Journal of Learning for Development – JL4D
ISSN: 2311-1550
2022, Vol. 9, No. 2, pp. 291-304

Innovative Open Schooling in Secondary Education in Mozambique: Technological Conditions for Students to Attend Distance Learning

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Abstract: This article describes part of the results, taken from ongoing initial research, on the potential of new media in distance education. The article explores the technological conditions that students involved in Open and Innovative Schooling (OIS) experience, focusing on the fifteen schools in Mozambique. Participants were selected by intentional sampling and a mixed method research approach was then followed. The results revealed that, in general, minimum technological conditions were created at schools for the distance learning process, despite some asymmetries between schools and students. These findings are useful for documenting and sharing the real condition under which OIS operates in the Mozambican context. Furthermore, it is key to influencing educational policies in order to include training in digital literacy, as well as strategies for technology distribution for students from the mentioned schools. These are also crucial for an in-depth reflection on the aspects to be improved for a better implementation of OIS.

Keywords: distance education, Open and Innovative Schooling (OIS), technological conditions for students to attend distance learning.

Introduction

Taking into account the potential in the use of Information and Communication Technologies (ICT) in education, within the scope of its ICT Policy Mozambique undertook to: encourage and develop the teaching of computer science in many different levels of the National Education System (NES); to promote the use of the internet at schools; to prepare teachers to be ICT promoters at schools; and progressively to provide schools with the equipment needed to access and master implementation of the policy *Mozambique ICT* (2000).

As a result, within the framework of the ICT Policy, as well as the Educational Strategic Plan, in 2011, Mozambique developed an Educational Technology Plan (ETP). The ETP is simultaneously an overview document on the introduction and impact of ICT on the evolution of the teaching model and learning paradigm in Mozambique. The ETP defines and prioritises the initiatives to implement in the NES which involve ICT, as being a source of information for the preparation of annual plans and budgets and a follow-up and monitoring tool (Ministério da Educação e Desenvolvimento Humano [MINEDH], 2019).

In its Pillar 1 – Information and Communication Technologies, the ETP has elected as its operational objective, to leverage the NES through the introduction of technology and internet access, where equipment and connectivity are considered as the basis for the ETP development.

According to MINEDH (2019), the ETP identified, to be achieved by 2026, two priority areas of action for the achievement of a technological infrastructure that allows the education system to incorporate the new ICTs:

- Equipment: equip 100% of classrooms in schools with computers and equipment to support new pedagogical methods, as well as promote the use of computers by students (five students/one PC); and
- Connectivity: provide internet access to all schools (100% of schools with internet access) and develop local network infrastructures in schools (100% of schools with a local network).

However, because of limited availability of resources, the potential of ICT in the Mozambican education sector is still much less than desired. "The introduction of ICT in education is associated with the existence of electrical and telecommunications infrastructures, which require huge investments. Although MINEDH shows sensitivity on the need to include ICT in the educational process, namely at curriculum level, for this to be expanded it is important that infrastructural issues are resolved" (MINEDH, 2019, p. 44).

Schools and students still do not make adequate use of technology potential for the mediation of the teaching and learning process because of weak penetration of electronic devices and internet access for learning.

It is because of this limited availability of resources that the IT Policy already required a strategy to proceed progressively, mobilising all national capacities and the international community.

In light of this, Mozambique, like Belize, Vanuatu, Malawi, Trinidad and Tobago, and Zambia, introduced the new model of Open and Innovative Schooling (OIS) in 2015, with the aim to satisfy the needs of out-of-school children, as well as of young people and adults who need a second chance to complete their schooling or improve their school results.

> The operational model of the OIS programme consists of building the capacity of teachers to develop and use curriculum-based Open Educational Resource (OER), managing the use of the developed e-content and ensuring the sustainability of the e-learning platform … or offline through COL's Aptus device. The OIS model focuses on the deployment of Aptus to reach communities with limited or no Internet access (Commonwealth of Learning [COL], 2018a).
>
> The Aptus is a low-cost device that allows educators and learners to connect to digital learning platforms and content without the need for grid electricity or Internet access. This mini-PC requires only battery power which can be recharged via grid power or solar charger, as needed. It can host up to 128GB of educational content and facilitate interactive, virtual learning anywhere – whether in a remote rural village or on a vast university campus. The result is a "Classroom Without Walls" that can be set up within minutes and accessed by any learner with a laptop, tablet, or mobile device (COL, 2018a).

The capacity of Aptus technology to expand access to digital study materials, to widen access to education, and to improve school performance was confirmed in a recent study by Cossa et al. (2021), carried out with students, teachers, and managers, who were involved in piloting the OIS in Mozambique. On the other hand, the study shows several aspects that need to be improved for successful OIS implementation.

The four prerequisites for the success of OIS are: well-trained teachers, quality learning resources, appropriate use of technology and good management of schools/support centres and, in Mozambique, a framework was developed and the prerequisites for successful OIS implementation were met (COL, 2018b; Manyamba et al., 2021). However, there are still no in-depth studies on the level of satisfaction of the different stakeholders on these prerequisites, as well as their effectiveness for the success of the OIS.

As a result, a study aimed at finding out the main factors that can influence the successful use of new media in the provision of distance education (DE) in lower secondary education (ES1), in Mozambique, focusing on OIS, is currently being carried out by a student from Universidade de Aveiro, within the scope of his doctoral thesis. In this study, to ensure coherence and systematisation between the objectives, the research question, as well as the research problem, were established, as were the key concepts, their dimensions and their respective indicators, based on Quivy & Campenhoudt's (1998) model of analysis.

It was assumed that to opt for the OIS among the 15 schools, it was important to consider the technological capacity of students to study at a distance, based on the idea of COL and Freeman (2003), who argue that for each technology that decision-makers are considering using in their institution, there are some issues that they will have to take into account, as well as some aspects regarding the implications of their technological options towards their students. Therefore, this study aims to analyse whether, for the implementation of OIS in the 15 schools, the decision makers have taken into consideration the following aspects:

- Will students have access to the Aptus technology? (If not, how will these students get access to the learning content in OIS?).
- How much will it cost students to purchase devices to get access to the content hosted on Aptus; how much will it cost them to use the Aptus technology?
- Do students know how to use Aptus technology?
- Will schools help students acquire the knowledge needed to use Aptus technology?

Therefore, the purpose of this paper is to explore the technological capacity of students to study at a distance, focusing on the OIS model currently being implemented in 15 secondary schools in Mozambique, based on some initial results of the original ongoing research.

Methods

The data examined in this paper, were drawn from the original research findings, collected from a survey by hard copy questionnaire of 327 students, in September 2021.

Given that intact groups already exist, the participants were selected by convenience sampling (Coutinho, 2015). According to the initial plan, designed for the first study, each school would support 20 students, making a total sample of 300 students. Thus, Pedagogical Technicians at the central level, who assisted us with the data collection in 15 OIS schools, took 22 student surveys to the schools, two surveys being used for contingencies. Considering that DE students are only present at the Resource Centres (RC) on the days scheduled for face-to-face tutorial sessions, the criterion used for the selection of students participating in the study was based on the order of arrival of those who had

scheduled face-to-face tutorial sessions on the day of data collection at the RC. We believe that this criterion conditioned the variation in the number of participants per school.

However, Emília Daússe Secondary School in Inhambane had a different criterion. Their school managers made a specific schedule with the students for their participation in the study and, as a result, 46 students were present at the RC on the day of data collection. And, to include all students, and with the permission of the data collection team, the school decided to reproduce additional questionnaires for the remaining students. Therefore, this was the main reason for the high number of students attending compared to other schools.

The difference in criteria between Emília Daússe Secondary School in Inhambane and the other 14 schools, was based on the fact that our sample was made up of participants we had access to in order to collect data in different schools. This is suitable for Coutinho's (2015) criteria on convenience sampling.

The data collected were analysed through a thematic content analysis method, and descriptive and non-inferential statistics were also applied in the evaluation of the responses to the questionnaires, due to the small sample size, with an average of 22 students per school. All similar responses were grouped into categories that reflected various topics related to the experiences, opinions and realities of the students enrolled in OIS in Mozambique.

Findings and Discussion

Comparing the participation of students per school, the results show that Emília Daússe Secondary School of Inhambane, had the highest number of participating students 46 (14%); followed by Nampula, Xai-Xai and Manhiça Secondary Schools, with 22 students each (7%); the Secondary Schools of Macombe, Machava-Sede and Noroeste 1, participated with 21 students each (6%); the Secondary Schools of Pemba, Emília Daússe de Changara, Eduardo Mondlane de Gorongosa, and Manjacaze, with 20 students each (about 6%); and finally, the secondary schools of Cuamba, Namialo, Nicoadala and Samora Machel, with 18 students each (about 5%).

Preparation on how to Study at a Distance

The results showed that, overall, in the fifteen OIS schools, 72% of students had preparation on how to study at a distance, and 28% did not. The results have revealed that a significant percentage of students had preparation on how to study at a distance, although we believe that this number of students cannot be considered ideal. All students were supposed to have an orientation on how to study at a distance, since "the implementation of the OIS was preceded by training tutors and managers of support and learning centres in matters related to skills development to enhance the tutoring of enrolled students in the Secondary Distance Learning Program (SDLP). The covered topics included pedagogical strategies to support active learning through the integration of technology supported by Aptus device" (COL, 2020).

Considering the results per school, it was found that Nicoadala Secondary School, with 100%, had the highest proportion of students who had had some preparation in how to study at a distance, while the Eduardo Mondlane Secondary School in Gorongosa, with 25%, had the lowest proportion, among all the schools, as shown in Figure 1.

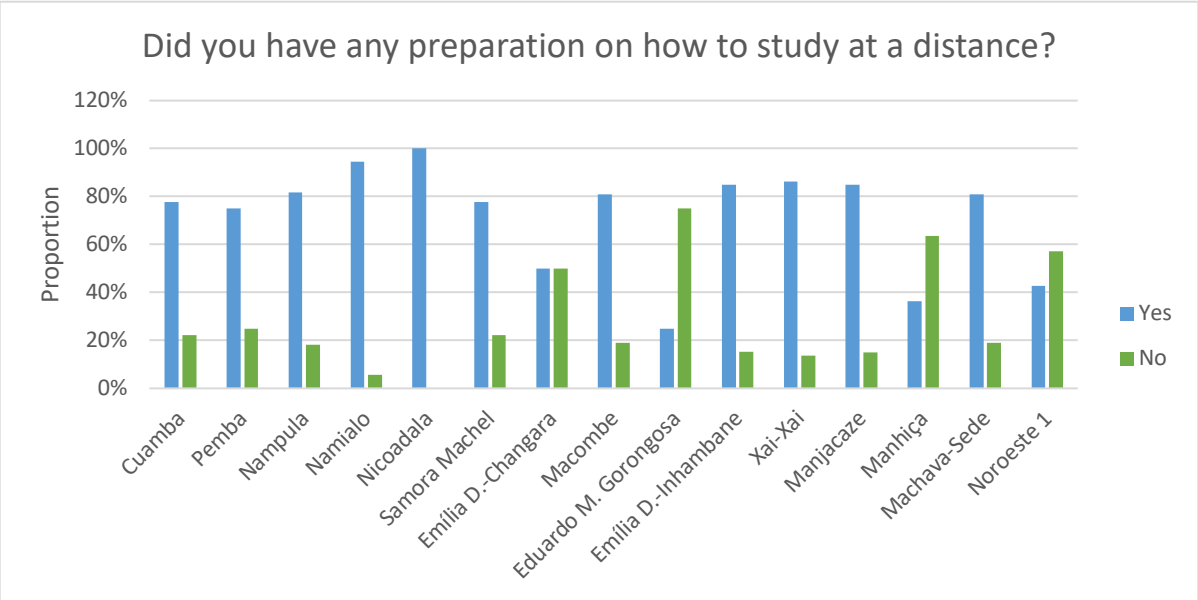

Figure 1: Percentage of students who had preparation on how to study at a distance per school

Based on a cascade training model, a manager from each RC participated in a centrally organised training session on preparing students to study at a distance, and in turn, this teacher/manager from the RC had the task of replicating this training session for his/her colleagues, who were appointed to mediate the Teaching Learning Process (TLP) through DE in the school. It is believed that this cascade training model has the advantage of reaching a larger number of teachers in a short time, and of being less costly.

However, when there is no immediate follow-up and support in schools by the central level body to ensure this cascading training is carried out as soon as the RC managers return to schools, this may be a flawed strategy. It is presumed that such a lack of follow-up and monitoring of the capacity-building training being replicated in schools may have been the cause of this proportional difference in student s' preparation to study at a distance between different OIS schools. Presumably, each school has acted according to the commitment of its managers with respect to DE implementation, and not based on a centrally-defined standard for monitoring and supporting schools in their preparation for the introduction of the new model of OIS.

Access to a Computer or other Electronic Device

The overall result (Figure 2) shows that 61% of students had access to a computer or other electronic device, and 29% did not have access. The remaining 10% of students did not respond to this question, so their situation is unknown. Among those who had access to a computer or other electronic device, 33% had access at home, and 28% at school.

Among the fifteen schools, Nampula Secondary School stood out, with 100%, the highest percentage of students with access to a computer or other electronic device, while Eduardo Mondlane Secondary School in Gorongosa had the lowest percentage of students, 5%, with access to a computer or other electronic device.

However, Machava-Sede and Noroeste 1 Secondary Schools had the highest percentage of students, both with 48%, with access to a computer or other electronic device at home, while at Eduardo Mondlane Secondary School in Gorongosa, no student had access to a device at home.

Results show that Nampula Secondary School stood out with 78% of students who had access to a computer at school, and Eduardo Mondlane Secondary School in Gorongosa had the lowest percentage, where no student had access to a computer or other electronic device at school.

These results may be due to the unaffordable cost of the devices, as it remains a significant barrier to access to electronic devices in Mozambique. Our perception is that there is a need for an immediate intervention by the Mozambican government in subsidising access to electronic devices, among other options, such as philanthropic acts to support access and their use on behalf of education.

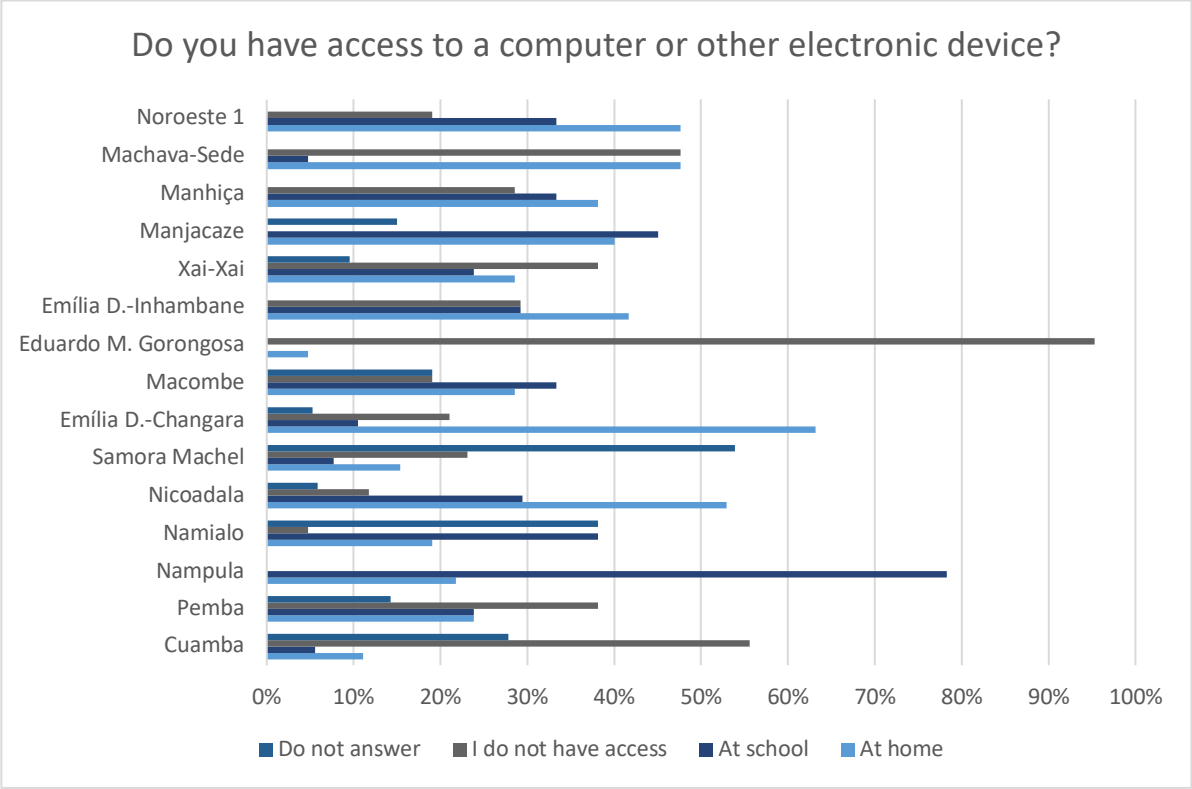

Figure 2: Students with access to a computer or electronic device per school

Type of Electronic Device which They Have Access to

Concerning this, the students, had the possibility of ticking more than one option. The fact that the results (Figure 3) show that a smartphone is the device which students have more access to, at 53%, confirms other data from the National Statistics Institute (INE) (2019), which showed that, in Mozambique the percentage of the population with mobile phone ownership, at 28%, is higher than the population with access to a computer (26%) or to a tablet (19%). The highest proportion of students who had access to a computer/laptop (67%) is in Nampula Secondary School, while Nicoadala and Samora Machel Secondary Schools, stood out when results revealed that no student, from these two schools, had access to a computer/laptop.

Data from INE (2019) indicate that in Mozambique overall, the percentage of the population actively using a computer/tablet use was 4% - 11% in areas urban and 1% in rural areas, respectively. Maputo City stood out for having the highest proportion (25%). From these data, it could be predicted that not all students involved in OIS would have access to a computer/tablet. Curious is the non-existence of a correlation between the location of the schools, urban or rural area, and the number of students who had access to a computer/tablet. So, considering data from INE (2019), it was supposed that the students from Noroeste 1 Secondary School were those with more access to a computer/tablet, due to its location in Maputo City, the capital of the country, compared to the students from other schools. Contrary to the expectation, the results showed that the students from Nampula Secondary School had more access.

Another curious finding is that Mocombe Secondary School, a non-urban school, had the highest proportion of students who have access to a tablet (25%), compared to other schools located in urban areas. In contrast, the results showed that no student at Samora Machel Secondary School, a school located in an urban area, had access to a tablet.

Regarding access to a smartphone, the data revealed a contradiction between the question, "Do you have access to a computer or other electronic device?" with the following question, "What kind of electronic device do you have access to?" The contradiction lies in the fact that the results showed that Eduardo Mondlane Secondary School in Gorongosa had the highest proportion of students (86%) with access to a smartphone, and those were the same students who replied 'no' to the question, "Do you have access to a computer or other electronic device?" Perhaps, for this question, there might have been a misinterpretation of the term "electronic device" by the participants, consequently, they might not have known that a smartphone is an electronic device, thus, the reason for this contradiction.

The fact that no students had access to a smartphone in Samora Machel Secondary School, according to the data, can probably be explained by the organisational matters of some Mozambican schools. The introduction of many new programmes in schools, especially those which are centrally decided, are usually accompanied by a package of material and financial resources for their implementation, and, as a result, it may have been thought that as OIS is a new programme and centrally designed, in the same way, devices would be distributed to students, which, in our opinion, should have been the case. We, therefore, suspect that the answers given by the students may have been influenced by this reasoning.

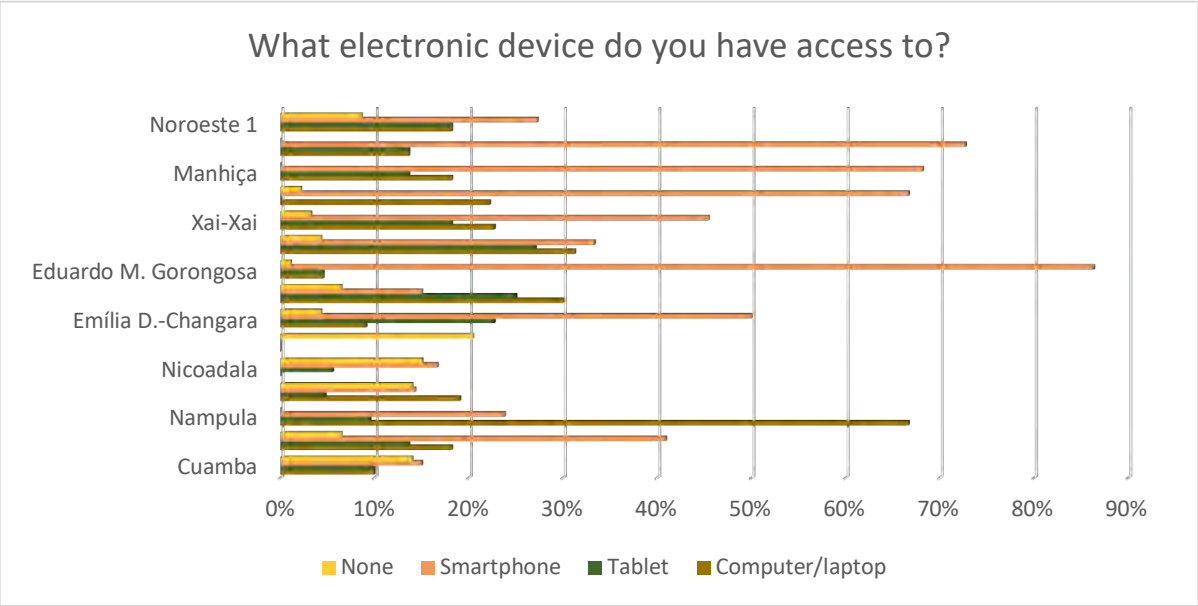

Figure 3: Type of electronic device that students have access to per school

Access to a Device with an Internet Connection

Results (Figure 4) revealed that 69% of students had access to a device with an internet connection, and 31% did not have access to the internet. The school with the highest proportion of students with internet access (13%) was Emília Daússe Secondary School in Inhambane.

Among students with access to an internet-enabled device, the results showed that 18% had an internet connection at home, 26% at school, and 25% on their mobile device. The secondary schools of Machava-Sede and Manhiça, both with 45%, had the highest proportion of students who had an internet connection at home, while at Emília Daússe Secondary School in Inhambane, no student had an internet connection at home.

For students who had an internet connection at school, the results revealed that Nampula Secondary School, with 91%, had the highest proportion, and at Nicoadala Secondary School, no student had an internet connection at school.

Regarding the internet connection on their mobile device, Eduardo Mondlane Secondary School in Gorongosa, with 86%, had the highest proportion of students, and Nampula Secondary School had no student with an internet connection on a mobile device.

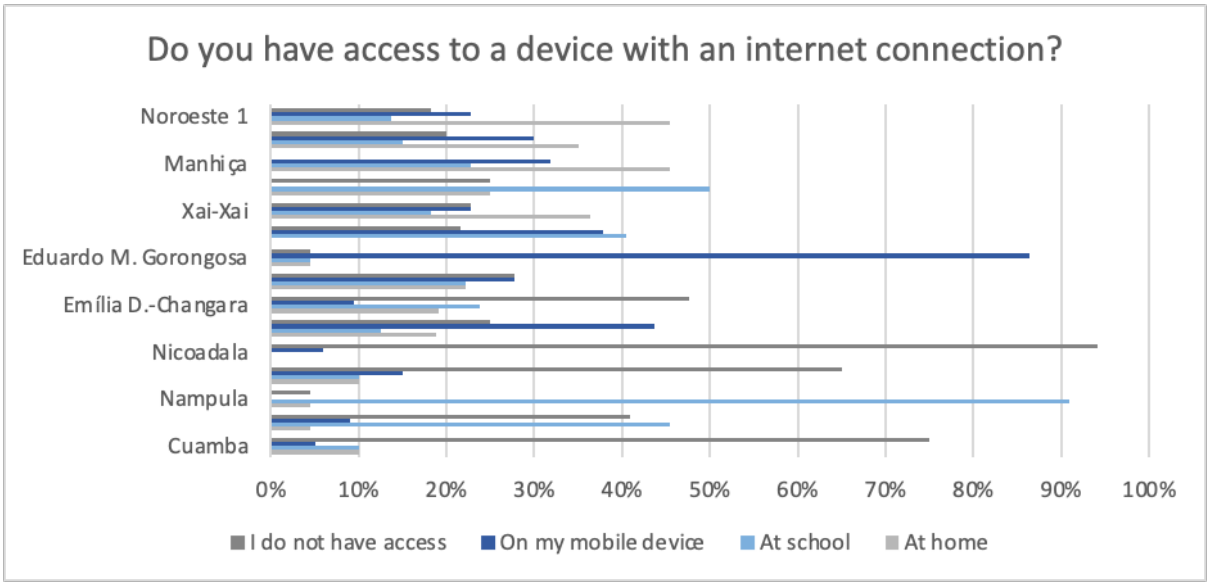

Figure 4: Students with access to an internet-connected device per school

The results shown in Figure 4 are not far behind what we expected when we started this study, as the Accessibility Report 2021 (Alliance for Affordable Internet, 2021) indicates that Mozambique is ranked 51st (out of 72 studied countries) in the Accessibility Drivers Index (ADI), in terms of the infrastructure country sub-index (35.23), and access sub-index (49.45). The drop from the 43rd position, which it previously held, in this ranking is an indicator of the slow pace of progress of policies and regulations towards greater internet accessibility.

Given the potential for Technology Enabled Learning (TEL) in the internet connected environment, in terms of multimedia content, interaction, synchronous and asynchronous learning opportunities, there is a need to accelerate innovative approaches to create programmes that can subsidise internet access, and expansion of school or community Wifi, as options to connect students.

It must be highlighted that,

> It is exactly in these areas where open schooling is critical to ensure that children, youth and adults out of the school system have adequate access to learning opportunities that can provide a sustainable livelihood. Therefore, improving access to technology in such contexts is a priority, and the learning process, enabled by technology, can strengthen current open schooling models to increase learning opportunities and the quality of learning experiences (Mays, 2020).

Quality of Internet Connectivity Used

Results revealed that 41% of the students considered the quality of the internet to be very good, 35% good, 10% poor, and 14% very poor. The school with the highest proportion of students who considered internet connectivity as very good was Nampula Secondary School, (91%), and the school with the highest proportion of students who considered internet connectivity as very poor was Cuamba Secondary School, (38%) (Figure 5).

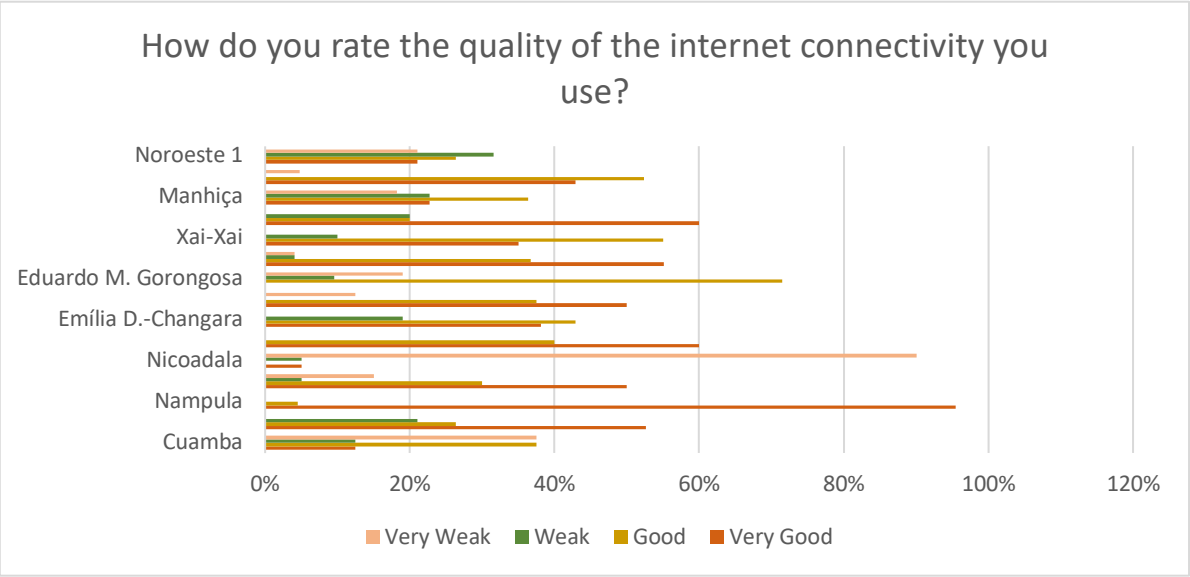

Figure 5: OIS students' perception about the quality of the internet

Current Skill Level in using Mobile Phone, Tablet or Computer Technologies for Learning

Results revealed that 33% of the students, considered their level of skill in using mobile phones, tablets or computers as very good; 40% considered it as good, 16% as weak, and 11% as very weak. Cuamba Secondary School had the highest proportion of students who considered their current skills in using mobile phones, tablets, or computers for learning as very good, at 47%; and Nampula Secondary School had the highest proportion (38%) of students who considered their current level of skills in using technologies as very weak (Figure 6).

We think that the pace of introduction, the OIS student´s familiarity with the technology of Aptus and the accessibility of immediate support are significant contributors to the successful adoption of OIS.

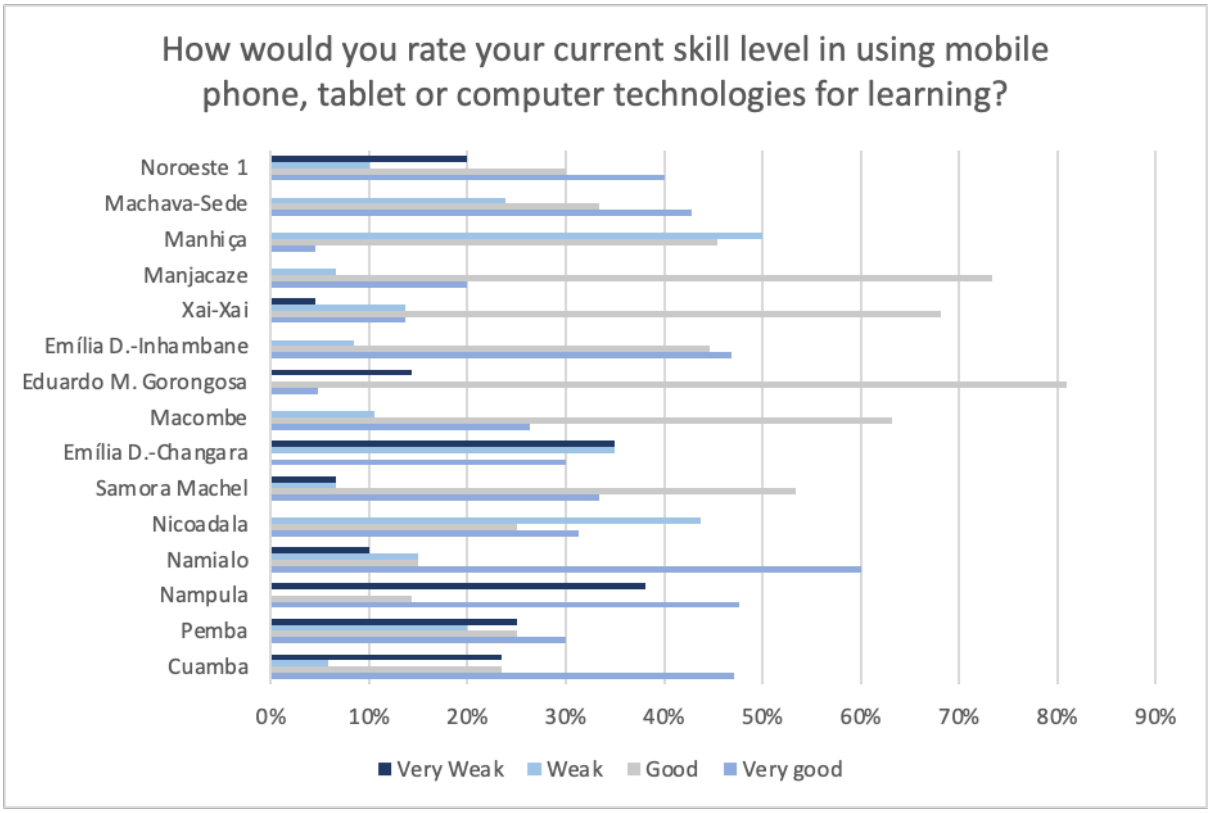

Figure 6: OIS students' perceptions about their level of skills in using devices for learning

Using the Internet to Carry out Research

Results revealed that 30% of the students used the internet to carry out research very often, 33% used it frequently, 14% occasionally, and 23% never.

Secondary Schools from Pemba and Namialo, both with 13%, had the highest proportion of students who used the internet to carry out research very frequently. Emília Daússe Secondary School in Inhambane had the highest proportion of students (24%) who used the Internet frequently as well as occasionally (22%); and Cuamba Secondary School had the highest proportion of students, 12%, who had never used the internet for research.

Use of Internet to Communicate with Colleagues

Results revealed that 35% of the students used the internet very often to communicate with their classmates, 22% used it frequently, 15% occasionally, and 27% never used the internet to communicate with their colleagues.

Emília Daússe Secondary School in Inhambane had the highest proportion of students, 18%, who used the internet very often, and, also, the highest proportion of students who used it frequently, 23%, and occasionally, 15%. The highest proportion of students who had never used the internet to communicate with their classmates belonged to Cuamba Secondary School, 13%.

Use of Internet to Communicate with Teachers

Results revealed that 20% of students used it very often to communicate with their teachers, 24% used it frequently, 18% occasionally, and 37% had never used the internet to communicate with their

teachers. These results by schools revealed that Emília Daússe Secondary School in Inhambane had the highest proportion of students, 18%, who had used the internet very frequently to communicate with their teachers, 27% frequently, and 25% occasionally. Cuamba Secondary School had the highest proportion, 13%, of students who had never used the internet to communicate with their teachers.

Conclusion

This article aimed to explore the technological conditions for students to participate in distance learning, focusing on OIS, underway in fifteen secondary schools in Mozambique. The main findings indicate that, overall, there is a considerable proportion of students without any preparations for e-learning (28%); without any access to a computer or electronic device (29%); without access to a device with an internet connection (31%), who consider the quality of the internet as weak (24%); without any skills in using mobile phones, tablets or computers (27%); who have never used the internet for research (23%), or to communicate with their colleagues (27%), or with teachers (37%). Findings related to these indicators vary considerably between schools, that is, we did not find any standard performance in the fifteen schools which clearly identifies them as OIS schools.

The preparation of students for distance learning, the digital literacy of students, the use of Aptus, and the distribution of mobile devices for students are elements that were excluded in the implementation phase of the OIS, although it seems clear they are essential components without which none of the proposed benefits in the use of Aptus technology for learning would be achieved.

> Digital literacy does not only improve access to higher quality educational materials but it is also a gateway to more opportunities. For children and young people, these experiences and skills are crucial for their ability to survive and thrive in the globalised world. Therefore, digital empowerment needs to be intentionally integrated into all technology-based education initiatives" (Wiebe et al., 2022).

Consequently, there are challenges for OIS implementation regarding e-learning preparation, management and capacity building of all stakeholders, provision of enough devices, and provision of the internet to prevent learners and the school community from rejecting technology-mediated education and denying its adoption. Furthermore, the OIS goals need to be explained in more detail to students and school communities, as this may pave the way for subsequent success as the current beneficiaries of OIS become advocates of technologies use in education provision.

The provision of DE, using technologies, has increasingly been creating innovations, improving access and opening opportunities. What is known, however, is that it is not spontaneous but rather the result of a breakthrough, a lot of scientific research and many innovations. Therefore, we believe that the findings in this study could be useful for documenting and sharing the real condition under which Open and Innovative Schooling operates in the Mozambican context. Furthermore, they are also crucial for an in-depth reflection on the aspects to be improved for a better implementation in the later stages. We concur with Mays (2020) that, "There is no one perfect model for open schooling; each country will need to tailor the model to match their priorities" (p. 20).

Acknowledgement: We would like to thank Professor Jossias de Arminda Chauque and the school community of the fifteen OIS in Mozambique.

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Cite this paper as: Cossa, S. P., & Ramos, F. (2022). Innovative open schooling in secondary education in Mozambique: Technological conditions for students to attend distance learning. *Journal of Learning for Development, 9*(2), 291-304.