approach.

Currently, knowledge is shared either orally or in written form in the form of printed courses. Even what we consider traditional teaching, such as ex-cathedra teaching with the support of a slide show, seems relatively unusual in the selected pilot projects.

Our partners and colleagues in the pilot projects have all emphasised the potential of the technical solution developed by the EXAF research centre. The results of the pilot projects are indeed very encouraging and satisfying. At this stage of its development, the technical solution is the “alpha” version of our technology. It has been introduced to a very targeted audience to obtain the best feedback from the users. Our aim was to validate the project and ensure that the solution met a real need. The Web application is a usable and functional product.

Testing the technical solution in the pilot projects enabled us to assess the relevance of developing a low-tech solution for areas with poor internet

connectivity, and to validate the project by making sure that it meets the main need of future users. However, certain additional features could be developed to optimise the user experience, such as the availability of an offline application, its translation into other languages, its ergonomics and aesthetics, and so on.

The development of this technical solution by the EXAF team was driven by the desire to create a technical solution with a tangible and real impact on the daily lives of those using it. When responding to our questionnaire, the users of the solution developed in this project emphasise that not only does this tool offer them access to quality education and better inclusion in the world of work, but also enables other positive impacts, such as better access to health awareness and prevention information.

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Appendices

Appendix 1: ‘Personas’

Persona 1: Mouhamadou

<ul style="list-style-type: none"> ■ 15 years old ■ Single ■ High school student ■ Owns neither smartphone nor computer (neither personally nor in family) ■ Very poor connectivity + frequent power outages 	<p>Background</p> <p>Mouhamadou studies in a rural school with no Internet connection. On average, 10% of the village’s inhabitants are connected to the Internet, mainly via cell phones.</p> <p>Teachers (often based in urban areas) generally have an Internet connection at home and can use it to prepare lessons.</p>
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Current solutions

- Mainly face-to-face. Teachers travel to the villages to give their lessons.
- During the COVID period, only city schools were able to deliver courses with radio, TV and internet broadcasting. In rural areas, training content was available on USB keys, then printed out by the teachers before they went out to give their lessons.

Persona 2: Maureen

<ul style="list-style-type: none"> ■ 35 years old ■ Married, 3 children ■ Training in law ■ Refugee (currently living in a refugee camp) 	<p>Background</p> <p>Maureen is currently living in a refugee camp with many socio-economic problems. Like around two-thirds of the learners in her class, she has a smartphone, but no computer. E-learning in this context requires a different approach. Telephone messaging applications offer considerable advantages over other online technological tools in terms of simplicity, efficiency, low cost, accessibility and instant access, both for learners and trainers.</p>
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Persona 3: Rania

- 18 years old
- Single
- Unemployed
- Owns a smartphone
- Lives in a rural area

Background

Rania is trained by doctors from a local hospital. The courses are given by doctors or nursing assistants who come to teach in rural areas.

The teaching method is very traditional, face-to-face, with conventional supports. The idea of using digital technology as a learning tool is not widespread. Like most of her classmates, Rania owns a smartphone, but the high cost of Internet data limits its use. For example, she wouldn't be able to pay to download educational videos.

Doctors and medical staff generally have computers, but don't use them for training.

Persona 4: Musa

- 27 years old
- Married, 2 children
- Nursing assistant
- Lives in a small town (40,000 inhabitants)
- Owns a smartphone

Background

The Internet is available to most citizens living in urban centres, but it is relatively slow in the small town where Musa lives.

The training institute where Musa attends further training courses has already begun digitising the content of its curricula, used during the Covid period. However, trainers lack the skills to master e-learning platforms. The lack of technological resources and the technical aspects of their application represent a challenge for the implementation of e-learning.

Persona 5: Céleste

- 30 years old
- Married, 1 child
- Doctoral student in computer science (+ gives evening classes)
- Lives in a large urban centre
- Owns a smartphone and a laptop

Background

Céleste is studying her second PhD year at a medium-sized university. She also gives evening mathematics and computing classes for a local association. She has a laptop and a fairly good, but relatively unstable, Internet connection (usually better in the morning).

At the university where she works as a teaching assistant, e-learning is fairly well established, thanks in particular to international collaborations. On the other hand, the training institute for which Céleste teaches is singularly lacking resources and long-term vision, and Céleste would like to convince her colleagues to include distance learning methods among their activities.

Appendix 2: Evaluation questionnaire on inequalities and participant satisfaction

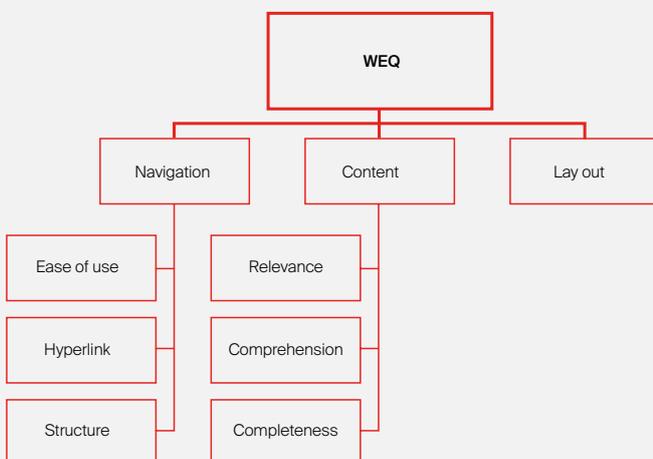
To assess the potential of the digital solution to mitigate digital inequalities, we used the concept of capability to represent the dimensions through which technological solution can mitigate socio-economic inequalities and foster digital inclusion. We opted for the Digital Economy and Society Index (DESI), a tool developed by the European Union to assess digital transformation. It includes four dimensions: human capital, connectivity, digital technology integration and digital public services.

The idea is to calculate a DESI as part of the educational activities of these trainers, focusing only on certain dimensions to measure the impact of technological solution on digital inclusion and exclusion. Among the four DESI dimensions, we asked our respondents about the solution's impact on the following three dimensions: connectivity, integration of digital technologies and human capital.

The evaluation of user satisfaction was based on a questionnaire called WEQ - for Website Experience Questionnaire. (Figure 16)

The online questionnaire was chosen for its standardisation, ease of administration (26 questions) and simple questions. In addition, the questionnaire also focuses on navigation and attractiveness aspects, which are essential to ensure good ergonomics. Each indicator is calculated from three or four questions, with at least one which is inverted. For example, for the ease-of-use criteria, we have three questions: "I find this website easy to use", "I had difficulties using this website" and "I consider this website to be user-friendly". The second question is inverted compared to the other two. In our example, the values for the inverted questions are also inverted. The value 1 (completely agree) of the question "I had difficulties using this website" is converted into a value 5 when calculating the indicator. The average of the answers to these three/four questions gives the value of the indicator. A value close to 5 indicates greater user satisfaction, while a value close to 1 indicates user dissatisfaction.

Figure 16
Structure of the Website Evaluation Questionnaire, adapted from (Elling et al. 2012).



The WEQ (Website Experience Questionnaire) evaluates the user experience on a website through six main indicators, which are divided into a few main elements: Navigation, Content and Introduction (Elling et al. 2012). Details of the questions can be found in the appendix; opinions were measured on a five-point scale, where 1 represents the most negative opinion and 5 represents the most positive (negatively worded items were reversed).

The 'Navigation' element includes the following elements:

- Ease of use: This indicator assesses the ease with which users can navigate the website to find the information they are looking for.
- Hyperlinks: This indicator evaluates the clarity of hyperlinks on the website and the ease with which users can find the information they are looking for.
- Structure: This indicator evaluates the structure of the website and the ease with which users can find the information they are looking for.

The 'Content' element includes the following:

- Relevance: This indicator evaluates the quality and relevance of the information provided on the website.
- Understanding: This indicator evaluates the ease with which users can understand the information provided on the website.
- Completeness: This indicator assesses the quality and accuracy of the information provided on the website.

The 'Attractiveness' element evaluates the visual appearance of the website.

- Image quality
- Quality of graphics

Here are the questions we asked people using our technical solution:

1. Ease of use:

- I find this website easy to use.
- I had difficulties using this website.
- I consider this website to be user-friendly.

2. Hyperlinks:

- The home page clearly directed me to the information I needed.
- The home page directed me immediately to the information I needed.
- It is unclear which hyperlink will take me to the information I'm looking for.
- Under the hyperlinks, I found the information I expected to find.

3. Structure:

- I know where to find the information I need on this website.
- I was constantly redirected to this website while looking for information.
- I find the structure of this website to be clear.
- The practical layout of the website helps me find the information I'm looking for.

4. Relevance:

- I find the information on this website useful.
- The information on this website is of little use to me.
- This website offers information I find useful.

5. Comprehension:

- The language used on this website is clear to me.
- I find the information on this website easy to understand.
- I find many words on this website difficult to understand.

6. Completeness:

- This website provides me with sufficient information.
- I find the information on this website incomplete.
- I find the information on this website accurate.

7. Introduction:

- I find this website unattractive.
- I like the look of this website.
- I find the design of this website attractive.

Appendix 3: Pilot project in Egypt

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Consulting report

Title of the mandate

Consultancy for the EXAF Centre of the EPFL, in the framework of the project "E-learning in fragile contexts".

Mission

Under the responsibility of the project manager, the following tasks were mandated:

Tasks	Description	Max. number of working days (indicative)	Deliverable(s)
1. Preparation of the pilot project			
1.1 Selection of a teacher to test the technical solution developed by EPFL (hardware and software)	The contractor will suggest a teacher who is interested in participating in the pilot project and who understands the main advantages and challenges of e-learning.	1 person-day	Contact details and description of the selected teacher (in the preliminary report)
1.2. Purchase of hardware according to the instructions of the EPFL technical team	The contractor will be responsible for the purchase of the material to be distributed in the framework of the technical project. Each purchase will be validated by the EPFL technical team and proof of payment will be kept for reimbursement of expenses.	1 person-day	Description of equipment purchased prior to the technical team's mission, including proof of payment (in the preliminary report)
2. Support during the mission of the technical team			
2.1 Help in preparing the mission	The contractor will advise on a mission to test the technical solution developed by EPFL in real conditions. In particular, it will provide advice on accommodation and transport on site during meetings by videoconference.	2 person-days	Preliminary report (contribution to the mission plan)
2.2 Support during the mission	During a mission of maximum 3 days, to accompany, if necessary, the technical team to facilitate relations with the target audience of the technical solution	3 person-days	Mission report (in final report)
3. Writing of the final report			
3.1 Drafting a final report	The contractor will collect feedback from the use of the technical solution during the pilot project and synthesise it in a final report forwarded to the EPFL project team	3 person-days	Final report

I. Introduction and background

The objective of the project is to contribute to the SDG 4 – “Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all”, by developing a sustainable low-flow digital education system for areas with poor Internet connectivity.

To ensure its sustainability, the teaching system must be based on mutual knowledge of participants and on technical solutions that are available and accessible in the targeted contexts, easy to use without a significant technical training, and easily replicable in various fields.

Together with the EPFL (École polytechnique fédérale de Lausanne), Unité (the umbrella Organisation of Swiss Centre for Development & Cooperation) is carrying out this collaborative project to provide technical solutions to improve access to distance education and thus to offer equal opportunity to everyone to learn.

The consultancy mandate of Katharina Dams served the bridge-building purpose between the Swiss and the Egyptian side. The mandate is as an SDG Ambassador, committed to contribute reaching the global development goals. As mentioned above, the project “e-Learning in fragile contexts” contributed to the SDG 4. It also supported reaching achievements in following points:

- SDG 4.4. By 2030, substantially increase the number of youth and adults who have relevant skills, including technical and vocational skills, for employment, decent jobs and entrepreneurship
- SDG 4.5. By 2030, eliminate gender disparities in education and ensure equal access to all levels of education and vocational training for the vulnerable, including persons with disabilities, indigenous peoples and children in vulnerable situations

Besides the SDG contribution, the project offers a unique opportunity to small NGOs such as the member organisations of Unité to broaden horizons in international cooperation and intersectoral cooperation.

Small NGOs often do not have the capacity or knowledge to benefit from such projects. Additionally, they may lack resources, not only financial, but also in terms of human capital. This can include a lack of employees in general, as well as a lack of experts with tertiary education in the respective field.

As a consultant for development cooperation, Katharina Dams (author of the present report) is filling out this gap for the member organisations of Unité such as Mission am Nile (MN) International. While organisations like MN International have a temporary support of a consultant like Katharina Dams, not all NGOs have that option. In order to reach more professionalism and thus higher participation rates in opportunities like this project, more investment in terms of education & training of the decision-makers of the member organisation is needed.

II. Project Team Description

Name, gender, and number of the participants to the pilot project

The general Project Team for part Egypt (preparation phase) consisted of:

- | | |
|----------------------------|--|
| - Katharina Dams (F) | - Pilot project manager, Consultant Development Cooperation for region Upper Egypt |
| - Frédéric Meylan (M) | - Project Manager, EPFL |
| - Andres Gomez (M) | - IT Engineer, EPFL |
| - Saïda Naji (F) | - Project Officer, EPFL |
| - Ximena Salgado Uribe (F) | - IT Engineer, EPFL |

In the pilot project in Nile Hospital in Upper Egypt, the core project team consisted of:

- Katharina Dams (Pilot project manager, Consultant Development Cooperation for region Upper Egypt)
- Dr. Emad Soliman (Nile Hospital Director)
- Andres Gomez (E-learning Engineer)
- Saïda Naji (Project Officer)

The core project team was made up of individuals with diverse skills and abilities that complemented each other. On one hand, there were technically proficient members, while on the other hand, there were those with strong soft skills, including interpersonal skills and a focus on psycho-social interactions, a system thinking power overseeing the whole process and guiding in the right direction and an extraordinary leader.

During the pilot testing day following participant (besides the core team) took part:

- | | | |
|--------------------------|---|-------------------------------------|
| - Mariam Edward (F) | - | IT Engineer |
| - Abanoub Serian (M) | - | IT Engineer |
| - Dr. Engy Atef (F) | - | Head of Laboratory |
| - Nancy Nemr (F) | - | Head of Administration |
| - Medhat Milad (M) | - | Head of Operations Management |
| - Andrew Amir (M) | - | Quality Manager |
| - Sandy Santos (F) | - | Directors Secretary |
| - Elisabeth Bruckner (F) | - | Psychologist, guest not an employee |
| - Amir Hana (M) | - | Head of Wellspring Charity Wing |
| - Viola Adly (F) | - | Wellspring Charity Wing Employee |
| - Marina Hanna (F) | - | Administration |
| - Peter Reda (M) | - | IT |
| - Sami Adly (M) | - | Cafeteria Manager |
| - Eman Kamel (F) | - | Assistant |
| - Hany Saad (M) | - | Driver |
| - Wasfi Fouad (M) | - | Driver |
| - Mayer Emil (M) | - | Marketing |

Responsibilities within the host institution:

- Project Management
- Coordination between the Swiss and the Egyptian side
- Pre-pilot preparations (i.e. selection of an educator to test the technical solution developed by EPFL or purchase of hardware according to the instructions of the EPFL technical team)
- Planning and ensuring the pilot goes according to the plan
- Stakeholder Management (i.e. bilateral onboarding with the pilot project participants)
- Intercultural Management and cross-cultural mediation
- Intersectoral collaboration (connecting the different stakeholder and bringing them on one level of collaboration)
- Agile Management (implementing flexibility in the plan and options to re-evaluate next steps)
- Intermediate Project Evaluation (daily feedback meetings during the pilot phase)
- Internal and external Communication (with EPFL team and the team of Nile Hospital – proactivity in planning and holding online and in-person meetings)
- Organisation of meetings and pilot project packages with the Egyptian partner (Nile Hospital Director) and forwarding the results to the EPFL Project Lead

- Purchase of experiments material (for technical and time reasons, the material was finally purchased by EPFL before the mission in Egypt)

Role of Katharina Dams in the pilot project:

- Primary role as project manager and as a consultant for the international cooperation and global health with specialization in hospital management.
- Secondary role as coordinator and translator between the stakeholders

Role during the deployment of the technical solution for the targeted audiences:

- Project Assistance for the participants of the pilot cohort and support for the software engineer

III. Summary of the pedagogical presentation of the technical solution

Cultural perception of the pedagogical method

The cultural perception was one of the crucial points determining the success of the project. To support a good development in this regard, methods of intercultural management were used.

The preparation phase included ensuring every participant is onboarded properly. There were several bilateral meetings conducted to make sure the participants understand the scope for the project and its backgrounds (who is the project team, why is this project existing, what are its targets, why is it going to be tested in Nile Hospital and what are the benefits of participating in the pilot in the short and long run).

Pilot team members were pre-schooled about the pilot and had the opportunity to ask questions supporting right understanding of the project and its scope.

Additional preparation was conducted with the teacher team – the future multipliers.

Making sure there are no misinterpretation in the cultural perception, Dr. Emad Soliman was involved in preparations and onboarding as well. He translated not only to Arabic but adjusted the content so that the cultural perception is correct.

Thanks to this pre-work of Katharina Dams and Dr. Emad Soliman in intercultural management and transparent communication, the cultural perception of the pedagogical method was overall positive.

Cultural strengths and limitations of the pedagogy for the beneficiaries of the pilot project

Strengths:

- Clarity
- Transparency
- Equality in collaboration
- Well-explained tasks
- Simplicity of the steps
- Usage of practical examples
- Open feedback culture
- Team work spirit (instead of deployment of teacher-student culture)
- Empowerment of the local team (supportive pedagogy)
- Trust culture

- Personal follow-up pedagogy (ensuring no-one is left behind)

Weaknesses:

- Velocity (partially to fast pedagogy for some participants)
- Technically focused pedagogy
- Information asymmetry (difference in the level of knowledge about the technical solution)
- Too “advanced” pedagogy (use of academic and technical terminology)
- Partially missing explanations of the basics or project interlinkages (i.e. parts which are self-explanatory for the teacher but not necessarily for the students) or tendency to “jump in the middle” pedagogy
- Shame culture (being afraid to show lack of understanding)
- Hierarchy (generally present in the culture not in the hospital)
- Lack of knowledge about the local culture – partial dependency on a translator

One good example of how a weakness was managed was the idea to share the roles so that every team member could contribute with their strengths, rather than having only one person moderating the entire presentation and testing phase.

The consultant was excelling in introduction and explaining the backgrounds and interlinkages, while the Engineers were excelling at the practical phase. This combination can bring success also in the future parts of the project (i.e. during a public presentation on a conference).

IV. Challenges and opportunities identified during the exercise

Analysis of the use of the technical solution during the pilot project

The technical solution via the Raspberry and Moodle was well received. The prerequisites were good preparation and detailed explanation of the technology, how it works and what are the benefits and challenges of this solution.

Motivating factors for the use of the technical solution

- Affordability - low cost of purchase
- Usability – easy use
- Multiplication factor – outreach potential
- Hotspot solution in situations with no or low internet connection
- Free download option
- Upscaling potential for usage outside the hospital
- Utility – practical solution
- Common interest for innovative solutions in education

Blocking factors for the use of the technical solution

- Language barrier (partially)
- Cultural barrier (partially)
- Different levels of education of the participants
- Separation of the group into IT and non-IT members
- Time – limited time available
- Abstractness

Ideas for improving the technical solution for large-scale deployment

Conducting a second pilot project in schools – a cooperation between the outreach programme of the Nile Hospital on health literacy and education (i.e. on AIDS prevention or against female genital mutilation).

Or on a national level, another possibility would be doing a pilot on a national teacher's conference or similar large-scale event (i.e. in cooperation with the government or the embassy).

A logical consequence would be organising a third pilot when file compressing option of the technical solution is optimise.

V. Analysis of the feedback from the beneficiaries of the pilot project

Pros and cons of the hardware

The hardware is on one side affordable, practical and small in size, but on the other hand it is still not very known in the market (general market of potential users, outside the IT-industry).

Pros and cons of the software and the app

Moodlebox is a feasible and easy-to-use software solution, but it still has certain limitations. For instance, in the beginning, one would need a reliable internet connection to prepare the Moodle and its content for the lecture. Further evaluation of the pros and cons is included in the project initiation document. The participants confirmed most of them during the pilot phase.

Pros and cons of the integrated full solution

At the end of the pilot test, the integrated full solution was tested to ensure that all can remotely access to a high-quality education. The results are extremely promising. During the pilot phase in the Nile Hospital the participants showed capability in using the technology on its own – in a real life and self-created version about Quality Management and Standards in the Hospital according to the General Authority for Healthcare Accreditation & Regulation (GAHAR) and World Health Organization (WHO) guidance. All the participants of the testing have also filled out the questionnaire about the technology, its pros and cons and further questions about the context and future applicability.

Characterisation of the target audiences

The target audience was diverse. The Egyptian government claims to have 100% electricity coverage (every household having access to electricity and clear water) and that every high school student receives a tablet. Nevertheless, there are significant disparities between the rich and the poor population. The city of Nagada, where Nile Hospital is situated, belongs to a poor rural region. There are many people in need, living below the poverty line. In many families, smart phones are shared, for example among siblings. Despite of such cases, most of Egyptians possess a phone. The higher challenge is the internet connection quality – it is available in most of the places but functioning in a limited speed. The costs of internet are also a factor influencing the target audience – most of them do not have unlimited access and are very interested in the technical solution that creates a hotspot and allows for the reduction of document sizes when downloading. Being able to teach offline would be a great help in instable or no internet connection contexts of the target audience – especially for the external health education part where doctors often need to go to a remote rural area without any internet. The target audience generally has electricity and a smartphone and knows how to work with it, so it is easy to train them how to use the mini-computer and the app.

Scenarios envisioned for the use of the technical solution

Envisioned scenarios for the use of the technical solution include internal usage in the hospital in different departments for workshops and educational purposes and outside of the hospital in the outreach programme about health education in local schools and in for the citizens.

The external use in high schools of district Qena was the original plan for the pilot project in Egypt, but since there would be no guarantee of significant proportion of smart phone owners in the initial targeted public, the Egyptian partner proposed an internal solution for the hospital, which would involve their own employees. The selected employees were all smart phone owners and there was a possibility to prepare them prior to the testing day. This internalization of the pilot contributed to a success at first level, but on the other hand the external testing is still to be done in order to be able to evaluate the solution on a more general scale.

Recommendations

As mentioned above, future project continuation is recommended to find further utility of the solution in external settings and being able to test the planned advanced technical solutions (e.g. Telegram Bot).

Furthermore, since only one pilot was conducted in Egypt, it would be beneficial to conduct or outsource more pilot projects in this country to gather data on a larger scale from different settings and generate more universal results. A further project phase would provide a more comprehensive understanding of the implementation processes affecting the visibility of long-term result of the technical solution.

Future exploration could also be useful in finding additional technological solutions for education in fragile contexts.

VI. Concluding remarks

Overall assessment of the pilot project

The overall assessment of the pilot project is very positive. Among key factors for the overall success of the pilot project belongs:

- *Pilot Project Management*
The project manager was responsible for overseeing the smooth delivery of projects by managing the logistics, operations, budget, timeline, and scope of the agreement; reporting deliverables; and supporting partner tracking. She maintained regular contact with the team to monitor the pilot project development and with EFPL experts to assist in keeping work on track and on time.
- *Monitoring & Evaluation*
The monitoring and evaluation team oversaw the monitoring of the pilot project activities, evaluating these activities relative to their intended impacts, and reporting to EFPL. SMART goals were used to professionalize the process and practice effective project management.
- *Technical and Teaching Expertise*
The technical expertise was covered by EPFL on a high level. The E-learning engineer mastered the technical components of the pilot project excellently. He and Dr. Emad also demonstrated expertise in pedagogy.
- *Team Work*
Sharing knowledge across work areas and geographies to learn from one another, foster teamwork, build trust, spark innovation, and hear new perspectives. Working cooperatively with the local team was critical to achieve the planned goals. There was an introduction meeting organised by K. Dams to get to know the core team members professional background and foster a good team work. The core team functioned very well both professionally and personally.
- *International Cooperation*

The international cooperation began with earlier involvement of the consultant in this field, followed by a cooperation between her and the director of Unité Raji Sultan. As the opportunity of participating in the e-Learning project of EFPL arose, K. Dams fostered the international cooperation between interested and eligible African partners of the member organisation. The Nile Hospital in Egypt was in the end chosen to be one of the 3 countries for the pilot project.

- *Interdisciplinary Collaboration*

The project involved a range of stakeholders from non-governmental organisations, academia, and public sector actors in knowledge exchange, collaboration, and innovation to accelerate implementation of the given e-learning solution.

- *Intercultural management*

The importance of intercultural management lays in knowledge and understanding of its components starting with the *the importance of learning about cultures, ability to respond to different cultures with skills in preventing mistakes* in managing the cooperation within different cultures. It is wise to know something about the organisation where a person works in and the way its structure—a result of culture—affects its communication. The cultural context of the pilot project was complex as it contained two layers of the local culture – the geographic (Arabic) and the religious (Christian orthodox and evangelical). Previous work experience and education of the consultant in this field was very useful for the pilot project in Nile Hospital in Egypt.

- *Communication*

Clear and direct communication are belonging to the most influential success factors on a secondary level (after the technical and managerial expertise). The overall communication was working well due to the professionalism of the team members (same educational level, mutual respect, experience in working in international settings or common values and academic background).

The communication was direct, not involving additional members (a third party or a “middle man”, i.e. from the member organisation Mission am Nil) meaning direct communication with the Egyptian side through the consultant, who knew the hospital and its setting from her previous field work. Written communication in team was kept efficient, avoiding long mail threads and overprocessing.

Since the beginning of the project (December 2022) there was a regular exchange between the EPFL project manager (F. Meylan) and the consultant (K. Dams) as well as within the pilot team (K. Dams, S. Naji, A. Gomez and F. Melyan) which was formed in the beginning of February.

- *SDG orientation*

The project was dedicated to supporting the achievement of the SDG 4 – Quality Education for all. This helped to categorize and evaluate the project at international level and support a standardised impact measurement.

- *Transparency*

Transparency as one of the common values was present during the whole project. The team members were open and honest to each other and shared mutual trust.

- *Mutual respect, recognition & inclusion*

Sharing the principles of equality and mutual respect supported the success of the project. The Egyptian team members received recognition and equal treatment. The Swiss delegation was also warmly welcomed and treated with respect. This created a good working atmosphere

without judging, comparing, excluding, prioritizing or competing. The whole project is a good example for inclusion and equality – in terms of age, gender, position, nationality and profession.

- *Strong engagement & motivation*

There would be no project success without the extraordinary engagement of the team members and the pilot project participants. It was visible that the project does not only represent work with series of tasks to be fulfilled but that there is strong personal motivation to help providing sustainable solutions to current challenges in education for all. The mission was based on values of social justice – that everyone deserves the same level of high quality of education and no one is left behind due to a socio-economic status.

There was also a high interest and motivation present from the Egyptian side. They were eager to participate in the testing and showed their interest by asking a lot of questions. The motivation turned to be long term as they reflected an interest in further cooperation and interest in deployment of the technical solutions in different settings, at a regional or even national level, if including the broader stakeholder network.

- *Flat hierarchy*

Flat hierarchy in team provided a positive collaboration culture and speed in the implementation and testing phase. There was no process bottleneck person nor long waiting for signatures or support of broader stakeholders.

- *Innovation & Sustainability*

The project is a good example of “future of the work” – international, interdisciplinary, inclusive and innovative. In addition to this, it proves itself also in the category of sustainability and scalability to other institutions and regions. Having a team with innovative spirit did contribute to the project success as well.

Conclusion and prospects for further collaboration

Based on the context analysis, qualitative research methods such as interviews and the actual results of the pilot project in Nile Hospital in Egypt, it can be concluded that the proposed distance learning solution has a high potential in practice.

Free and good quality education is a human right. The Universal Declaration of Human Rights affirms that education is a fundamental human right for everyone and this right was further detailed in the Convention against Discrimination in Education. The right to education is indispensable for the exercise of other human rights. Quality education is one of the most powerful tools in lifting socially excluded children and adults out of poverty and facilitating inclusion into society. It narrows the gender gap for girls and women.

To enable this human right to be deployed, there must be equality of opportunity, universal access, and enforceable and monitored quality standard. The technical solution for distance learning in fragile contexts as Upper Egypt contributes to categories of equal opportunity (as it is affordable and easy to use) and quality standards (digital documents are easy to monitor and compare). In case the technological solution would be deployed at a larger scale, it has the potential to contribute to universal access to high quality education as well (under the hypothesis the educators are correctly trained and able to create multipliers).

The proportion of contribution to better education would not be that significant without the engaged pilot project testers team, who were motivated to experiment and challenge the solution, and who were transparent in sharing their needs for a better use of the solution.

One of the main results of this pilot project is the proven importance of interdisciplinary and international collaboration. All sectors and actors on the global market are interlinked. The more we are aware of it and the more we initiate cross-collaboration, the more the world can benefit from it. Globalisation created a generation of international specialists and global citizens who can work in any team around the world and use diversity as an asset to achieve extraordinary goals. The project core team is an excellent example of this generation.

Cooperation in Global Development has a high potential and it starts with initiatives and projects like this. Thus, this project is not only about a solution based on optimizing the size of the files used via a web application combined with the use of a nano-computer which acts as a hotspot, but on a system level about rebalancing the social justice in developing countries, as a part of decolonialisation process and our contribution to a more inclusive, equal and fairer world.

The role of the bridge-builder in this project might seem to be a secondary role, yet after analysing the overall picture of this project, its crucial importance becomes obvious. It has a visionary and pioneering function and is able to see connections and opportunities for collaboration where there were none before. It serves as a glue between different actors (EPFL, Unité, MN and Nile Hospital) and it needs a lot of courage to start something new, continue even if there is no internal support and stay resilient if resistance from the opposition occurs. After all these challenges, it can be concluded that this project was a precious debut of a cooperation in an extensively conservative setting – in a metaphoric sense since it is a first bridge ever outside of the own circles.

And last but not least, where it all meets is the common interest in creating impact – everybody in his/her own field. The contribution might be diverse in terms of tangibility or visibility and coming from academical, technical, pedagogical, diplomatic or managerial fields, yet the goal was always common.

For any future collaboration, I am willing to contribute with my knowledge, skills and time and I am driven to achieve superior results, balancing long- and short-term priorities to make further real-world impacts together with EPFL and Unité.

Future project continuation is desired from not only from my side, but from the Egyptian side as well. And the Egyptian partner was not the only one interested in collaboration – the Ethiopian partner in education sector expressed his interest, if there would be another pilot project aiming to upscale the given technology to another country.

We are only able to achieve significant change in education, or any other field, if we learn to collaborate beyond the borders of our fields and countries. This project is a unique proof that where there is professionalism, humanity and common values; it is possible to connect different fields such as research, education, healthcare, IT, development cooperation, public sector and private sector or academia with consultants and reach remarkable results for common welfare. It was an honour to work in this project and I do hope this is not the end.

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Appendix 4: Pilot Project in Côte d'Ivoire

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Rapport de consultant

Titre du mandat

Consultance pour le Centre EXAF de l'EPFL, dans le cadre du projet « *E-learning dans les contextes fragiles* » .

Mission

Sous la responsabilité du chef de projet, les tâches suivantes avaient été mandatées :

Tâches	Description	Nombre max. de jours de travail (indicatif)	Livrable(s)
1. Préparation du projet pilote			
1.1 Sélection d'un ou d'une enseignant-e qui sera chargé-e de tester la solution technique élaborée par l'EPFL (hardware et software)	Le mandataire proposera un ou une enseignant-e intéressé-e à participer au projet pilote et à même de comprendre les principaux avantages et enjeux de l'éducation à distance.	1 jour	Coordonnées de contact et description de l'enseignant-e sélectionné-e (dans le rapport préliminaire)
1.2. Achat du matériel (hardware) selon instructions de l'équipe technique de l'EPFL	Le mandataire s'occupera d'acheter le matériel qui sera distribué dans le cadre du projet technique. Chaque achat sera validé par l'équipe technique de l'EPFL et les preuves de paiement devront être conservées pour remboursement des frais.	1 jour	Description du matériel acheté avant la mission de l'équipe technique, y compris les preuves de paiement (dans le rapport préliminaire)
2. Soutien durant la mission de l'équipe technique			
2.1 Aide à la préparation de la mission	Le mandataire apportera ses conseils pour la réalisation d'une mission ayant pour objectif le test en conditions réelles de la solution technique élaborée par l'EPFL. Il apportera notamment son conseil concernant le logement et le transport sur place durant des meetings par visioconférence.	2 jours	Rapport préliminaire (contribution au plan de mission)
2.2 Accompagnement durant la mission	Durant une mission de 3 jours maximum, si nécessaire, accompagner l'équipe technique pour faciliter les relations avec le public cible de la solution	3 jours	Rapport de mission (dans rapport final)

	technique.		
3. Ecriture du rapport final			
3.1 Rédaction d'un rapport final	Le mandataire recueillera les retours d'expérience de l'utilisation de la solution technique durant le projet pilote et synthétisera ces derniers dans un rapport final qui sera transmis à l'équipe de projet de l'EPFL.	3 jours	Rapport final

Dans le cadre de l'écriture du rapport final pour laquelle 3 jours ont été alloués dans le cadre de la mission de consultance, la structuration suivante est proposée :

Équipe impliquée pendant le projet pilote

Titre	Prénom(s)	Nom	Rôle dans le projet pilote et le déploiement de la solution technique pour les publics cibles
M.	Sylvain Ollo	MOMO	<p>Consultant</p> <ul style="list-style-type: none"> • Lien entre l'équipe de l'EPLF et le Collège Lumière Azaguié (Côte d'Ivoire). • Participation à la préparation du projet. • Identification et mise à disposition d'un point focal en la personne de Monsieur Kouassi Gédéon KOUMA pour soutenir la mission de l'équipe technique. • Préparation du rapport final.
M.	Ousmane	COULIBALY	<p>Fondateur du Collège Lumière Azaguié</p> <p>Autorisation pour la mise en œuvre du projet pilote dans son établissement.</p>
M.	Kouassi Gédéon	KOUMA	<p>Directeur du Collège Lumière Azaguié et point focal du Consultant en Côte d'Ivoire.</p> <ul style="list-style-type: none"> • Participation à la sélection du Professeur chargé de tester la solution technique. • Recherche du matériel (hardware) à acheter selon instructions de l'équipe technique de l'EPFL. Au regard des stocks assez bas de ce type de matériels en Côte d'Ivoire avant le projet pilote et des délais assez courts avant la mission, tout le matériel a été acquis en Suisse. • Aide à la préparation de la mission. • Accompagnement de l'équipe technique de l'EPFL pendant la mission. • Participation au rapportage
M.	Bi Douali	NANDY	<p>Professeur de Physique-Chimie.</p> <p>Il était chargé de tester la solution technique élaborée par l'EPFL (hardware et software) avec les élèves de la classe de e 3^{ème} 2 dont la tranche d'âge des apprenants variait entre 14 ans et 16 ans. Dans cette classe il y avait 28 garçons et 30 filles. Sur l'ensemble de ces apprenants, 20 disposaient déjà d'un smartphone. Au regard de ce nombre, nous avons conclu que les apprenants de cette classe étaient plus aptes à manipuler des smartphones ou des tablettes.</p> <p>M. Nandi sera chargé de la mise en œuvre du projet</p>

M.	Issoufou	DIARRA	Informaticien. Il était chargé d'installer l'application (https://download.moodle.org/mobile) sur les appareils des apprenants qui participaient au projet pilote.
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Description du public cible

Le public cible de ce projet pilote intitulé « *E-learning dans les contextes fragiles* » est constitué de 58 apprenants de la classe de 3^{ème} 2 du Collège Lumière Azaguié (une petite ville communément appelée bidonville dans certains pays africains) de Côte d'Ivoire. Ces apprenants étaient composés de 28 garçons et 30 filles dont la tranche d'âge se situait entre 14 ans et 16 ans.

La plupart de ces apprenants sont issus de famille très pauvres dont certains peinent à avoir un repas par jour et à honorer leur engagement financier vis-à-vis de l'établissement. En effet, les bidonvilles sont pour la plus part habités par les ménages vulnérables qui ne peuvent pas faire face aux charges courantes d'une grande ville.

Synthèse de la pédagogie de présentation de la solution technique

- **Perception culturelle de la méthode pédagogique.**

L'enseignement numérique est perçu en Côte d'Ivoire comme un facteur d'amélioration de la qualité de l'éducation. Il fait partie des stratégies discutées au niveau du Ministère de l'Éducation. Ainsi, la méthode pédagogique utilisée dans ce projet pilote s'insère bien dans le contexte culturel ivoirien et peut bien être utilisée par les enseignants de l'ensemble des établissements privés et publics pourvu que les décisions viennent du ministère de l'Éducation et non de la base.

En somme, l'intégration du numérique dans le système ivoirien et dans certains pays africains serait la bienvenue non seulement pour faciliter certaines tâches pédagogiques telles que la disponibilité des résultats des évaluations en un temps record, mais aussi pour gagner du temps.

- **Avantages et limites de l'exercice pour les bénéficiaires du projet pilote.**

La solution développée présente des avantages et des limites pour les bénéficiaires.

Au niveau des avantages, la méthode pédagogique utilisée est très dynamique et fait partie du quotidien des élèves. En effet, les enfants sont de plus en plus tournés vers les outils numériques tels que les téléphones, les smartphones, les tablettes et les réseaux sociaux. Or, avec la solution pédagogique développée, c'est comme si l'on retrouvait les enfants dans leur environnement pour leur apporter la connaissance. Le support étant numérisé, cela devient plus attractif pour eux, qui s'y intéressent par rapport au support physique qu'est le papier.

Les limites de la méthode pédagogique se situent surtout au niveau de l'accès aux tablettes ou aux smartphones, des outils nécessaires pour la mise en œuvre de ladite. En effet, tous les élèves n'ont pas accès aux smartphones ou aux tablettes à cause du manque de moyens. Ce fut le cas pour plusieurs élèves de la classe de 3^{ème} 2 du Collège Lumière Azaguié de la Côte d'Ivoire où seulement 20 apprenants disposaient d'un smartphone sur un total de 58 soit 34,48%. Par conséquent d'autres élèves, dont les parents ont peut-être moins de moyens, se

sentiraient exclus par cette méthode pédagogique si elle venait à être vulgarisée. Au-delà de l'exclusion, il y a lieu de noter le défi de la maîtrise des smartphones ou des tablettes par certains enfants à cause de leur âge. La tranche très jeune ne sait pas souvent manipuler ces appareils parce qu'ils n'y sont pas habitués.

Challenges et difficultés soulevés par l'exercice

L'utilisation de cette solution technique pendant l'étape d'exercice est très accrocheur. Les élèves sont curieux de découvrir car elle est nouvelle pour eux. De ce fait, ils étaient tous motivés à trouver l'exercice dans la Raspberry Pi. Ce facteur « accrocheur » est un élément qui pourrait motiver à l'utilisation de cette solution en Afrique. L'apprenant a l'impression qu'il est en train de jouer en répondant aux questions du cours alors qu'il est en train d'acquérir des connaissances.

Le deuxième facteur motivant est la mémorisation des apprentissages. Au regard du fait que l'apprenant considère l'exercice dans la Raspberry Pi comme un jeu, il finit par le maîtriser aisément sans aucune pression extérieure. Ainsi, il sera à même de se rappeler des réponses qu'il a déjà visionnées lorsqu'il était sur son smartphone ou sa tablette lorsqu'il reverra les mêmes questions quelque part.

Bien que cette solution technique soit adaptée aux réalités de la Côte d'Ivoire et de certains pays africains, il y a lieu de prêter attention à certains facteurs qui pourraient bloquer l'utilisation de ladite solution. Nous relevons dans ce rapport trois facteurs :

- **Le niveau de préparation des élèves** : Pour le cas de la classe de 3^{ème} 2 du Collège Lumière Azaguié, certains apprenants avaient du mal à accéder à l'exercice parce qu'ils n'ont pas été préparés bien avant à l'utilisation du matériel. Ils étaient en même temps en train de découvrir le matériel et aussi à chercher à effectuer les exercices. Il aurait fallu prendre un temps pour les former à l'utilisation du matériel, comment ouvrir son compte, comment repérer son exercice et comment le traiter avant de faire la séance de cours.
- **Le niveau de vie des parents d'élèves** : Le niveau de vie de certains parents d'élèves ne leur permet pas d'offrir des tablettes ou des smartphones à leur enfant. Or, si les élèves n'ont pas ces outils, la solution technique ne pourra pas être vulgarisée. Afin de trouver une réponse à cette difficulté, il serait souhaitable que chaque établissement ait des tablettes que les apprenants pourront utiliser pendant les cours.
- **L'interdiction du téléphone portable dans les écoles** : Le téléphone portable est interdit dans les écoles dans beaucoup de pays africains, en particulier en Côte d'Ivoire par le gouvernement ivoirien. Ainsi, pour la mise en œuvre de cette solution technique, il y a lieu de mener un vrai plaidoyer auprès des gouvernants pour réintroduire le smartphone à l'école (au minimum pendant de brèves périodes qui serviraient à télécharger les séquences de cours et les exercices) et trouver des solutions pour encadrer son utilisation.

Analyse des retours d'expérience des participants au projet pilote

Les retours d'expérience des utilisateurs nous permettent de déduire que la solution intégrée utilisée lors de ce projet pilote à l'avantage de permettre au plus grand nombre d'apprenants de suivre des formations de qualité à distance. Selon eux, la solution intégrée (matériel, logiciel et l'application) est très utile pour la préparation des cours et des évaluations par le biais de la plateforme moodle. Pour eux, la phase de préparation des cours et des activités sur moodle

nécessite une bonne maîtrise de l'outil par le professeur.

Les utilisateurs pensent que cette solution intégrée pourrait être une option sûre si les établissements scolaires disposaient de salles informatiques et d'informaticiens bien formés sur la configuration de la Raspberry Pi. Or, le constat dans beaucoup d'établissements scolaires ivoiriens et d'autres pays de la sous-région montre qu'il reste beaucoup à faire pour résoudre ce défi de disponibilité de salles informatiques. Les participants au projet pilote ont relevé aussi le fait que le matériel, le logiciel et l'application soient difficiles à trouver sur place. Ils pensent que c'est là où se trouvent les inconvénients de ces outils surtout pour la Raspberry Pi qui n'est pas accessible à tous, mais qui demande assez de temps pour maîtriser certains paramètres. En effet, pendant la phase pilote, il a été difficile de trouver le matériel nécessaire en Côte d'Ivoire pour l'exécution du projet.

De plus certains paramètres de cette solution intégrée sont en anglais, ce qui limite la maîtrise de l'outil par les acteurs francophones.

Malgré les défis relevés, les participants au projet pilote envisagent les scénarios suivants pour l'utilisation de la solution technique dans leur établissement :

- Maîtrise des différents outils techniques par le professeur, Monsieur Nandy en montant au moins trois types d'exercice dans la solution intégrée. Monsieur Nandy a déjà commencé à se préparer depuis la fin de la phase pilote.
- Formation d'un noyau de professeur. En effet, le Directeur du Collège Lumière Azaguié a déjà choisi un groupe d'enseignant qui sera formé par Monsieur Nandy pour poursuivre le projet.
- Sélection des exercices et leur ajout par le nouveau professeur dans la Raspberry Pi.
- Ouverture d'une lucarne appelée « l'école numérique » dans les emplois de temps de certaines classes où les professeurs formés par Nandi viendront chaque mercredi soir pour encadrer les élèves. Le début de cette lucarne est prévu pour la rentrée scolaire 2023-2024.
- Utilisation des didactiels mis à disposition sur l'application web de compression développée par EXAF. Ces didactiels n'étaient pas encore tous disponibles lors du pilote, mais pourraient se révéler très utiles.

Le témoignage du professeur, Monsieur Nandy soutient les idées avancées ci-dessus.

« Je suis Monsieur Nandy, Professeur de Physique-Chimie, l'un des assistants et collaborateurs du projet e-learning qui a vu le jour à Azaguié le 14/03/2023 au Collège Lumière de ladite localité. Ce fut un honneur pour moi de prendre part à ce projet relatif à la nouvelle méthode d'enseignement numérique.

L'intégration du numérique dans notre système serait la bienvenue non seulement pour faciliter certaines tâches pédagogiques telles que la disponibilité des résultats des évaluations en un temps record, mais aussi pour gagner du temps.

Mais, à mon avis, la phase pratique du projet sera un travail de longue haleine pour deux raisons fondamentales : c'est tout à fait un domaine informatique par conséquent il nous faudra du temps pour maîtriser certains paramètres du Raspberry pi pour mieux préparer les cours et les évaluations par le biais de la plateforme moodle. La seconde raison est relative à la non-disponibilité de salle informatique au sein de notre établissement. De plus le fait que plusieurs enseignants doivent se partager deux Raspberry pi pour créer un réseau local pourrait se révéler un facteur limitant.

Après les séances des activités avec Ximena (experte informatique de l'EPFL), j'ai eu quelques

difficultés dans les débuts pour la phase de préparation des cours et des activités sur moodle mais je continue d'améliorer le travail au fur et à mesure de mes essais.

Personnellement, je trouve ce nano-ordinateur très intéressant et commode pour la mise en place des activités pédagogiques. »

Suggestions d'amélioration

La mise en œuvre du projet pilote « E-Learning dans les contextes fragiles » au Collège Lumière Azaguié a permis de recueillir les avantages, les défis et le retour d'expérience des participants sur le système d'éducation numérique développé. Pour renforcer les acquis et optimiser les résultats pour la suite de mise en œuvre du projet, les recommandations d'amélioration suivantes sont formulées :

R1 : Impliquer les décideurs de chaque pays dans la vulgarisation de la solution. Dans la plupart des pays africains, les établissements scolaires exécutent les projets et programmes scolaires validés par les gouvernants. Ainsi, pour une large vulgarisation dudit projet, il serait souhaitable d'avoir l'accord de principe des ministères, ce qui favoriserait son utilisation dans les établissements à la base.

R2 : Mettre en place des tutoriels (des petites vidéos descriptives du matériel de l'enseignement numérique) au profit des professeurs d'une part et des élèves d'autre part. En effet, à défaut d'être présent en amont pour former les professeurs et les élèves, il serait intéressant de disposer de petites vidéos sur les modules suivantes :

- **Professeur** :
 - Présentation du matériel intégré.
 - Préparation des cours et des activités sur moodle.
 - Configuration de la Raspberry Pi.
 - Les techniques d'enseignement d'un cours à distance.
- **Élèves** :
 - Présentation du matériel intégré.
 - Création et ouverture d'un compte e-mail.
 - Repérage et traitement d'un exercice.

Synthèse

De façon globale les résultats de ce projet pilote « E-Learning dans les contextes fragiles » sont très satisfaisants et occurrent un lendemain meilleur pour l'enseignement à distance en Afrique par la vulgarisation de cette solution. Cependant, cela va nécessiter une bonne collaboration dans la dotation en tablette au regard des effectifs pléthoriques dans les établissements scolaires africains.

Bien qu'il faille faire attention au risque que certains élèves ne possédant pas de smartphone puissent se sentir exclus par cette méthode pédagogique, il faut noter que certains élèves (surtout des filles) ont également souligné que cette méthode leur permettait de prendre plus confiance en eux/elles lors des réponses aux questions. En effet, le fait de répondre sur un smartphone ou une tablette permet d'éviter le jugement de ses camarades lorsque l'on répond. Ainsi, cette solution pourrait permettre de redonner confiance aux élèves timides et donc de leur permettre de mieux s'intégrer à l'école.

Merci à l'équipe à l'équipe de l'EPFL pour la confiance placée en nous.

Appendix 5: Pilot Project in Kenya

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Programme website: <https://exaf.epfl.ch/>

Report on the testing of the application with staff at North Coast Medical Training College



Title of the mandate

Consultancy for the EXAF Centre of the EPFL, in the framework of the project "E-learning in fragile contexts".

Introduction

In December 2022, as a director of North Coast Medical Training College, I received information about the project "E-learning in fragile context" and was asked whether North Coast Medical Training College was interested in participating in such a project to test a new application to ease sharing of files in low-speed internet settings. I discussed with the team and also with our co-worker on E-learning, Diana Ombelli, and we agreed to support.

The information was provided as follows:

1. We are currently developing a tool that will allow compressing the files used for e-learning (e.g. video, picture, etc.). It will consist in a Web Application, as well as a Bot, working on the Telegram Smartphone App.
2. The tools described in #1 will be open source and 100% free.
3. We currently need to test these tools (we have a small budget to subcontract your organization, in order to receive a feedback – i.e. small report containing the lessons learnt from the utilization of the tool.
4. The period for this beta testing would be: January to March 2023.

After several meetings, docs for the assignment were shared end of February. However, March being a very busy month for us, both Diana and I managed to test for ourselves the application several times, give some feedback back to the team, but did not manage to engage the teachers until the end of March. Some hiccups with the availability of the site / application were experienced, but eventually a good number of the staff was able to test and provide feedback on the application through a form designed for the purpose (Annex 1). They were also shared the survey link (<https://fr.surveymonkey.com/r/D6GF5XM?lang=en>) to fill out after testing.

By second half April eight teachers had managed to complete the testing and provided their feedback. The feedback was analysed (Annex 2) and forms together with the direct observations of myself and Diana, the basis for this report.

Team involved during the pilot project

There were 12 people involved in the pilot project. More were targeted but due to the unavailability of the application at two points in time when we were testing, we did not manage to engage all intended participants. There were six (6) males and six (6) females involved in the project – ICT and e-learning support staff, management, and teachers.

No	Name	Gender	Responsibilities in NCMTC	Role in pilot
1	Marianne Darwinkel	Female	Director	Plan, lead, test and support
2	Diana Ombelli	Female	E-learning co-worker	Test, coordinate and support
3	Eric Kilelu	Male	ICT head	Support the ICT related questions
4	Babu Ali Babu	Male	E-learning head	Coordinate and guide the trainers
5	Henry Akunda	Male	Trainer	Test the application
6	Mercy Amulega	Female	Trainer	Test the application
7	Winnie Kasichana	Female	Trainer	Test the application
8	Phelix Baraka Mwangome	Male	Trainer	Test the application
9	Jamila Musa	Female	Trainer	Test the application
10	Emmanuel Nyale	Male	Trainer	Test the application
11	Thomas Mlewa	Male	Trainer	Test the application
12	Dorcah Ogeto	Femal	Trainer	Test the application

Summary of the pedagogical presentation of the technical solution

- **Cultural perception of the pedagogical method.**

The pilot did not focus on cultural perceptions. Generally, in terms of the educational levels, they were sufficient to handle the application though I noted that two of the trainers did not manage very well, though they did not note that themselves. From their reports, the files remained exactly the same size. As this is unlikely, I think they did not find the page where they could see the converted size but repeated the unconverted size.

- **Cultural strengths and limitations of the pedagogy for the beneficiaries of the pilot project.**

The pilot did not explore this.

Challenges and difficulties raised during the exercise including analysis of the feedback from the beneficiaries of the pilot project

Initially, testing was hampered by issues that made the application unavailable from time to time (especially around 20 March and 4 April 2023). Thereafter, trainers were able to test and explore and though generally the experience was positive, few challenges and difficulties were experienced.

The general feedback was that that the application is highly relevant as it eases the access to information for learners and also because it uses less space wherever it is stored.

The application was perceived as simple and easy to use which is also core in its usage.

A challenge that featured several times, and which is understandable, but nevertheless a limitation for the staff using the app, and likely the factor that blocks most, was that when they upload the videos / pictures / documents, during the uploading process, stable and fast internet is required:

“It requires strong internet to convert, especially larger video's.”

“It displays "pending" or "started" for hours without converting”

“Uploading files needs stable and strong internet connection, meaning if one is not having that, it takes more time waiting for the upload

“Cannot use the application if wifi is low, keeps telling me "sign in" - failed several times”

Most of the time, the participants recorded substantive, sometimes impressive decreases in the file sizes, for example, with high compression, a video of 227.9MB decreased to 10.3 MB and a jpeg from 5.7MB to 776.8KB, both without noticeable loss of quality. This was however not 100%, we recorded three instances whereby some files actually increased in size: a png file increased from 491KB to 506.6KB, a video increased from 202,8MB to 263.0MB, and a small jpeg-file increased from 18.8KB to 19.1KB. Also, specifically in the reduction of PDF and JPEG files, pictures became blurry with high compression (e.g. 12.8MB to 861KB or 5MB to 265KB).

Lastly, staff observed that PPT files and Word documents could not be reduced by the application and they thought that it would be useful if those types of files would also be supported.

Ideas and recommendation for improving the technical solution for large-scale deployment

- **Offline use:** To ease use for the beneficiaries, the persons using the application and reducing size of files, consider amending the application for offline use on local area networks or devices. This way, it will cause less frustration of failed attempts due to poor internet connection.
- **Extent and effects of the compression:** Provide a general description on which factors influence the amount of compression possible and the possible effects of medium and high compression. Show a preview of the compression effect on the uploaded file before you choose between medium and high compression. This will enable users to make an informed choice on which files to compress and to which level rather than working through trial and error.
- **Expansion to other types of files:** Consider expansion of the possible formats to be converted.

Summary

The application is already very useful and was appreciated for what it already does and for its potential to do more. Most of the time, the effects and experiences were positive. The most important hampering factor was the need to upload the files to be converted, especially if then subsequently the conversion was either not leading to a smaller file or was leading to a too low quality product.

As the college we would not mind to support the development of this tool in future and we hope our staff can continue to have access to the tool.

Annexes

- Annex 1: Tool used to collect information from participant trainers
- Annex 2: Overview of feedback from the participants

Drafted and submitted by



Marianne Darwinkel
Director North Coast Medical Training College
Bomani, Kilifi, Kenya
27 April 2023

Application site: <https://e-learning4all.app/>

Annex 1 : Tool used to collect information from participant trainers

Application – reducing size of reference materials

Introduction

An organization in Switzerland, called the EXAF Centre, is working on a project that involves the creation of an application to make e-learning easier in places with high costs or low speed of internet. They asked us to support the development of this application.

The application that they have made is a compression application. It helps to make various types of files smaller in terms of the number of bytes. This means that they are faster to upload and download. For now, it can handle video files, picture files, and PDF.

As a teacher undergoing the introduction to teaching training, you are kindly requested to help testing this application and provide your brief report.

You are requested to test the application using at least five different files, and preferably different types (jpeg, pdf, gif, png, mp4, etc.)

This will take about 1 hour.

You will be provided with some airtime as a token of appreciation after submission of your test report.

The application can be accessed through <https://e-learning4all.app/>

Report

1	Name	
2	Tel. no. (for airtime / mpesa)	
3	Gender	

4	What is your general impression of the application?	
5	Will this be a useful application that you are likely to use in your work and why?	
6	What type of files did you try to reduce using the application?	

7	Describe for five of the files the following:			
No	Type of file (pdf, jpeg, etc.)	Original size	Size after reduction	Any comment on the quality or other aspects of the file before and after?
1)				
2)				
3)				
4)				
5)				

8	What are positive / strong points of the application? What did you like about it?	
9	What is a challenge with the application, what might limit its use?	
10	What ideas do you have for improvement?	

Upon completion, please do the following survey:

<https://fr.surveymonkey.com/r/D6GF5XM?lang=en>

Thank you for your time to test the application, filling out this report and completing the survey !

You will be shared airtime or equivalent in mpesa as a 'thank you' for the participation

Annex 2: Overview of feedback from the participants

1	Name	Diana Ombelli			
2	Tel. no. (for airtime / mpesa)	742080820			
	Sex	Female			
4	What is your general impression of the application?	The design is essential. The menu is compact and self-explaining			
5	Will this be a useful application that you are likely to use and why?	Yes, this application is useful because reduces the size of files commonly used in learning materials			
6	What type of files did you try to reduce?	Jpeg, mp4, png, PDF			
7	Describe for five of the files the following:				
	No	Type of file	Original size	Size after reduction	Comment on quality or other aspects of files before / after?
	1)	jpeg	5.7 MB	1.3 MB	High compression -> no noticeable loss of quality
	2)	Mp4	38.6 MB	11.2 MB	Medium compression -> no noticeable loss of quality
	3)	Mp4	227.9 MB	10.3 MB	High compression -> no noticeable loss of quality – impressive reduction!
	4)	png	491 KB	506.6 KB	Medium compression -> no noticeable loss of quality – size has increased!
	5)	PDF	12.8 MB	861 KB	High compression -> PDF contains a black and white picture which resulted very pixelated. In other pictures the effect is less visible.
	5)	PDF	12.8 MB	861 KB	High compression -> PDF contains a black and white picture which resulted very pixelated. In other pictures the effect is less visible.
8	What are positive points, what made you like the application?	The high compression reduces considerably the size of video's without noticeable impact on quality.			
9	What is a challenge with the application, what might limit its use?	The conversion time for videos is more than a few seconds. The conversion (high compression) of the PDF has a negative impact on the quality of the pictures. The png file has increased size!			
10	What ideas do you have for improvement?	Show a preview of the compression effect on the uploaded file before you choose between medium and high compression.			

1	Name	Phelix Baraka Mwangome				Emmanuel Nyale				
2	Tel. no. (for airtime / mpesa)	796735707				0797436723 (mpesa)				
	Sex	Male				Male				
4	What is your general impression of the application?	The application is very fast and easy to upload materials				It will work for me.				
5	Will this be a useful application that you are likely to use and why?	Yes, because it gives clear directions on how to upload the materials				I usually struggle with sharing huge files to my students learning platform, this application will come in handy.				
6	What type of files did you try to reduce?	PPT				PDF, jpeg				
7	Describe for five of the files the following:					Describe for five of the files the following:				
	No	Type of file	Original size	Size after reduction	Comment on quality or other aspects of files before / after?	Type of file	Original size	Size after reduction	Comment on quality or other aspects of files before / after?	
	1)	PDF	9.6MB	8.7MB	Good	Pdf	138mbs	42mbs	Retained the original contents	
	2)	JPEG	2.6MB	2.5MB	Good	Jpg	5mbs	265kbs	Picture became blurry	
	3)									
	4)									
	5)									
	5)									
8	What are positive points, what made you like the application?	It is fast, easy to follow instructions, it reduces large files to manageable sizes				I love the size reduction of files.				
9	What is a challenge with the application, what might limit its use?	Logging in				The process to reduce file size is long.				
10	What ideas do you have for improvement?	Fasten the process of login				Automate most of the steps in the process.				

1	Name	Mercy Amulega				Winnie Kasichana				
2	Tel. no. (for airtime / mpesa)	112263728				716217989				
	Sex	Female				Female				
4	What is your general impression of the application?	It is good and easy to use				It compresses a large file to a smaller file which is easy to share with students.				
5	Will this be a useful application that you are likely to use and why?	Yes, it has the ability to compress large files very fast and at a high rate (specifically pdf files)				Yes, it will be useful as it makes work easier				
6	What type of files did you try to reduce?	Video, photos, pdf				PDF file names as HS-vermont needle disposal initiative fact sheet				
7	Describe for five of the files the following:					Describe for five of the files the following:				
	No	Type of file	Original size	Size after reduction	Comment on quality or other aspects of files before / after?	Type of file	Original size	Size after reduction	Comment on quality or other aspects of files before / after?	
	1)	pdf	594KB	529KB	41% reduction	PDF	307.2KB	96.3KB	It indicates the original size but no indication on the converted size	
	2)	jpeg	2.8MB	408KB	86% reduction	PDF	82.7MB	72.1MB	It took a long time to upload the file	
	3)	video	202.8MB	263.0MB	30% increase	JPEG	18.8KB	19.1KB	N/A	
	4)	pdf	6.2MB	3.1MB	50% reduction	Word	15.6KB		Indicated that it could not convert-file not supported.	
	5)	video	7.44MB	Did not work	Remained pending					
	5)	video/MP4	1.5MB	665KB	57% reduction					
8	What are positive points, what made you like the application?	It works perfectly for PDF and video's. For the smaller video it converted immediately. For large video it may take hours even on strong internet				It is interesting because it makes work easier in terms of sharing files				
9	What is a challenge with the application, what might limit its use?	It requires strong internet to convert, especially video's. It displays "pending" or "started" for hours without converting.				Cannot use the application if wifi is low, keeps telling me "sign in" - failed several times				
10	What ideas do you have for improvement ?	Allow / enable videos to be converted instantly				N/A				

1	Name	Henry Akunda				Thomas Mlewa				
2	Tel. no. (for airtime / mpesa)	707378383				743797487				
	Sex	Male				Male				
4	What is your general impression of the application?	Easy to use, steps are clear and simple to follow.				Impressive				
5	Will this be a useful application that you are likely to use and why?	Yes, helps to compress larger documents to smaller sizes, for easy sharing to learners				Yes, it's not time consuming				
6	What type of files did you try to reduce?	PDF file, Image Jpeg and videos				Assignment files				
7	Describe for five of the files the following:					Describe for five of the files the following:				
	No	Type of file	Original size	Size after reduction	Comment on quality or other aspects of files before / after?	Type of file	Original size	Size after reduction	Comment on quality or other aspects of files before / after?	
	1)	PDF	130.0KB	48.5KB	Clear words, the document is good.	Jpeg	34.3	34.3	Challenge in converting the file to a medium size	
	2)	JPEG	5.7MB	776.8KB	Good quality, No difference from the original image					
	3)	Video	604.2MB	265.4MB	Good Audio and visual.					
	4)	Video	1.1GB	Error						
	5)	PDF file	289.1MB	Error						
8	What are positive points, what made you like the application?	Able to compress documents and images Simple and easy to use. Efficient and effective The process is time effective.				It is a faster ,you can reduce the file size				
9	What is a challenge with the application, what might limit its use?	Error in converting large PDF file (289.1MB)/ Video(1.1GB) One needs a stable and good internet for conversion				I availability of network hinders it from working				
10	What ideas do you have for improvement?	Improve on conversion of large documents or videos				Improve on network connection for it to work effectively				

1	Name	Dorcah Ogeto				Jamila Musa				
2	Tel. no. (for airtime / mpesa)	728358401				725120007				
	Sex	Female				Female				
4	What is your general impression of the application?	I love the fact that it is fast especially when uploading the files and converting them				One can easily work with the application.				
5	Will this be a useful application that you are likely to use and why?	Yes. The fact that one creates a folder, it is easier to separate separate files according to their relevance and when accessing them is easier.				Very useful. Because file compression can save you a lot of time to search for it later.				
6	What type of files did you try to reduce?	PDF files				PDF				
7	Describe for five of the files the following:					Describe for five of the files the following:				
	No	Type of file	Original size	Size after reduction	Comment on quality or other aspects of files before / after?	Type of file	Original size	Size after reduction	Comment on quality or other aspects of files before / after?	
	1)	PDF	48.8MB	48.8MB	No change in file size					
	2)	PDF	5.8MB	5.8MB	No change in file size					
	3)	JPEG	119.6KB	119.6KB	No change in file size					
	4)	MP-4	60.7MB	60.7MB	No change in file size					
8	What are positive points, what made you like the application?	The arrangement of the files and folders. Gives detailed information as to when a file was uploaded								
9	What is a challenge with the application, what might limit its use?	Uploading files needs stable and strong internet connection, meaning if one is not having that, it takes more time waiting for the upload								
10	What ideas do you have for improvement?	For now I don't have any								

