UNIVERSITY OF GOTHENBURG

**DEPARTMENT OF EDUCATION, COMMUNICATION & LEARNING**

# Digital skills challenges and opportunities for digitally under-resourced primary schools in Zambia: an exploratory study.

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| Thesis: | 30 higher education credits |
| Program and/or course: | International Master's Programme in IT & Learning |
| Level: | Second Cycle |
| Semester/year: | Spring term 2021 |
| Supervisor: | Lisa Molin |
| Examiner: | Roger Säljö |
| Report no: | VT21-2920-004-PDA699 |

# Abstract


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| Keywords: | Digital Skills, Digital Devices. |


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Purpose: The purpose of the research was to propose a design of a digital learning platform that creates opportunities for digital learning in digitally under-resourced primary schools in Zambia.

Theory: Activity theory anchored on five principles of activity systems, inclusivity, historicity, use of contradictions, and mutual changes encompassed the theoretical framework for this thesis.

Method: The research applied mixed methods where data were collected using interviews and surveys from learners, teachers, and administrators at four primary schools and one Open Day secondary school in Zambia. Data were presented by SPSS statistical frequency tables.

Results: The result ascertained the causes of the low digital skills among the learners in the under resourced primary schools in Zambia as insufficient digital devices leading to reduced digital practice by learners. Two clusters of solutions were generated: one on policy and infrastructure development and the other one on digital platforms development. The digital platform design path pointed to the features that a digital platform should possess.

# Foreword

The international master's programme in Information technology and learning offered by the University of Gothenburg is a program whose deliverables align information technology and learning. I was privileged to commence the programme in the Autumn of 2019 and the programme has empowered me with ideal skills and knowledge in the field of information technology and learning. The programme is holistic with theoretical and practical elements and is presented amicably using all the methodologies of teaching and learning.

For the thesis I was greatly motivated to take a theme that proposed an intervention to the real-life digital challenges that learner face in the developing countries and particularly so in Zambia. Schools in in Zambia suffer from reduced funding making learning tools almost unavailable. This calls for different options to cushion the situation and digital platform design is one of them.

As an international student, I stayed in Gothenburg for the programme. I pay tribute to my family that endured my absence for the period I was in Gothenburg and at the same time thanking the Swedish community for being highly accommodative.

Credit is equally given to the course organisers and all my lecturers in the departments of Education and Communication and Applied Information Technology. These are a team of dedicated people towards work, and in ensuring that the teaching standards are world class. My classmates as well made my learning easy.

I offer my appreciation to my supervisor, Lisa Molin for her tireless efforts in seeing that I accomplished the thesis. Her quick establishment of rapport with me was outstanding.

Finally, I acknowledge the important role the Swedish Institute played in funding my studies and stay in Sweden. Their work is awesome in complementing human resource development in developing countries.

James Vwavwa Sikalima

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# Contents

# 1. Introduction

Worldwide, we find many regions where under-resourced primary schools have few digital devices such as computers to serve learners. Yet those schools are mandated by the ministries of education through their curricula to support students in acquiring digital skills. The non-availability of digital devices creates problems in terms of opportunities for acquiring digital knowledge and skills. Finding opportunities for students' digital learning in educational practices, despite scarce access to digital devices, is highly important to be able to develop such skills. This thesis aims to propose a design of a learning platform that creates opportunities for digital learning in digitally under-resourced primary schools in Zambia.

Society all over the world has been pressured to go digital for the obvious perceived advantages (World Bank, 2016), that encompass stimulation of economic growth (Pradhan et al, 2018), creating online workers (Aroles et al, 2019; Littlejohn & Margaryan, 2014;), educational development (UNESCO, 2003), developing Internet connectivity in schools (Marcus-Quinn et al., 2019), stepped and individualised teaching of learners (Hennessy et al. 2016) and in designing and planning of lessons (Dalton, 2017). With these and other pros of digitalisation, most governments the world over, and more so those in low resourced countries, have been left with few choices but to initiate policy and curricula in schools at all levels to enhance digital knowledge and skills transfer to learners. This is what UNESCO (2017, p. 4) terms "national digital skills for all initiatives" and in line with the United Nations' (2017) Sustainable Development Goal (SDG 4.4.1) number that seeks to increase the proportion of people especially youths with digital skills. Despite the curricula introductions, owing to the absence of adequate digital resources in developing countries, there has been insufficient acquisition of digital skills by the learners at all levels of education since learners are not afforded digital devices to use as digital skills proficiency requires practice (Dirkens, 2012).

Zambia, being a developing country has similar digital problems as other countries. Zambia lies in southern Africa with a population of 17,885,422 (Zambia Statistics Agency, 2020), and has digital skill levels of 43.6% for basic skills, 25.2% for standard and 6.6% for advanced level for the period 2017 – 2019, (International Telecommunications Union [ITU], 2021). As a response to enhance digital skills among the learners, the Zambian government in 2013 launched the computer studies curriculum at the upper primary level in primary schools (Changwe & Mulenga, 2020). The purpose of the syllabus was to enhance the following digital skills: use the computer and its productivity tools effectively, understand and apply

requirements of computer science ethics and security, use Internet, design, and produce communication materials for schools, collaborate with others, understand, and use basic productivity tools and Windows´ principles (Curriculum Development Centre, 2014). The upper primary level includes grades 8 and 9 that comprise fourteen to sixteen years old learners and is also referred to as Junior secondary school. Computer lessons at this level are examinable at the national level. Making a subject examinable is a clear-cut indication that high competence levels are required. However, like in other developing countries, digital skills learning in upper primary schools in Zambia is hampered by inadequate digital tools, reduced funding, and insufficiently trained teachers (Changwe & Mulenga, 2020; Kaumba et al., 2021; Nyanja & Musonda, 2020). In addition, Mukosa and Mweemba (2019) intimated existence of a high digital divide in Zambia that limits eLearning and they recommended digital skills education, digital technology infrastructure development, and government policy reviews as necessities to lessen the digital divide. Despite recommendations for increased funding from central government, the trend has been that funding allocations to the Ministry of General Education budget have been dwindling since 2017, for example, the allocations as a share of the national budget to the ministry of Education declined from 16.5% in 2017 to 16.1% in 2018, 15.3% in 2019, 12.4% in 2020 and 11.5% in 2021(National Assembly of Zambia; 2017, 2018, 2019, 2020, & 2021)

It is worth noting that suggestions for improvement in digital skills have mostly been isolated from the digital tools themselves and highly inclined to funding solutions at the macro levels such as massive computer procurement (Hosman & Armey, 2017; Kingsley, 2017). However, notable considerations must be made at the micro level that hinge on digital devices' affordances that would include digital tools´ effectiveness, cost, equity, and sustainability in aiding learning (Shamim & Clement, 2016), and refocussing learning from content to process and skills, (UNESCO, 2015). Therefore, in view of the prevailing conditions, to minimize the problem of scarce digital resources and to create opportunities for learners to acquire digital knowledge and skills and effective management of digital resources, creative ideas and innovations are needed through platform design solutions that can create opportunities for digital skills learning even when digital devices are few.

Digital solutions are innovations such as digital learning platforms and Learning Management Systems (LMS) that can be designed to suit individual learners, schools, and available digital resources that would potentially serve the purpose (Hillman et al., 2020; Balzotti et al., 2016; Walker et al., 2017). A digital learning platform in this research refers to a computer software

that facilitates learning that would stand alone or be integrated through web applications that generates income only through software purchase. In addition, this kind of a platform would have similar features as an LMS dealing more with content and activities in closed communities but with functions that can be open (Faustmann et al., 2019). Such a type of a digital learning platform would have features responsive to the needs of learners in the digitally under-resourced primary schools making it different from other common commercial education platforms.

## 1.1 Aim and research questions

By grounding the study in Activity theory (Engeström, 1987, 2001, 2014), the aim of this thesis is to propose a design of a digital learning platform that creates opportunities for digital skills learning in under-resourced primary schools in Zambia. To be able to propose a relevant design, an investigation of the present challenges and opportunities in the local digital learning practice was carried out. This was done by collecting data from learners, teachers, and administrators from five selected primary schools in Zambia by way of surveys and interviews using the following research question:

*What challenges and opportunities for digital learning are identified among learners, teachers, and administrators and how can they be used to design a digital learning platform to enhance digital skills in digitally under-resourced primary schools in Zambia?*

To identify such challenges and opportunities, data weew collected and analyzed to find out the problems that reduce, limit, or hinder digital skills development, and how the users of the few digital devices would find it easy to learn using the available devices. Frequency distributions have been used when determining the magnitude of the problem areas in the sampled population and individual feelings, expectations and general views of the users formed the bulky of data needed for the digital solutions.

## 1.2 Organisation of the thesis

Following the introduction with its overview, aims and research question, is the theoretical framework framing the thesis, i.e., Activity theory. The theory has been used as basis for explaining the processes, mechanisms, and stance taken in developing a platform to enhance digital skills. The methodological section that explains the various methods used in data collection, and analysis follows. The results section is presented after the methods and basically

put across the results in various formats. The discussion is then presented with detailed analysis of the results, interpretations, proposed solutions and linkages to similar research. The main thesis ends with a conclusion. The document presents further references and appendices of documents used in the research.

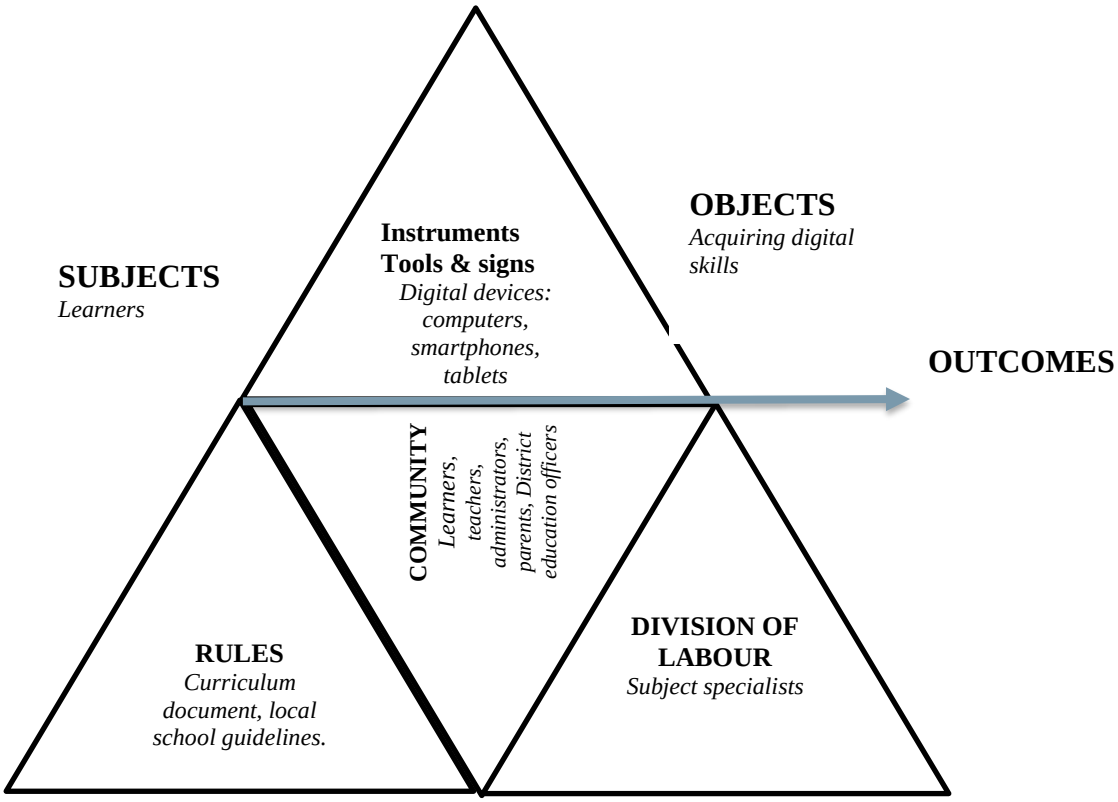
# 2. Theoretical framework and central concepts

To accomplish the investigation on the digital learning challenges and propose design of a digital learning platform to address the challenges in under-resourced primary schools in Zambia, this thesis is framed by Activity theory (Engeström, 1987). This section is devoted to the description of the perspective and its application and relevance in this research.

## 2.1 Activity theory

Activity theory is an umbrella term for understanding human activities as systemic and socially situated phenomena. It was originated in the works of Russian psychologists such as Sergei Rubinstein and Alexei Leontiev, and further conceptualised by Engeström as Cultural Historical Activity theory (CHAT), (Engeström, 2001) It addresses three broad categories of context, human cognition, and development (Stevenson, 2008) while addressing integrated components of subject, object, outcomes, tools, rules, community, and division of labour (Engeström, 2001). Components of the theory are represented in figure 1.

Figure 1. Components of Activity theory




Adopted from Engeström, 1987, p. 87.

According to the theory, subjects and objects consciously and objectively perform activities that create relationships in communities. Activities are goal-oriented actions that create

relationships in a community and are often guided by rules, tools, division of labour, and outcomes (Engeström, 2014). Engeström (2014) further states that activities can take different amounts of time whose main purpose is to explain objectively oriented reciprocal relationships between subjects and objects. The theory states that although activities are considered objective, they are open to subjective interpretation, hence prone to induce tension amongst subjects in a community (Engeström, 2014). It is further assumed that an activity is influenced by both the physical, non-physical tools used and the social context of the activity as defined by the wider community. Thus, proficiency and potentiality of tools govern, establish, or ascertain the outcomes, thereby making tools cardinal to outcomes (Hasan et al., 2014). The *tools* are also called *means* and are the artefacts that subjects use to interact with the object. These could be hard and software such as digital platforms, digital learning management systems, digital devices, plans etc. Hasan et al., (2014) ascribes tools to be myriad and diverse to include physical items, intangible items like ideas, or third tier such as society, contexts, etc. This brings up the importance of tools used in enhancing education. In this case we can relate the features of a digital device to be paramount in actualising the digital skills learners can acquire.

The *subject* represents the people who are primarily involved in the activity, in our case the learners, and to second level the teachers and school administrators. The *object* is the focus of the activity or motive (Engeström, 1987) which in this thesis represents digital skills acquisition or digital knowledge acquisition aims as outlined in a curriculum. These are implicitly laid down in the schemes of work, lesson plans and the curriculum. They can also involve learners´ curiosity to develop skills intrinsically. *Community* refers to second or third level individuals in the activity such as other learners, teachers, school administrators and parents. *Rules* are established to govern the processes and relationships among subjects, means, community, and objects by way of standard ethical conduct, explicit written laws, or policies. In the case of digital skills propagation, it would include the curriculum and school information technology policies and rules. *Division of labour* would be represented by roles played by specific specialities amongst teachers and community members.

In summary, Engeström (2001) gave five principles on which activity theory is founded. The first being that the *activity system* comprising artifacts, subjects, and objects makes the prime unit of analysis. The second principle is that of *inclusivity* that brings different people together creating specialities, promoting divergent views, application of rules, and opinions in an activity system. The third principle is that activity systems are created and transformed over

time -*Historicity*- whose significance is that problems and expected resolutions in an activity system can best be understood historically. This can explain why some schools are worse off in terms of providing digital skills when others are better off in similar environmental circumstances. *Contradictions* are seen as determiners of change and development in the fourth principle. Engeström (2001) term contradictions as cumulative organisational and structural tensions in and between activity systems. These emanate from changes induced by radical and incremental innovations (Norman, 2013). The fifth principle states that activity systems make *expansive mutual transformations* creating new systems, norms, policies, or rules.

Further, Engeström (2014) introduces learning activity within Activity theory as "pertaining to societal productive practice, or the social life-world, in its full diversity and complexity" (p. 99), which is relevant in today´s learning world and in this research. Therefore, the significance of Activity theory in this research is that it provides an understanding of how educational communities such as schools carry out activities collaboratively using tools (digital tools) in different settings or contexts (schools, regions, and countries) for outcomes under different constraints. Further, Activity theory helps in understanding accumulating structural tensions between schools and higher-level ministry of education management systems. In addition, the theory aids in understanding the dynamics of pedagogical skills transfer with an account of various actors and factors found in primary schools such as the digital tools, the curriculum, the environment, teachers´ roles and experiences and management (Goodyear & Carvalho, 2020).

## 2.3 Central Concepts

### 2.3.1 Digital Skills

In our quest to seek challenges and design of a platform to develop digital skills, we should understand what digital skills are. There are a lot of conceptions about digital skills (Flynn & Geniets, 2016). UNESCO (2018) explains that a digital skill is being able to use a digital device to produce, store or share information. The ITU (2020) says digital skills are ones´ capability to interface and apply technology for various tasks to obtain solutions. These range from simple to complex in a three stepped progression from basic to standard and advanced. Further, digital skills are associated with growth in complexity of behaviours one displays from one stage to the other in using digital devices. The basic digital skills include use of computer peripherals and managing files while technological assessment or analysing data are standard skills; and advanced programming falls under advanced skills (ITU, 2016). Using a systematic

literature review of 57 articles, Laar et al., (2020, p.9) investigated the factors that differentiate digital skills among workers. Significant factors included "Demographic and socioeconomic factors, personality and psychological communication (16.7%), problem-solving (14.9%), and information skills (12.2%) with ICT use and ICT experience accounted for the largest (15.8%) and technical skills (14.2%)". They found that material determinants such as ICT access were mainly covered in studies examining "problem-solving (9.0%), technical (5.6%), and information skills (5.0%). Mental and motivational determinants" were again the most prevalent in studies that examined technical (22.3%), information (17.3%), and problem-solving skills (14.9%)."

In their quest to define digital skills, Deursen and Dijk (2008) came up with two research questions on establishing the levels of operational, formal, information and strategic digital skills of Dutch citizens; and whether there were statistically significant differences among the categories of gender, age, educational level, Internet experience, amount of time weekly spent on the Internet, help from peers, primary location of Internet use and societal position. They used a sample of 109 respondents of which 51 were males and 58 females, with an age range of 18 to 80 years and educational attainment of low, medium, and high. Nine performance test assignments were used on internet and results examined using regression analysis On average Deursen & Dijk (2008, p. 1) found that "80% of operational skill Internet tasks and 72% of formal Internet skills assigned have been successfully completed and that Information Internet skills are completed in 62% of cases. However, strategic Internet skills are accomplished by only 25% of those subjected to performance tests".

They concluded that all performances, with all four types of digital or Internet skills, are significantly different for people with high, medium, and low education. They found that internet experience correlates with operational skills whereas for purposes of learning or training, operational and formal skills appear to be obligatory. Another observation was that formal, information and strategic skills did not grow with years of internet experience and amount of time spent online weekly and that education was the only significant predictor for the number of information tasks completed.

In the final analysis, Deursen and Dijk (2008) provided a summary of conceptual definition of digital skills related to internet as: operational skills to operate digital media, formal skills to handle the special structures of digital media, information skills for searching, selecting, and

evaluating information in digital media and strategic skills for use of information contained in digital media an individual's personal or professional goal.

Finally, a summary of digital skills at primary level includes "data, information and digital content assessment, digital collaboration, digital identity management, content creation and safeguarding privacy and personal data" (European Commission/EACEA/Eurydice, 2019, p. 10). From a synthesis of the above definitions, digital skills in this thesis refer to abilities to create and manage files, create content, interface navigation, use internet, content assessment and digital collaboration.

### 2.3.2 Digital devices

Digital devices are also termed information communication technologies (ICT), digital tools etc. They involve computer-based devices for capture, storage, and processing of information that include computers, tablets, smartphones, and others. They are incremental in the sense that performance features change from one type to the other and from one period to the other without necessarily presenting all new features. Digital devices in learning take the function of containing texts for learners, providing access of learning materials to learners and teachers, and easing instant communication among the partners in learning (Lang & Tong, 2012). Selwyn, (2014) asserts that digital devices have sociological connotations in the sense that they connect many users socially in any learning community. The features on the digital devices can enhance or retard digital skills acquisition.

Finally, in this thesis all types of computers that include smartphones, tablets, desktops, and laptops that can capture, store and process information will be referred to as digital devices.

# 3. **Literature Review**

This section outlines the literature on the subject from the studies done in different parts of the world and Zambia in particular. Relevant literature was searched using the University of Gothenburg online library, Google Scholar and Microsoft Academic search engines. The search terms included “digital skills learning” and “e-learning in primary schools”, (world perspective, developing countries and Zambia). Further, inclusion criteria were that the articles had to be peer reviewed and be within ten years of publication. In addition, conference papers and project evaluation reports were also included.

Acquiring digital skills amongst primary school learners is generally associated with several challenges such as complexity of subject content (Papadakis et al., 2017). In a quantitative study of 678 primary school learners in Spain, to provide empirical evidence about the levels of digital skills of learners Perez-Escoda, et al. (2016), found that the acquisition of digital competences was not exclusive to use of devices, but specific instruction.

Efforts have been made worldwide to enhance digital skills such as the “Digital Skills for Decent Jobs for Youth” campaign meant to garner political will and any resources that could help young people attain digital skills for digital jobs (Global initiative on Decent Jobs for Youth, 2017, p.10). In some European Union countries efforts for digital skills development involved appointment of digital coordinators in schools, infrastructure development, building strong political support systems, and parental involvement away from school (European Commission/EACEA/Eurydice, 2019), whereas the ITU (2016), recommend creation of digital skills coalitions, councils, or taskforce, generating of new policies and programmes and so forth.

Digital devices’ availability in schools is a challenge schools face (James 2019; Gil-Flores et al., 2017; & ITU, 2016). Gil-Flores et al (2017) used multilevel logistic regression models to analyse the role of school ICT infrastructure and teacher characteristics to explain ICT use in education among 3339 teachers from 192 secondary schools in Spain. The chief result showed that the availability of educational software, teacher ICT training, co-operation among teachers, and teaching concepts influence classroom ICT use. The issue of educational software relevant for learning, teacher training and co-operation are vital to digital skills development of learners and therefore vital for this study.

UNESCO, with funding from the South Korean government, implemented a project dubbed ICT Transforming Education in Africa whose overall aim was to develop an e-school model, through open and distance learning and ICT policy development in Mozambique, Rwanda, and Zimbabwe (UNESCO, 2020). Of interest to this research is objective one which was focused on improving accessibility and quality of basic education by use of innovative digital solutions and supporting teachers to adopt new pedagogical approaches.

In pursuance of the first goal, three different programs were carried out as follows: In Mozambique, an e-school for basic education was established that concentrated on building digital skills, improving managerial and information systems for quality and reliable data. 22 primary and secondary schools and 500 teachers took part in the project. Open digital materials were made available. In Rwanda, the focus was to improve the capacity of teachers to embrace ICT in teaching and assessment through standardised teacher training. In Zimbabwe, the goal was to heighten ICT use in 20 e-school. Open Educational Resources were established as well as teacher training. While it was concluded that digital skills were acquired by learners in the project areas, the projects may not be sustainably replicated in other schools in those countries without donor support. In addition, recommendations in the report that budgetary allocations for activities be transferred to national and/or institutional annual budgets, cannot be sustainable as national budgets are always constrained and nations may have other priority areas.

Across Africa, similar challenges are evident. For example, a study by Kashada et al (2018) explored the factors that affect the adoption and use of digital learning technology in the learning process in Libya´s public universities by exploring factors responsible for digital learning technology failures in countries with less developed economies, like Libya. Using regression weights of variables, they identified managerial support as a principal factor in establishing relationships among usefulness, ease of use, user knowledgeability of decision support system importance, and applying digital learning technologies.

Kaliisa and Picard (2019) in a study analysed the challenges in mobile learning adoption using systematic literature review of selected peer reviewed journal articles. Among the key findings were the need to create content for use on mobile phones, creation of equal access to mobile phones and their use classroom use.

James (2019), in a descriptive study of low digital skills in developing countries queried on how best countries may respond to the low digital skills problem. His findings were that

policies in developing countries were inadequate, thereby limiting technological choices and substitute sources of information further hindering problem appreciation and needed actions to remedy low digital skills. He recommended introduction of comprehensive policy frameworks that take care of available indigenous resources, institutions, and socio-cultural organisations. He proposed re-definition of digital skills to be within the social-cultural context of the learners in the under-resourced environments.

Further studies have revealed that multiple interventions are required, as generally dealing with one leave out others. Instances include the One Laptop Per Child (OLPC) initiative in Rwanda as having resulted in enhancing digital skills amongst learners, though it is said to have negative effects of promoting rote learning, multi-tasking in class and implementation burdens for teachers. It is further stated that below par digital content was poorly integrated into the curriculum (Fajebe et al., 2013).

These challenges are evident in studies done in Zambia, (Kaumba et al., 2021; Nyanja & Musonda, 2020). Kaumba et al., (2021) in their study explored the implementation of ICT in selected rural primary schools of Mwinilunga district, Zambia specifically to get the disablers affecting the teaching of ICT in rural primary schools, and to describe the strategies used to promote digital skills uptake in rural primary schools. They used both qualitative and descriptive methods. Challenges identified included lack of ICT equipment, poor Internet, limited skilled teachers and absence of infrastructure. To remedy the disablers, it was recommended that use of personal cell phones as teaching devices, use of zonal schools and expert teachers.

Further in Zambia, Walubita et al., (2015), carried out an empirical research to explore the most appropriate method teachers could use to enable a substantial number of their learners to be exposed to tablet based GraphoGame - an academically researched learning application for teaching kindergarten and primary school children early literacy skills. This was done by sharing a small number of tablets across large classes with a mean of sixty grade one learners (8 years old) per class. Of interest to this research are three questions asking whether GraphoGame mounted on tablets increased literacy or if exposure to it significantly differed for the different intervention conditions employed and whether one of the three GraphoGame intervention conditions (clinic, sessional or shuffling) produced a sufficient period of exposure to the GraphoGame. Their results affirmed that the GraphoGame could allow many learners to practice and increase their literacy even if the playing time was short. This kind of an

innovation could be closer to improving digital skills to learners in under-resourced primary schools in Zambia.

Digital software platforms that present video to word processing, digitally oriented curriculum, instructional content, adaptive instructional technologies like writing support and test marking can be a good way to help the lowly resources primary schools across the world. Hillman et al. (2019) outline qualities of learning platform as "personalisation of content and precision-based adaptive learning, grouping abilities and data exploitation" (p. 12). In a related research as part of a design internship program at the University of Gothenburg in 2020, Sikalima (2020), did a small-scale study based on a small sample of population (Four learners and two teachers) on design solutions to the problems associated with limited digital devices at two primary schools in Zambia that led to the development of a digital learning platform prototype (see appendix 2 for images). The platform allowed for digital pedagogical instructions to be provided according to the level of the learner. Upon testing the platform using variables in a pre-test and posttest surveys, it was found to be easy to navigate, and could be applied in any school with or without Internet, (Sikalima, 2020). It was recommended that more research needed to be done on challenges and probable digital solutions for the prototype to be fully developed. This served as the push factor for this thesis.

# 4. Methodology

The aim of this thesis is to propose a design of a digital learning platform that creates opportunities for digital skills learning in digitally under-resourced primary schools in Zambia. This section presents the methods that were used to collect and analyse data in line with the aim and the research questions; What challenges and opportunities for digital learning are identified among learners, teachers, and administrators and how can they be used to create a digital learning platform?

Research was done in Zambia in four upper primary and one Open day secondary schools whose funding is substantially low and erratic. The research involved learners, teachers, and administrators. Mixed methods framed the collection of data, research context, participants, and the analytical framework.

## 4.1 Mixed methods

This research applied mixed methods. The mixed method is well placed to investigate the challenges in digital learning and explain how opportunities for digital learning can be created to support digital skills proficiency in under-resourced primary schools. The term mixed methods refer to systematic integration of quantitative and qualitative data within a single investigation for a more complete and synergistic utilization (Wisdom & Creswell, 2013). Synergistic utilisation of data refers to synthesis of quantitative (probabilistic) and qualitative (non-probabilistic) methods for a complete understanding of a phenomenon. The aim is simply to give a richer, deeper, and wider view of a phenomena. I decided to apply both methods because there is need to understand the magnitude of the problem of digital resources in under-resourced primary schools with substantial empirical data. This research partly deals with numbers in absolute class enrolments, numbers of learners, actual digital devices in use and the time learners spend on digital lessons, hence the importance quantitative methods. On the other hand, the communities that include learners, teachers, and administrators have their own views and feelings about digital experiences that are important to arrive at solutions that do not need probabilistic methods, hence the incorporation of qualitative methods particularly applied ethnography.

It is important at this stage to describe qualitative methods as those that involve stakeholders ascribing meaning to phenomena, use observation in natural and real-life settings, give wholesome descriptions and interpretation of phenomena, inferencing, and explaining causation, cultural contexts, and interaction patterns. (Cohen et al., 2017).

Quantitative methods are anchored on objectivity in social reality involving measurement of events and use of statistical data. Quantitative methods are based on the premise that facts can be measured scientifically to prove validity and reliability that can lead to generalisations (Matveev, 2002). The chief statistical package applied in the research is the Statistical Package for social Sciences (SPSS) frequency distributions and percentages as quantitative whereas opinions are qualitative.

## 4.2 Context and participants

The research was conducted in five schools in Zambia which for anonymity's sake have been labelled as Open Day Secondary school 1[1], Primary school 2, Primary school 3 and Primary school 4 in one district and the fifth was Primary school 5 in a neighbouring district. The schools are within the same proximity (within twenty-one kilometres) and were purposefully chosen for easy access. Schools like Open Day Secondary school 1, Primary school 2, and Primary school 4 lie in the peri urban zone, while the other two lie in rural areas giving a representation of digital devices, knowledge and skills found in the rest of the country. Within the surrounding villages, almost all households own ordinary cell phones, few have smart phones, laptops, and tablets, in a country where the percentages of households with mobile cellular telephones and computers are 73.6% and 8.1% respectively, whereas individuals with smartphone constitute 29.6 %, and those that use the internet make 14.3%, Zambia Information and Communication Technology Agency (ZICTA, 2021). Predominantly, people are farmers, though government workers in various departments and some businesspersons are also available.

For this research, participants refer to individuals or institutions that took part by way of providing data in surveys or interviews and include learners, administrators, and teachers. The choice for the three sets of participants was based on the application of the inclusivity principle in Activity theory of bringing all concerned and affected groups of people together. The term participant is used synonymously with the terms, respondent, or user. In any research, views of participants provide first-hand experiences and corroboration of the situation thereby augmenting the researcher's views (Cohen, et al., 2017; Lowgren & Stoterman, 2004; Norman, 2013).

[1] An Open day Secondary school is a non-boarding school that provides secondary education from grade 8 to 12.

As the research intended to establish challenges and opportunities by which digital skills for learners could be enhanced in under-resourced primary schools, the participants consisted mainly of individuals linked to education provision and included learners and teachers at primary schools and school administrators. The participants in the research were learners in grade 9 (14 – 16 years), teachers of digital subjects commonly known as computer or information and communication technologies (ICT) lessons and administrators. At the upper primary level in Zambia, there are two grades i.e., 8 and 9. It was anticipated that both grades would participate, however, since grade 8 learners were not yet selected and enrolled to commence studies, only grade 9s took part in the research. A total of forty-four (n = 44) learners participated in the survey. Among the 44 learners that took part in the survey, eight were from Primary School 5, ten from Open Day Secondary school 1, ten from Primary school 3, nine from Primary school 2 and seven from Primary school 4. There was a purposeful balance of boys and girls in the survey. The selection criteria for the learners were that they had to be in grade nine, take computer lessons, be 15 years or above. Tables 1 and 2 below show the distribution of learners who took part in the survey by school and age, respectively.

Table 1. Distribution of learners by primary school

| School | Number of Learners | Percent | Cumulative Percent |
|---|---|---|---|
| Primary School 5 | 8 | 18.2 | 18.2 |
| Open Day Sec school 1 | 10 | 22.7 | 40.9 |
| Primary school 3 | 10 | 22.7 | 63.6 |
| Primary school 2 | 9 | 20.5 | 84.1 |
| Primary school 4 | 7 | 15.9 | 100.0 |
| Total | 44 | 100.0 | |

In terms of age, learners ranged from fifteen to twenty-one years as shown in Table 2 below. In developing countries especially Zambia, it is common to find over aged learners in primary school. The other respondents included six teachers and three administrators.

Table 2. Distribution of learners by age

| Age in years | Frequency | Percent | Cumulative Percent |
|---|---|---|---|
| 15 | 15 | 34.1 | 34.1 |
| 16 | 16 | 36.4 | 70.5 |
| 17 | 8 | 18.2 | 88.6 |
| 18 | 2 | 4.5 | 93.2 |
| 19 | 1 | 2.3 | 95.5 |
| 20 | 1 | 2.3 | 97.7 |
| 21 | 1 | 2.3 | 100.0 |
| Total | 44 | 100.0 | |

## 4.3 Data collection and analysis

This thesis was invoked to propose a design of a digital learning platform that creates opportunities for digital skills learning in under-resourced primary schools in Zambia. The data collection methods included surveys and interviews whose questionnaires are attached in appendix 1. Notes were also taken during interviews and one voice recording of an administrator lasting twenty minutes was done.

Table 3. Data collection methods

| Participant | Method for data collection |
|---|---|
| Learners | Survey |
| Teachers | Survey and interviews |
| Administrators | Interviews |

Having used surveys and interviews to collect data, I present below an explanation of the characteristics of the chosen methods and instruments and their limitations.

### 4.3.1. Survey questionnaires

Survey questionnaires are said to be less expensive, easy to correct, analyse, integrate with other statistical computation packages, can be administered on smartphones, and can be processed fast (Jones et al., 2008). It was anticipated that the research would use survey monkey electronic questionnaires for both learners and teachers since participants could choose to complete the questionnaire later if they did not have enough time to complete it at once by simply saving before posting. However, scarcity of smartphones and absence of Wi-Fi in the schools made it impossible for learners to use electronic questionnaires. As a result, manual

questionnaires were printed and distributed to learners in the five schools. This increased the data collection time by five working days and data processing time, as data had to be entered into SPSS physically. Unlike the situation for the learners, electronic questionnaires were used with the teachers. Therefore, 'Survey Monkey'[2] was used for easy administration. The six teachers that took part in the survey had access to smart phones and personal internet connectivity. Questions were framed in a manner that could facilitate response to what challenges and opportunities that can be identified in the local schools. In this regard, questions were framed under two groups, i.e., those attributing variables to numbers and those related to opinions, feelings, experiences, and factual suggestions.

Both open and close ended questions were used to elicit information needed in the survey. Closed questions related to issues that needed definite answers such as the available number of digital devices, sex of respondent and so forth. Closed questions produced responses that were discrete and easy to analyse and treat statistically and allowed differences among groups of learners in the sample to be made. Open questions gave participants unrestricted and broadened responses with justification of their responses if they so wished. The questions solicited for personal views and experiences that needed expansion such as the challenges and how the respondents viewed possible solutions or interventions to the challenges, motivation, and the way forward.

### 4.3.2. Interviews

Three administrators from three schools representing Open day secondary 1, Primary school 3 and Primary school 2 were interviewed. The interviews were in line with the theoretical framework in Activity theory that require face to face interaction with participants in discussing perceived problems and solutions. The other advantages of interviews are their allowance of flexibility in data collection, enabling multi-sensory channels to be used and easy control of the interview order (Cohen et al., 2017). In a research as this one, aimed at ascertaining challenges and how a digital platform solution can be developed to create to develop digital skills for learners in under-resourced primary schools in Zambia, it was paramount that the subjects were interviewed. The average time taken to interview each of the three administrators was 30 minutes.

[2] https://www.surveymonkey.com/

The interviews were semi structured in nature. Semi structured interviews allow for obtaining all the information planned for and gives way for any unplanned for information. In addition, personal feelings of the interviewees and involuntary body language can easily display and taken note of by the researcher. Moreover, interviews lay the ground for the researcher to be with interviewees and empathise with them. Empathy puts the researcher at the same status level as the respondent thereby freeing the respondent to disclose their feelings emotions and facts pertaining to a situation. Due to the regulations pertaining to the Covid 19 situation, social distancing and mask wearing were observed for two respondents while the third was done through telephone. Notes were taken as administrators were being interviewed as a way of data maintenance. Voice recordings were done to complement the notes during analysis.

### 4.3.3 Challenges experienced in using the survey and interviews

There were some challenges in administering questionnaires to learners. The print-out questionnaires had to be used because of few digital devices and Internet challenges. The administration of questionnaires took different paces in the different schools. The challenge for the interviews was that some administrators opted not to be involved in being interviewed. However, 3 out of five the administrators that were interviewed.

### 4.3.4 Analytical framework and process

The survey data collected from learners was entered into SPSS for the generation of statistical frequencies. The data was categorised into variables with frequencies in terms of numbers and percentages of respondents. The percentages determined the magnitude of the challenges or suggested solutions. Multi-related concepts, elements, or factors were used to measure digital engagement such as amount and number of times of using a device, perceptions, motivations including attitude of users (Miller et al., 2019). In line with Miller and colleagues, the variables were determined from the challenges faced in digital skills acquisition and the corresponding responses to improve the digital skills. Even if Miller et al. (2019) did their study in the medical field, the focus was on digital learning and therefore relevant to education.

Variables were determined to fall into two categories; those related to digital infrastructure and organisation (quantitative) and individual perceptions (qualitative). The variables included the numbers of digital devices found in each school, the types of digital devices, specific challenges, the time learners spent practicing, the motivation factors for the participants, and the anticipated solutions. The responses from the interviews were presented under the same line of variables in the results section.

### 4.3.5 The personas analysis

The emotions and personal reactions to the challenges and opportunities provide the personas of the participants under the current digital circumstances. Personas help with understanding of the challenges and the suggested solutions (d.school, 2009). The personas have hence been created and presented in the last part of the results section.

### 4.3.6 Intervention logic analysis

In proposing a design of a learning platform that creates opportunities for digital skills learning in under-resourced primary schools in Zambia, an intervention logic presenting main solution pathways was used. Inputs are the processes, tools, technology, and actions that are for design and implementation and, in short, are simply factors suggested by the participants that were clustered into lines of action. They are mechanisms to bring about the intended changes or results. The logic helps in dealing with different parts of a planning programme (Chen et al., 1999) and helps build consensus. It provides a framework of challenges that are clustered into few but wider areas where selection of the most appropriate intervention or solution is done. Once the area has been chosen, the stated solution points become activities for implementation. In this research, they form the characteristics of the digital platform features.

## 4.4 Ethical considerations

This study has been conducted in accordance with the Swedish Research Council's ethical guidelines (2017) and the Zambian education research policies. Ethical considerations in any research play a pivotal role in validating the research. Basically, the major role ethical considerations play among others, include alignment of interests of parties involved, creating transparency, aiding in assessing the efficacy of the research, ensuring data privacy, security and withdraw means, and whether benefits of all outweigh potential harm (Jachimowicz et al., 2017). Essentially ethical conduct protects the researcher, participants and institutions involved. In actual sense, ethical conduct is manifested through voluntary participation, informed consent, confidentiality, and anonymity. Ethical conduct is often laid down in codes of conduct, policy documents or legal frameworks. Regarding ethical issues in e-questionnaires, respondents' digital identity and reputation had to be safeguarded (Blyth, 2015; Cohen, Manion & Morrison, 2017).

In line with the Swedish Research Council's ethical guidelines (2017), the purpose of the research was explained on the questionnaires and verbally, and informed consent was obtained from all learners. Only those willing to take part continued with the survey. Parental consent was not necessary in this study since all students were fifteen years old and above. The

respondents were also assured of anonymity as their names were not asked for anywhere, and that the other data on age and sex would be maintained confidentially. This also implies that all names of places and schools are fictitious. Lastly, privacy and data protection were assured. The data is protected with passwords. The other participants that included teachers and administrators were assured of the same ethical considerations. It was however agreed with administrators that their views would be quoted and displayed using their positions.

Even though the research has been conducted in line with the dimensions explained above, it is important to mention that since the research was conducted in Zambia, Zambian regulations had to be followed in addition to the Swedish. Firstly, this implied that permission from the District Board Secretary had to be obtained in order to be allowed to conduct research in the participating schools. Such a permission is within the Zambian education policy guidelines and was granted through a letter dated 4th February 2021 given in Appendix 2. Secondly, the headmasters in the various schools had to authorise data collection from learners.

# 5. Results

To propose a design of a digital learning platform, challenges and opportunities for digital learning were identified among learners, teachers, and administrators. The results presented below reflect the given answers and serve to provide a point of departure for the aimed proposal design. The result is presented commencing with the facts or numbers about the actual digital resources found in the schools. This is followed with learners' digital learning experiences, difficulties learners faced with digital skills development and the number of learners that owned or did not own a digital device for use in learning digital skills. Time learners spent in class to learn using digital devices was explored just as much as learners´ perceptions of level of difficulty/ simplicity in using digital devices. Communication methods during digital lessons, and proposed solutions to address the digital skills problem by learners, teachers, and administrators. Critical aspects of the digital policy for learning by administrators as well as personas are presented. The results presented below reflect answers given to the raised research question.

## 5.1 State of digital resources in schools

It is imperative in the first instance to see if the schools where the research was done had low levels of digital resources as the aim of the research is to propose a design of a digital learning platform that creates opportunities for digital skills learning in digitally under-resourced primary schools in Zambia. Therefore, the respondents were asked to give the types and numbers of digital devices that were in use in their schools. All the participants gave their own views of the available digital resources. Learners' responses indicated that all the five schools had only desktops and laptops as digital devices for learning as given in Table 4 below.

Table 4. Learners: Types of digital devices owned by primary schools

| Type of device | | Frequency | Percent | Cumulative Percent |
|---|---|---|---|---|
| | Desktops | 27 | 61.4 | 61.4 |
| | Laptops | 17 | 38.6 | 100.0 |
| | Total | 44 | 100.0 | |

Teachers gave out similar responses but with numbers as follows: one laptop and five computers at Open day secondary school 1, four laptops at Primary school 5, one desktop at Primary school 3, one desktop at Primary school 2 and twenty desktops at Primary school 4.

They summed up problems as lack of computers, networking tools and conducive computer rooms; for example, at Primary school 4 the computer room was used as a library and teachers´ common room. They lamented the small number of trained teachers, hence making it hard to manage all classes. The teacher at primary school 4 was untrained and merely volunteering to teach, yet he headed the department. The teachers further said that the small number of smart phones in the wider community made it difficult for learners to do any research away from school. These findings are similar to the study by Kaumba et al., (2021) and Nyanja and Musonda (2020) in their study of impediments to digital skills learning in selected schools in Zambia. This attest as fact that the availability of digital devices is really a great challenge.

For the state of digital resources in schools once again, the administrators provided similar responses to those of learners and teachers. The quoted responses from administrators are presented below in Table 5.

Table 5. Administrators´ responses on the state of digital tools in their schools.

| Discourse and dimension | Quoted answers |
|---|---|
| **Administrators' views about the number of digital resources in their schools** | *"We have one Laptop, two operational Desktop computers, one projector, one printer and a satellite Television"* (**Open day secondary school 1)**<br><br>*"one desktop" (***Primary school 3***)***<br><br>*"The school has one desktop; however, we are generally assisted by Mwembeshi High school where our learners use their computers. The problem we encounter with this type of arrangement is that our learners are allocated limited time and have to move away from our school premises to access the services".* **(Primary school 2)** |
| **Administrators' views about the overall state of digital resources in their schools** | *"As briefly highlighted above, the ICT infrastructure level at this school is very basic. For starters, the school has no specialised room where ICT equipment can be stored and where lesson can take place. Additionally, the ICT equipment itself and furniture are in critical short supply to allow for meaningful practice by the learners. This limits their exploratory abilities and acquisition of the necessary skills," (***Open day secondary school 1).<br>*"Not adequate, no access to internet" Devices not adequate, absenteeism of learners from class."* **(Primary school 3)**<br>*"Infrastructure lacking, we teach theory and have only one teacher. Have no electricity, little assistance from community Interfaces not too friendly to learners, a lot of unnecessary features"* **(Primary school 2).** |

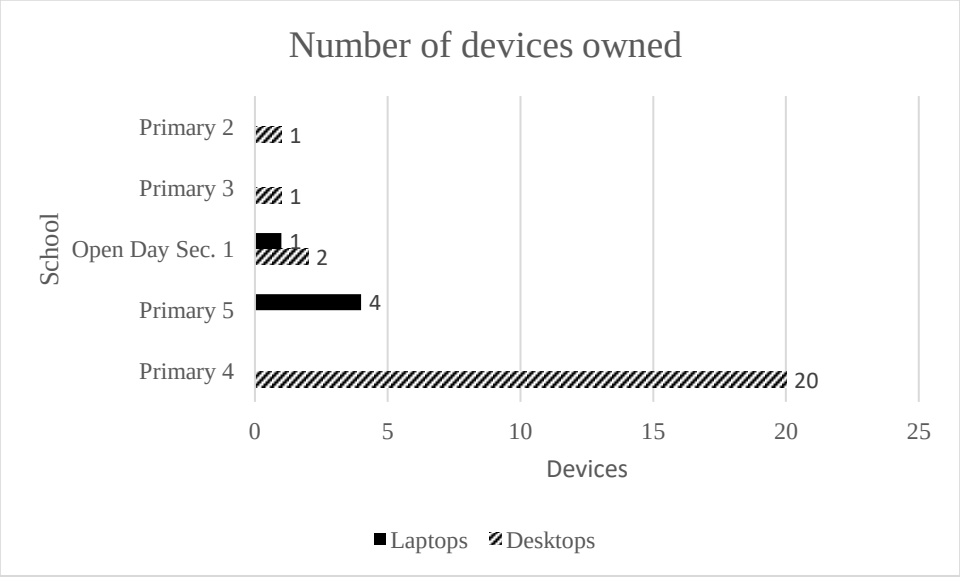
Administrators responded that the devices were not enough for learners. In terms of numbers at Open day Secondary 1 for example, the administrator said the school had one laptop, two operational desktop computers, one projector, one printer and a satellite television. At Primary school 2, they had a desktop computer, and a similar number at Primary school 3.

It is also interesting to note that teachers and administrators had different figures when it came to numbers of devices present. At Open day secondary school 1, for example the administrator emphasised on operational desktops as opposed to the non-functional that teachers included. Teachers are the custodians of the devices and are prone to account for all even if some devices do not work.

The principal activity of the schools in this research according to Activity theory is to help the subjects who are learners to participate in digital skills development using the tools such as the digital skills in their communities. These results show that the tools are inadequate for the activity to be conducted smoothly to achieve the aim. What was, however, a striking revelation was the optimism that the participants had to be able to achieve their goals any day in future.

Reconciliated total devices owned by schools as of April 2021 are given in Table 6

Table 6. Operational devices owned by schools.




With the numbers given, it is, therefore, established that the schools had few digital devices. The administrator for Primary 3 said that their school had learners do practical lessons at a neighbouring secondary school on limited time. The participants at this school seemed to have been accustomed to the arrangement to a point where no other efforts seem on the pipeline for them.

## 5.2. Learners' digital learning experiences

### 5.2.1. Difficulties learners faced with digital skills development.

Learners were asked to state the other difficulties they faced in acquiring digital skills. The question was open, and the learners gave out the responses that were keyed in SPSS and results are outlined in Table 7 below.

Table 7. Reported difficulties learners faced with digital skills learning.

| Learners´ responses | Frequency | Percent | Cumulative Percent |
|---|---|---|---|
| Insufficient digital devices | 20 | 45.5 | 45.5 |
| No response to question | 2 | 4.5 | 50.0 |
| Little time to practice | 4 | 9.1 | 59.1 |
| No teacher | 1 | 2.3 | 61.4 |
| Did not face any problem | 7 | 15.9 | 77.3 |
| Had Interface difficulties | 3 | 6.8 | 84.1 |
| Language difficulties | 1 | 2.3 | 86.4 |
| Power interruptions | 4 | 9.1 | 95.5 |
| No Wi-Fi | 2 | 4.5 | 100.0 |
| Total | 44 | 100.0 | |

The result about the challenges the learners faced showed that forty-five percent (45%) of the learners indicated that their schools had insufficient digital devices as already given in the preceding paragraph on available digital devices. Insufficient digital devices simply mean that the available devices were few as shown in table where many learners used one laptop such as twenty learners to one laptop at Primary 3. Further, 15.9% said they did not have any problem at all while 9.1% indicated that they had little time to practice digital skills on computers. The issue of little time meant that the total time in a period of thirty minutes a learner spent on a digital device was less than the total time allocation for the period.

Another 9.1 % said they had power interruptions while practising. It is common experience for power outages because of load shedding by the power utility company. In addition, 6.8% said they had interface navigation difficulties. The interface navigational abilities refer to a learners' ability to make use of the features found on the face of a digital device such as the

basic skill levels as described by the ITU on digital skills in section 2.3.1. above. Moreover, 4.5 % reported that they had no Wi-fi, while an equal number did not respond to the question. Lastly, 2.5 % said they had language problems and an equal number indicated that they did not have teachers. Language problems are a challenge where local languages are not the main language of instruction in the subjects taught at school. Zambia has seventy-two languages out of which seven are major languages taught in schools, while English as a second language is the official language. The lack of trained teachers in under-resourced primary schools has widely been acknowledged in the past studies (Changwe & Mulenga, 2020; UNESCO 2016; James 2019; World Bank, 2016). Teachers who are not trained in ITC may not be able present the prescribed skills in the syllabus to the extent where learners can easily understand.

From the responses especially on the unavailability of wi-fi, eLearning cannot take off for use of the few available digital devices. This is a serious impediment to development of internet skills. Secondly, the no responses to the question could not be explained. The non-disclosure of information on problems makes it difficult to propose wholesome actions to cushion the problem of digital resources. It is gratifying to see that a reasonable number of learners (15.9%) said they did not experience any challenges, though the basis for this is not clear.

### 5.2.2 The number of learners that owned or did not own a digital device for use in learning digital skills.

As to whether learners owned personal digital devices for use in and outside class, the results showed that 81.1% did not own any digital device while 18.2% owned a digital device of some kind as given in Table 8. Personal digital devices play an important role in learning as they can be used both in class and away at home. However, even if personal devices were available, challenges in using them at school would be electricity and policy restrictions on the use of personal smartphones. It is said that the digital divide in the developed world has been reduced owing to the use of a multiplicity of devices (James, 2019). The fact that this is not the case in under resourced countries poses a big problem to getting digital skills**.**

Table 8. Learners who owned personal digital devices

| Learner owns a digital device | Frequency | Percent | Cumulative Percent |
|---|---|---|---|
| Yes | 8 | 18.2 | 18.2 |
| No | 36 | 81.8 | 100.0 |
| Total | 44 | 100.0 | |

### 5.2.3 Time learners spent in class to learn using digital devices.

The amount of time spent practicing digital skills is a vital variable in understanding how digital solutions can be developed to improve digital skills. Having been asked to state the amount of time they spent on digital skills development in class, learners gave varying responses from school to school but similar at a particular school. One learner indicated that there was no chance to practice. Another one intimated that only twenty minutes were allocated per week. Four indicated that they had thirty minutes to use digital devices. 65.9% of learners reported that they spent forty minutes. Since a period takes thirty to forty minutes, learners who gave that specific amount of time did not give their individual time spent on the computer. This is an implication that they do not understand the practice time. However, the important point was that the time was limited.

### 5.2.4 Learners´ perceptions of level of difficulty/ simplicity in using digital devices

The respondents were asked to state whether, the digital devices they were using were easy to use or if they found them hard to use. The result shows that 63.6% of the learners said that they had no difficulties in using the devices. However, 34.1% found them difficult to use, with one respondent absconding. Perceptions about level of difficult / simplicity can motivate or demotivate learners (Bergdah, et al., 2020).

### 5.2.5 Communication methods during digital lessons

Communication methods during digital lessons play a vital role in skills development. Teacher centred method of communication develops knowledge level learners' involvement through practice improves skills (Chen, 2019). Learners were asked to put across the main means of information exchange during digital lessons. Awesome responses were received that included oral (29.9%), texts and graphics (36.4%), and all the methods combined (27.3%), while 3 (6.8%) did not provide any answer. These responses are tabulated in Table 9.

Oral means of exchanging messages are characteristic of teacher's exposition method (Chen, 2019). This signifies less use of the digital device to generate and share information. It can mean less practice of basic digital skill (Dickens, 2012). It was, however, worthwhile to see that text and graphics accounted for 36.4%, meaning that some practice for skills were done.

Table 9. Reported principle means of communication during digital lessons

| Communication ways | Frequency | Percent | Cumulative Percent |
|---|---|---|---|
| Oral | 13 | 29.5 | 29.5 |
| All | 12 | 27.3 | 56.8 |
| Text and graphics | 16 | 36.4 | 93.2 |
| no answer | 3 | 6.8 | 100.0 |
| Total | 44 | 100.0 | |

## 5.3. Learners' motivation and perceptions of digital learning

The survey posted a query that needed learners to state their levels of motivation. The learners had to state the source of their motivation to learning digital skills. Like the other questions, this too was open, and this is what they suggested in Table 10.

Table 10. Learners' motivations

| Motivation | Frequency | Percent | Cumulative Percent |
|---|---|---|---|
| Interest | 24 | 54.5 | 54.5 |
| Compulsion | 13 | 29.5 | 84.1 |
| Be a developer | 3 | 6.8 | 90.9 |
| No answer given | 4 | 9.1 | 100.0 |
| Total | 44 | 100.0 | |

The result indicates that 54.5% had general interest driven by the need to be able to use digital tools for everyday operations. 29.5 % of the learners indicated that the curriculum compelled them to embark on digital skills development. Compulsion relates to being given the digital subject as a compulsory subject and the subject cannot be taken as an option. Only 6.8% of the

learners wanted to take a digital career as programmers or developers, while 9% of the learners could not respond to this question. The general interest was for basic communication and implies that only basic digital skills for this set of learners was all they needed. In this case learners tend to miss the digital rewards (World Bank, 2016) and become less competitive on the world job markets.

## 5.3 Learners proposed solutions to address the digital skills problem.

Learners suggested solutions to the digital situations they were facing. The proposed solutions can also be referred to as interventions. They are basically the actions, processes, or deliverables that when taken will cushion the challenges. The proposed solutions were that schools should:

(a) procure digital devices (36.4%); to procure is basically to buy. Whether this is feasible or not, the question we need to ask with proposed solution is why procurement has not been done. Is this the factor behind the growth of lack of digital resources?

(b) partnering with local communities to increase resource base (2.3%); This solution calls for collaboration with the other members of the community to look for digital devices (tools).

(c) learners were to be allocated more practice time (50%); Learners in this case asked for more time to be on a digital device developing skills, and

(d) that reading of digital/ computer related books should be enhanced.

Their responses are presented in Table 11.

Table 11. Suggested Solutions to the digital challenges by learners

| Suggested Solutions | Frequency | Percent | Cumulative Percent |
|---|---|---|---|
| Buy digital devices | 16 | 36.4 | 36.4 |
| Community partnership | 1 | 2.3 | 38.6 |
| Increase time to practice | 22 | 50.0 | 88.6 |
| Obtain reading materials | 5 | 11.4 | 100.0 |
| Total | 44 | 100.0 | |

## 5.4. Teachers

Having examined the problems teachers faced of big classes, lack of digital devices, learner absenteeism and lack of training for some teachers, the findings are in line of those by Kaumba et al., (2021). When asked to explain what motivated them to teach, teachers said they were

encouraged by the love they had for teaching, found teaching easy and were further inspired by the desire learners had. Some said they got ideal administrative support and the desire to be part of the digital society. Some teachers were motivated by the training that they underwent. However, the teachers said they did not enjoy the working environment in teaching digital classes. They wanted to work in a digital environment where digital tools were visible. Some looked frustrated, though they had no better options but to remain in the same environment and wish for a better future.

### 5.4.1 Teachers' intervention proposals

Teachers were asked to explain how they apportioned the existing digital tools to the learners in their classes. The responses were that they divided learners into groups. Grouping was done to deal with large numbers of learners. At Primary school 3, the learners numbered 25 per group and were made to alternate from one session to the other. They made four sets of twenty at Primary school 3 for 85 learners, and groups of four for fifty-one learners at Primary school 4.

In addition, teachers said they allowed learners to use their personal mobile phones and tablets. However, this is only a single teacher´s device to single learner in a class of over fifty learners. They also proposed use of overhead projectors in teaching and having updated applications software. Overhead projectors may not improve digital skills as learners do not operate them. In terms of interface features, the teachers proposed how they wanted the learners and time to be organised and work should be given. These were grouping, time and task allocation capabilities of digital devices. The other proposal they gave was to seek government intervention in terms of supplying them with digital devices. The above stated suggested solutions by teachers have also been taken to the solution tree diagram on page 38.

## 5.5. Administrators

The interview results will present the views and feelings of the administrators about the current digital learning mechanisms. It will further show interactive ideas presented by participants' descriptions of the situation, characterisation, and specifications of the solutions they anticipated. It should be noted that only three of the five administrators opted to attend the interviews. In respect of their rights to choose whether to be interviewed or not, they were not pressured to explain why they had not accepted. Three administrators were interviewed, the other two had time excuses nor could they delegate their assistants.

### 5.5.1 Critical aspects of the digital policy for learning

When asked to explain the critical aspects of the ICT policy for learning the schools used, the administrators gave varying answers in Table 12.

Table 12. Critical aspects of the ICT policy for learning

| Discourse and dimension | Quoted answers |
|---|---|
| **Administrators' views about digital policy** | *"It is envisaged by the Ministry of Education that all learners especially at junior secondary school ought to learn ICT. Other than that, even those in primary school need to have a significant exposure to ICT use. Currently, the school runs from pre-school to Grade 12 and only two classes learn ICT at Grade 8 and 9 levels. This is a result of the limitations in the ICT equipment and teaching staff that the* school has. Consequently, the implementation aspect is a huge *problem for many schools, like ours"* ***(Open day secondary. 1 administrator)***<br>*"It is ideal for learners to learn Microsoft packages word processing, excel and power point".* ***(Primary school 3 administrator)***<br>*"Should be optional. Why teach IT?"* ***(Primary school 2 administrator)*** |

The responses from administrators showed that the policy framework on digital learning was available at the national level. This is because they were availed copies of the curriculum. However, administrators understood it differently with some questioning its introduction while others on why learners should take digital lessons at all. This could result from the fact that the government did not match the programmes introduced to the resources necessary to carry out the programmes. According to Activity theory, the fourth principle is about contradictions. As already explained, contradictions bring tension among members of a community and can also be determiners of change and development. The ministry of education introduced the curriculum that was implemented without supporting resources at the schools. The structural tensions emanated from changes induced by this radical introduction of a syllabus, without due regard to implementation, made some administrators to get infuriated and could not accept the changes with one accord.

### 5.5.2 Ideating solutions to the challenges faced by institutions.

With reference to the second aspect of the research question, the administrators were asked generate solutions to the challenges. When asked how they anticipated dealing with the challenges, the administrators had this to say in Table 13.

Table 13. Administrators' views about suitable interventions

| Discourse and dimension | Quoted answers |
|---|---|
| **Administrators' views about suitable interventions** | *"Firstly, put in place deliberate mechanisms of steadily acquiring more equipment for the school to carter for more numbers. Secondly, continue lobbying from government and cooperating partners to help equip the school. Thirdly, to deliberately build capacity in teachers to have both the knowledge and skills which they can impart on learners with ease"* **(Open day secondary school 1, administrator).**<br><br>"*Use groups of 5 or 6 learners. Procure more devices and digital infrastructure*" **(Primary school 3, administrator).**<br>"*Secure a lab and government assistance, increase practice time*," **(Primary school 2, administrator).** |

The administrators also recommended that teachers could use their personal smartphones or laptops to teach learners. Previous research showed that school policies did not allow smartphones to be used in class by learners (Changwe & Mulenga, 2019; Kaumba et al., 2021). This suggestion became more important after the spread of Covid 19 in 2020.

## 5.6 The Resultant Personas

Finding solutions require discovering the characteristic attributes of the affected people and the nature of the problem. As progression is made towards probable solutions the participants will be classified into personas. Personas are indirect representations of subjects who are valuable because they provide the different situational features for operating images and useful in assessing design solutions (Neate et al., 2019). In this research, four personas emerged.

### 5.6.1 The Girl Learner

The girl learner is a 15-year grade 9 learner who aspires to be a computer programmer and takes Information Technology (IT) as a mandatory subject. She further takes maths, science, and other subjects, eight in total.

She is immensely frustrated by little use of a digital device to develop her skills. The girl learner often stands behind the teacher watching him demonstrate digital lessons. It is always scrambling to be the first to sit on a computer and in no time, it would be time for the other subject, a situation that she disgusts. She is a highly brilliant but reserved learner who does not like scrambling for digital devices.

### 5.6.2 The Boy Learner

Boy learner is a grade 9 learner at Open day secondary school. He is 16 years and adores learning significantly. He only wants digital skills to be able to communicate. He walks a distance of five kilometres every day to school and always criticises teachers for not listening to their complaints about little digital practice. The fact that digital skills lessons are compulsory has made his learning unpleasant. He finds the subject not worthy learning as he only listens to the teacher. He is familiar with ordinary mobile phone handsets. Despite this, he always wants to be on top of his learning.

### 5.6.3 The Teacher

Teacher of digital lessons is a very ambitious teacher whose goal is to deliver his subject in ways that will make his learners understand it so that digital skills can be appreciated. He is always in time for his lessons. He has a diploma in education is improving his skills level with a continuous professional development program in information technology at a university through distance block release learning. His learning program is scheduled during school holidays; therefore, it does not affect his normal teaching. He handles two classes: Grade 8 and 9, each with 50 learners.

He finds his work somehow irritating because the school has no specialised room for computers. Every time he teaches, he requests learners to carry the laptops from the storeroom to class. What frustrates him most is the few number of digital devices that the school has. The school had only four laptops. His classes have an average of 50 learners each. A period is allocated 40 minutes, though on two occasions per week there are double periods amounting to one hour twenty minutes. He finds it difficult to distribute equal time to learners to practise.

Further, the school does not allow use of smart phones in school by learners in class. The school power supply is inadequate by way of a solar panel. In the department there are three teachers to handle all classes of who one is not trained.

### 5.6.4 The Admin

The Admin has the overall responsibility of overseeing all school programs. He is very energetic and loves his job. He is usually frustrated by instructions from the head office where he gets orders to have some subjects introduced despite not having the necessary teaching aids. Policy documents are sent to his office, but he has no local policies for his school. Digital infrastructure in the school is very limited which sometimes put him off. His school is in a community that has no virtual connection with the rest of the country.

## 5.7 Summary of Findings

Chief digital issues affecting schools are that learners and schools do not have ample digital devices to use for digital lessons. This is seen from chart that shows that a total of five laptops and twenty-six desktops were available in all the five schools. The number of learners in a class was very high making the teacher pupil ratio high. The average enrolment per class was fifty learners and the learning time for digital lessons was limited. The lesson period was allocated forty minutes within which teachers had to explain concepts and allocate learners time to practice. It was also found that some teachers were untrained and merely volunteered to take up digital subjects, for example the teacher and head of digital department at Primary school 4. In addition, the number of teachers was insufficient for schools. It was also found that there was little provision of digital resources from government. In addition, learners lacked complementary personal digital devices for use both at school and at home.

Coming to proposed solutions, participants suggested procurement of digital devices even though the capacity for such does not exist currently. Other options included increased engagement with government and local communities for funding. Opportunity creating pedagogical and design-based interventions for digital learning involved grouping of learners, assigning appropriate tasks and increasing practice time for learners.

# 6. Discussion

## 6.1 The state of digital resources

This section commences with an analysis of the state of digital resources in the primary schools of concern. The significance of discussing this portion of the findings is to understand the challenge of availability and sufficiency of digital devices in schools. As stated by Miller et al., (2019), the numbers of digital devices are a vital variable in dealing with digital resources and their effect on digital skills learning. As outlined in the introduction, such kind of a situation is found in several countries with low resources (Chan-Lin, 2016; ITU, 2016), and in Zambia is greatly attributed to a decline in funding (Changwe & Mulenga, 2020, National Assembly of Zambia, 2021).

The other factor lies in community perceptions about what constitutes an acceptable digital learning tool. With reference to community perceptions in Zambia, the digital devices that can be used to achieve intended learning outcomes are generally viewed as computers in the form of laptops or desktops whereas smartphones are mostly regarded as communication devices for sending and receiving private or business messages. Smartphones are regarded as being prone to abuse, and being disruptive to learning and to cause multitasking, therefore, not regarded as ideal for use in class. This perception could be connected to the responses that 81.1% of learners did not own any digital device as given in Table 8.

The education policy in Zambia does not allow the use of smartphones in class though with the advent of Corona 19 some teachers allow use of smartphones. This factor is more associated with the policy stipulations and can be resolved in line with what James (2019) recommended that when defining the digital skills people should have consideration of the contextual meaning. In this way, few digital devices should not be seen as a problem but rather the communities should re-define the tools to be considered as necessary learning tools than to limit the digital tools that the learners use.

The overall situation relating to digital devices is that they are not enough. Classification of the digital tools for learning itself is a constraint or tension point that require collective solution as the Activity theory espouse.

## 6.2 Implications of the number of learners that owned or did not own a digital device for use in learning digital skills

The results indicate that more than half of learners did not personally own any digital device of any kind. This situation is reflective of what is obtaining in the country as far as owning digital devices entail. According to the Zambia Information Communication Technology Agency (2018), a paltry 8.1 % of households in Zambia owned a computer, 14.3 % and 29.6 % of individuals used the internet and owned smartphones respectively as of 2018. The main cause for this is that the digital devices are beyond what most people in Zambia can afford to buy. The cost of living is very high, income levels are low, and peoples' priorities are on food security as opposed to buying digital devices. Therefore, this calls for measures that can enhance use of the few available digital devices to the maximum. Enabling mechanisms and software programs ought to be developed for use on the available devices.

## 6.3 Learners' motivation to digital learning and perceptions of level of difficulty/ simplicity in using digital devices

In developing digital platform solutions for enhancing digital skills and knowledge, it is critical to discover the motivating factors for learners and agents like teachers and administrators to strive to learn and teach digital skills, respectively. Motivation refers to setting an organism into action or behaviour by internal or external factors (Grey, 1991). The research results indicate that most of learners had general interest driven by the need to be able to use digital tools for everyday operations, a global situated demand. It is rare to see primary school learners who would not want to have any digital skill. All learners want to be associated to being modern and technical by associating with digital technologies. Whereas some of the learners indicated that the curriculum compelled them to embark on digital skills development and a small number could not respond to this question, it could be that in Zambia certain communities are too isolated in rural areas where even seeing a computer is something strange. For learners in such an environment, it becomes clear as to why taking digital lessons does not stimulate any interest in them. An examination of these factors points to the fact that most of the factors are extrinsic factors of motivation and could be attributed to the fact that learners could not have been consulted in issues relating to deciding the relevance of digital knowledge and skills that they are taught. Secondly, it can be explained that teachers and administrators did not clearly instruct learners on what digital classes were meant for (Escoda et al., 2016).

With only a small number of the learners wanting to be programmers or developers as career ends, it signifies that learner, and their teachers did not emphasise on job end of digital learning. Further, as some administrators did not appreciate the relevance of the introduction of digital skills development subject, this could have given negative perceptions about digital skills development to the learners thereby demotivating them.

## 6.4. Generating the Solutions

The aim of going digital by any country or individual, especially learners, is to get the benefits of the digital skills so called digital dividends (James, 2019). The results section is clear on the type of interventions proposed by the participants that schools should buy digital devices, partner with local communities to increase resource base of the schools for them to do the first proposal, that learners were to be allocated more practice time and that there should be books for reading.

Studies done about the digital solutions yielded similar suggestions such as scheduling of computer lessons´ time (Walubita, et al., 2015), supplying under resourced schools with used computers (Kaumba et al., 2021; Nyanja & Musonda, 2020), physical and technological infrastructure development (UNESCO, 2015), Wi-Fi establishment in schools, improvement of digital pedagogy (Dirksen, 2012), and teacher training (Changwe & Mulenga 2020). However, the suggestions as given by the scholars and institutions above have been there for a long time, yet in the developing countries like Zambia, the same proposals are brought forth. The explanation for this could be related to the assumption that most of the digital devices are designed for use in the Western World and therefore do not take into account the local contexts of the developing world (James, 2019) such as scarce funding and sharing devices one after the other learner.

Therefore, to have ideal interventions, there was need to take a different approach that takes care of cause effect relations in problem solving; by examining the relationship between the learners (subjects), the tools, objects, and the digital skills (outcomes) as espoused in Activity theory. Further probing and brainstorming with administrators and responses from learners and teachers brought out two major intervention clusters which are: policy and infrastructure development while the other relates to digital platform design solutions.

### 6.4.1 The policy and infrastructure development solution

While it is common to have local digital policies, the ones that were spelled by the participants referred to national policies that require government intervention. These policy interventions lie at the macro level of education design and are beyond what can easily be changed at the community or school levels. According to (Jones, 2020) such policies related to national and global infrastructure issues are political and need a lot of time to be dealt with to create an interrelated order of learning environment. In the Zambian situation, the government determines the policy and approves funding for policies to be implemented. However, the trend has been that allocations to the Ministry of Education have been declining over the years. making a net decline of 5% in five years (NAZ, 2021). From these statistics, and knowing that national priorities are set by politicians, we can in this regard state that education seems to be a non-priority sector in Zambia in this era.

Further analysis of wider policies applied at the local school level create tensions, contradictions and subjective interpretations as explained in Activity theory (Engeström, 2014). We see this by the responses that some administrators like at Primary school 2 that they did not see why digital lessons were being taught in schools, and the response that the government should fund the procurement of computers. Therefore, going forward in finding how solutions concentration on the subject-object-outcomes aspects in the sphere of digital platforms would be the most ideal.

The second aspect pertaining to the policy and infrastructure development would require policy changes with external collaborators, stakeholders, and government serious involvement. These would comprise the “entrepreneurs, the public sector, financiers, academics, the private sector and entrepreneurial support networks” (ITU, 2018, p. 10). This whole set up of stakeholders still needs development in the underdeveloped countries and Zambia in particular, and therefore, can little stand as the main intervention to the current problem in the short or intermediate term.

### 6.4.2 The digital platform design solution

The digital design solutions presented the second major intervention related to the design of a digital software in the form of a learning platform that can be installed in the available devices. Such a digital intervention would create a situated practice that actively engage learners´ mental processes, identify them within communities allow emotional expressions and the teaching function as they interact with the learning platform (Cleveland, 2020).

Building from the responses, teachers and administrators gave, grouping of learners according to the number of devices available is one of the opportunity points. Therefore, to effect it as a digital solution, a platform must be developed that facilitates the making up of groups of learners. The platform should facilitate totality of group work i.e., formation, tasks, and collaborative work. Activity theory implores that the proficiency and potentiality of tools gives determines outcomes as stated earlier. This can be achieved when rules are applied (Engetsröm 2014), and this should entail that the rules are imbedded as functions in the platform.

The other cardinal aspects that should characterise the platform should be the ability to control time allocated to the learners. Practicing time should be made even for all learners to have a benefit of the devices available (Sikalima, 2020). Such a feature would reduce biases on who uses a particular device and leverage practicing amongst learners. In addition, when members of a group are aware about time and deadlines, they worked to accomplish the tasks within the allocated time. Digital platforms in current use worldwide do not have access time limiting functions as a digital device is being used as they are not developed to be shared one after the other with time limits.

The teachers proposed that platform software should have a mechanism for updates. Software updates are needed to enhance system performance usability and fixing bugs and of course should be weighed against costs and risks; and that they enhance usage of digital devices. Updates in this case can be sent to schools using any available means each time they are made. This can be done by sending updates using smart phones to teachers. The point is that they ought to include constraints of a successful solution using a discovery approach, case studies and collaborative functions. Further the platform can go with user guidelines and specific training materials for teachers.

Activity theory has a clear expression of the importance of outcomes as explained in the theoretical framework. In a learning situation, an outcome is an identifiable change in behaviour that is anticipated in the learner (Cleveland 2020), such as selection of the right icon on the interface of a digital device. The digital platform should, therefore, have capabilities to meet this requirement. This can involve making a provision for the teachers to assign tasks that would lead to learners achieving those digital competences such as navigation, keyboard use, understanding tasks etc. The platform to be developed ought to have subject content that can be placed by local teachers. Content should match the level of learners as provided for in the curriculum.

Digital tasks should be easily uploaded by teachers, hence adaptable, collaborative, and engaging through process as well as content (Cleveland, 2020). The platform should operate both off-line and online independent of other general learning platforms and should also be available in mobile based versions.

**Table 13. Digital Platform features**

| Main platform feature | Action by a learner to develop a digital skill |
|---|---|
| **1. Home page with school name, menu.** | Learner clicks on the school name or forward icon or group in drop down menu that takes the learner to the group. (*Navigation skills*) |
| **2. Group page.** | Each group has names of learners. The learner clicks on name which gives access to the tasks page. |
| **3. Access to tasks page.** | Access to the task page triggers the **Timer** on. **Timer controls use of digital device.** The timer gives equal time to learners to practice. Learner Performs tasks given by the teacher within a given time frame such as 10 minutes. Learner can query teacher where uncertain and save work done. *(Keyboarding, data analysis, managing files, content creation, interface navigation, content assessment and digital collaboration skills)* |
| **4. Another learner given opportunity when time is due automatically** | |

# 7. Conclusion

This thesis aimed to propose a design of a digital learning platform that creates opportunities for digital skills learning in digitally under-resourced primary schools in Zambia. Digital learning challenges and opportunities for digital skills were identified through the perspective of learners, teachers, and administrators. It was evident from the research that the digital problems faced by learners in digitally under resourced primary schools in Zambia included inadequate digital devices, little time for learners to practice on digital devices, inadequate specialised buildings, insignificant funding from central government and having few trained teachers. In addition, there are few reading materials, poor Internet access and power outages. Further, classrooms are overcrowded with learners averaging fifty per class.

In deciding what opportunities would be created for digital learning, the respondents came up with varied suggestions which included buying more digital devices, sourcing for reading materials and recruiting more teachers. These suggestions as well relate to those made in earlier studies in Zambia (Walubita et al., 2015; Changwe & Mulenga, 2020). A synthesis of the interventions culminated into two main categories of interventions namely: (a) policy and infrastructure development, and (b) digital platform creation with features that support grouping of learners, alternating digital device use through digital device access regulation and appropriate task provisions by teachers. A probable solution, based on digital platform, therefore, could be developed to enhance digital skills to learners in digitally under-resourced primary schools in Zambia.

The research was limited to establishing the challenges and opportunities through a digital platform that only describes the characteristic features of the solution. The research was not exhaustive in the area of scarce digital resources. In view of these findings, more research based on larger samples of population is needed.

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# 9. Appendices

## 9.1 Questionnaires

### 9.1.1 Interview questions for school administrators

Greetings,

You are requested to provide your views, facts, feelings, and opinions concerning digital teaching and learning (computer or Information and Communication Technology) administration at your school. This is for the researcher to have a perspective of digital skills development at upper primary school level. The research is purely academic with the purpose of developing solutions to digital learning problems encountered in upper primary levels. The survey will be kept anonymous, and your name should not be displayed anywhere on the survey form. The interview will be recorded to help have original information.

Please answer the following questions.

a) Quantify the types of digital devices the school has for learners.

b) Explain the critical aspects of the ICT policy for learning the school uses.

c) Briefly give your reflection of the ICT curriculum.

d) How do you assess the school ICT infrastructure?

e) What are your major challenges in providing digital knowledge and skills to learners?

f) How do you anticipate dealing with the challenges?

### 9.1.2 Survey questions for teachers

Dear respondent,

You are requested to provide your views, facts, feelings, and opinions concerning digital teaching (computer or Information and Communication Technology) at your school. This is for the researcher to have a perspective of digital skills development at upper primary or junior secondary school level. The research is purely academic with the purpose of developing solutions to digital teaching problems encountered in upper primary school level. The survey will be kept anonymous, and your name should not be displayed anywhere on the survey form.

1. Infrastructure and organisation

a) What are the digital tools that you use in class for Digital/ICT/ computer lessons? Please provide quantities.

b) How do you apportion the listed digital tools to learners?

c) How many learners do you carter for in grade 8 and 9 that take computer lessons?

d) Do you personally own any digital device and use it for learning?

2. Qualitative aspects:

e) What motivates you to teach digital skills?

f) What challenges do you face in teaching digital skills?

g) How do you deal with the challenges you face?

h) What features on a laptop would you propose to see and use to help meet digital skills teaching?

i) How do you feel about the tools, teaching environment and the overall support and innovations in the digital learning environment in your school?

j) How would you love to see the digital learning environment in your school?

(03/02/2021)

### 9.1.3 Survey questions for learners

Dear respondent,

You are requested to provide your views, facts, feelings, and opinions concerning digital learning (Computer or Information and Communication Technology) at your school. This is for the researcher to have a perspective of digital skills development at upper primary or junior secondary school level. The research is purely academic with the purpose of developing solutions to digital learning problems encountered in school. The survey will be kept anonymous, that your name should not be displayed anywhere on the survey form. Other biostats such as grade, sex age and school will be required for analysis purpose.

1. Infrastructure and organisation

a) What grade are you in?

b) What is your sex?

c) What is your age?

d) Name of your school?

e) Which of these digital tools do you use in class for Digital/ICT/ computer lessons?

i) Desk top computers ii. Laptops iii. Tablets iv. Smart phones v. None of the above

f) Explain why you only use the listed digital tools.

g) How much time do you practice on a digital device (computer) per class period?

h) Do you personally own any digital device and use it for learning? Yes / no

i) Do you think you have enough time to learn computers? Yes / no

j) Do you understand the digital tasks set by teachers? Always, sometimes, never?

2. Qualitative aspects:

k) What motivates you to obtain digital knowledge and skills (learn computers)?

l) What demotivates you in acquiring digital knowledge and skills?

m) How would you want to acquire digital knowledge and skills?

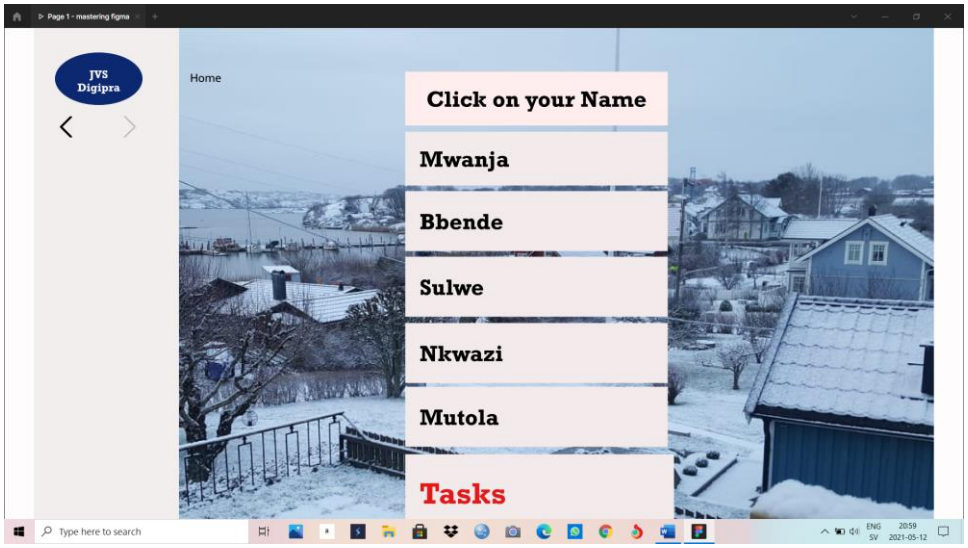
n) Do you find the digital tools easy to use? If not, what difficulties do you face with the features?

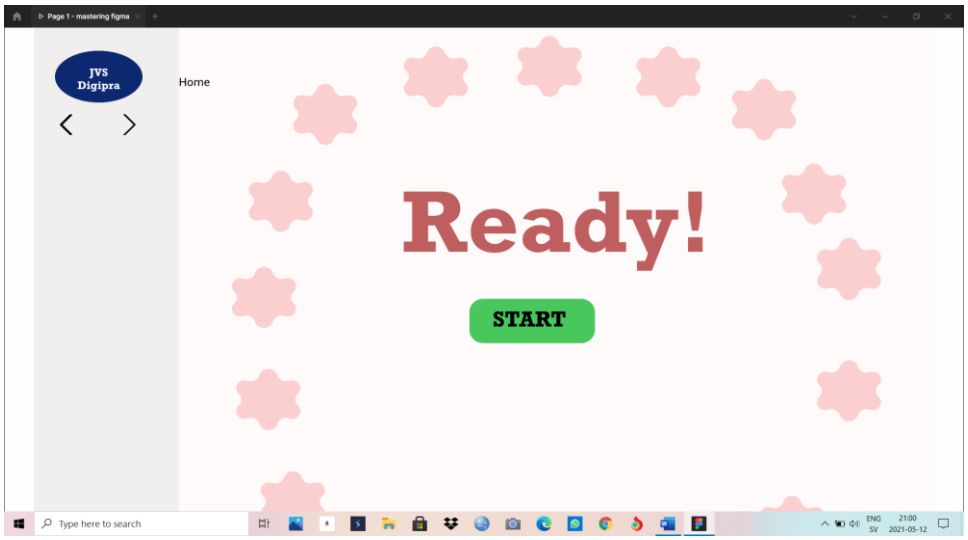
o) What would you propose to reduce the difficulties you face?

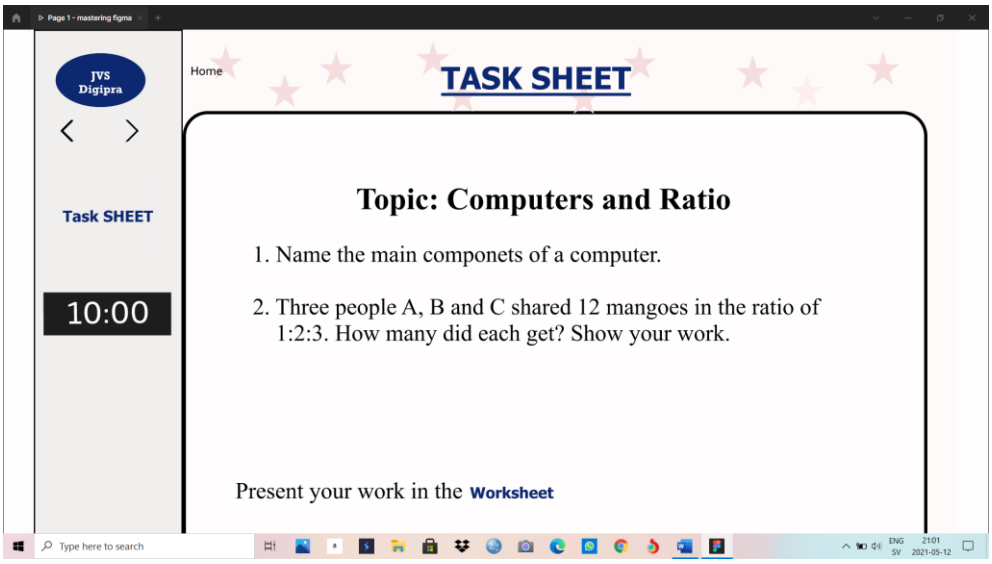
p) How you discuss issues, topics or ask and answer question answer during practical lessons using your digital device?

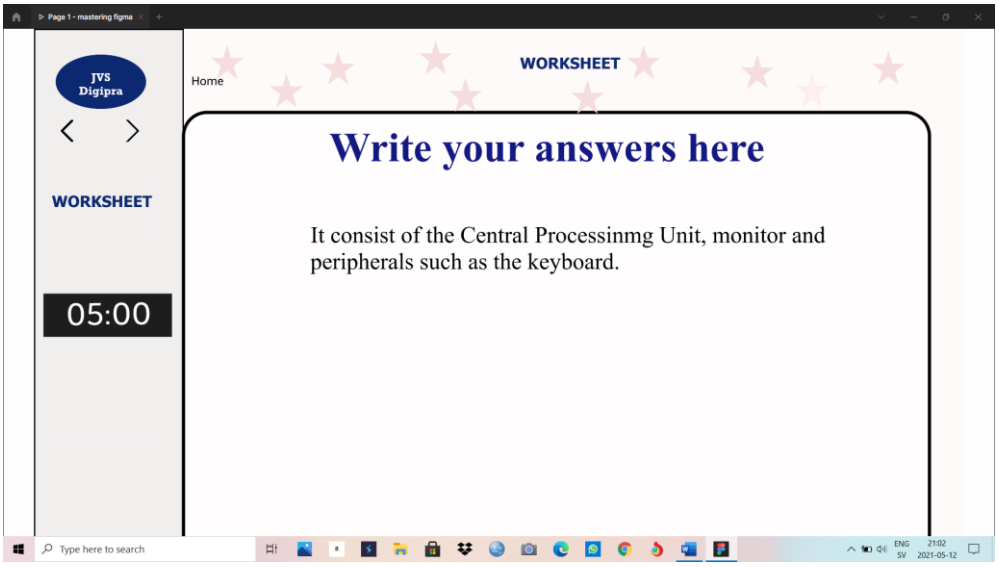
Thank you for your participation

## 9.2 Appendix 2 The Digital Learning platform prototype in images. (Sikalima, 2020)


JVS Digipra
Home
TASK SHEET
Task SHEET
10:00
Topic: Computers and Ratio
1. Name the main componets of a computer.
2. Three people A, B and C shared 12 mangoes in the ratio of 1:2:3. How many did each get? Show your work.
Present your work in the Worksheet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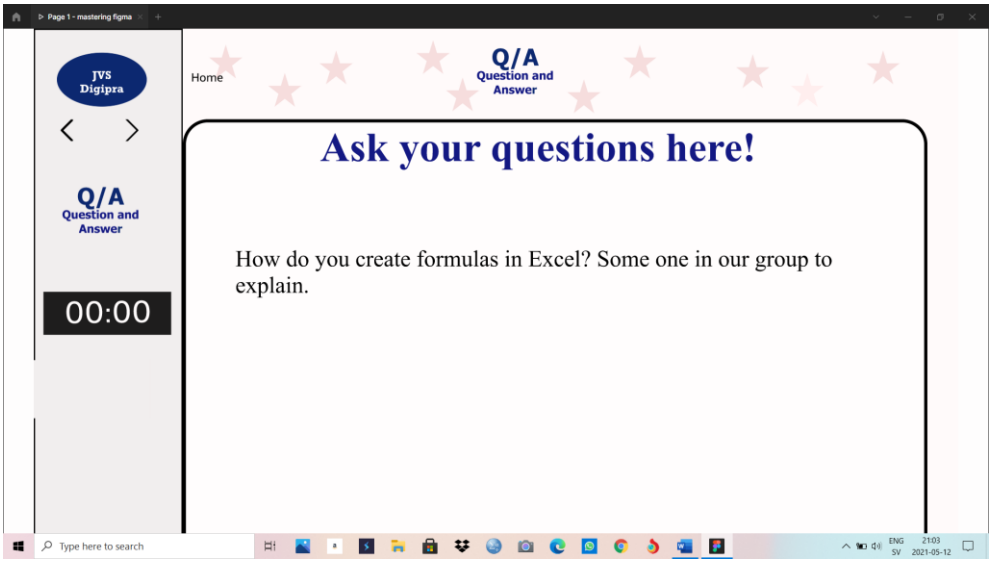
WORKSHEET
WORKSHEET
05:00
Write your answers here
It consist of the Central Processinmg Unit, monitor and peripherals such as the keyboard.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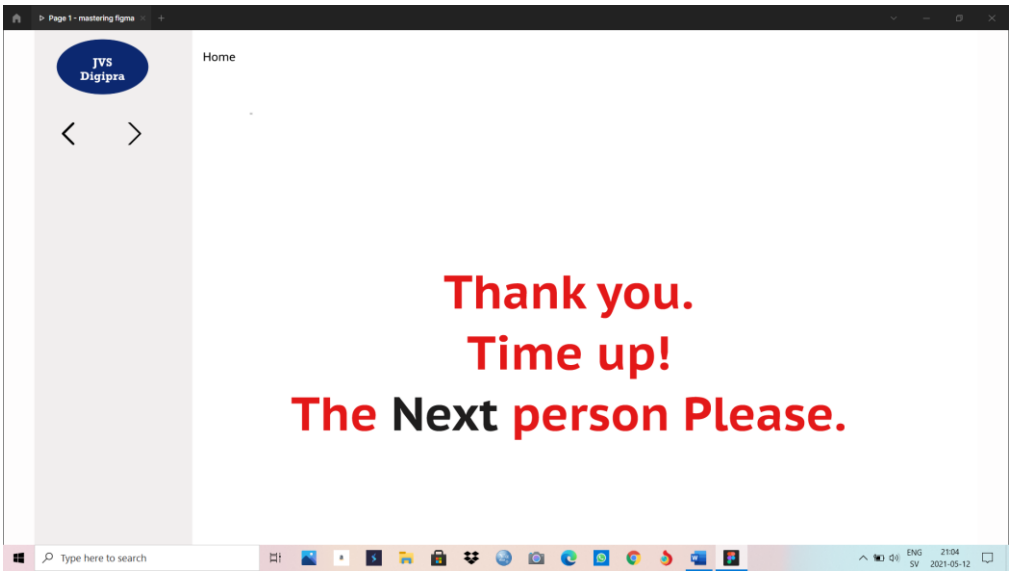
Home
Q/A
Question and Answer
Q/A
Question and Answer
00:00
Ask your questions here!
How do you create formulas in Excel? Some one in our group to explain.


Page 1 - mastering figma
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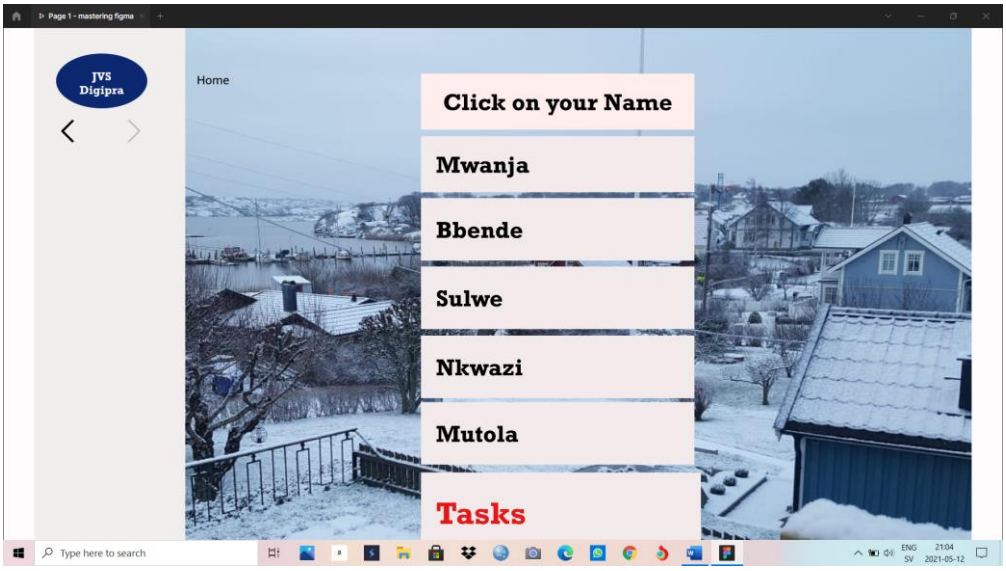
Home
Thank you.
Time up!
The Next person Please.
Type here to search


Page 1 - mastering figma
JVS Digipra
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Sulwe
Nkwazi
Mutola
Tasks
Type here to search