UNIVERSIDADE ABERTA

The potential of using smartphone in teaching and learning in Secondary school – A Descriptive study of selected schools in Maputo City

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Master in Pedagogy of eLearning

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A investigação realizada no âmbito desta Dissertação /Projeto está integrada nas linhas de investigação da Unidade de Investigação e Desenvolvimento - **Laboratório de Educação a Distância e eLearning**[1] (UID 4372/FCT), da Fundação para a Ciência e Tecnologia do Ministério da Ciência, Tecnologia e Ensino Superior.

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ABSTRACT

Today, Smartphones have spread all around the globe, from cities to remote areas. They have become essential and an integral part of our lives in which their use has and keeps impacting the way we conduct businesses, politics, socializing, communicating, and information sharing. From the education perspective, smartphone technology has shown its potential to create a mobile learning culture and enhance a socio-constructivist pedagogical model. A lot of research, mainly from the developed world, has focused on the benefits of the smartphone in higher education. Despite those findings from previous research that can apply in other geographical or regional settings; still, there are limitations as each community or society is unique in regards to social, economic, and cultural factors, among others. And Mozambique is not an exemption to the situation. This study aimed at exploring the potential of smartphone use in education with a particular focus on secondary schools. The study used the description method, and challenges that teachers and students have around the use of smartphones in teaching and learning in secondary schools. The literature review provided massive methods and applications of the smartphone in teaching and learning. In the literature review it is possible to identify that there is a group of teachers who perceive the use of the devices as pedagogical tools, and another group of teachers that are against or have a reservation towards its inclusion in education. Moreover, Students deemed the smartphones as highly necessary in education compared to teachers. The data retrieved from the literature review is align with the results obtained in the applied survey from the selected schools. The study documents that perhaps some teachers need the training to use such devices in teaching or that not all teachers and institutions have fully exploited the features and uses of smartphones in education, in particular, secondary school, and therefore, its use can be overlooked. As Mozambique fails to provide the technology stipulated in its Technological Education Plan of 2011 (TEP/PET) due to scarcity of financial resources, such can justify some teachers who overlook the reason at such technology like smartphones. From a literature perspective, it can be that some teachers are immigrants; therefore, they have difficulties in adopting or adapting to the trend. The study suggested that it is essential to try out some projects, such as teaching students with smartphones to yield comparison against traditional teaching and learning.

Keywords: Applications, Smartphones, Perceptions, challenges, secondary – schools,

RESUMO

Atualmente, temos smartphones espalhados por todo o mundo, das cidades às áreas remotas. Eles tornaram-se essenciais e parte integrante de nossas vidas, na qual seu uso tem impacto na maneira como conduzimos os negócios, a política, socializamos, comunicamos e partilhamos informações. Do ponto de vista da educação, os smartphones mostraram ter potencial para criar uma cultura de aprendizagem móvel, útil para o modelo pedagógico sócio-construtivista. Muitas pesquisas, principalmente realizadas em países desenvolvidos, concentraram-se nos benefícios do smartphone no ensino superior. O contexto e o cenário geográficos revelam que há menos estudos em países em desenvolvimento, como é o caso de Moçambique. Apesar das descobertas de investigações anteriores que podem ser extensíveis noutros contextos geográficos ou regionais; é necessário analisar outros contextos, pois cada comunidade ou sociedade é única dos pontos de vista social, econonómico e cultural, entre outros, e Moçambique não é uma exceção. Este estudo teve como objetivo explorar o potencial do uso de smartphones na educação, com foco particular nas escolas secundárias. O estudo usou o método descritivo para avaliar o conhecimento sobre recursos e aplicações, bem como as perceções e desafios que professores e alunos têm em relação ao uso de smartphones no ensino e aprendizagem nas escolas secundárias. Na revisão da literatura realizada foi possível identificar que métodos e o tipo de uso é dado ao smartphone no ensino e na aprendizagem. Na revisão da literatura verificou-se que há um grupo de professores que percecionam positivamente o uso dos dispositivos móveis como ferramentas pedagógicas, mas há um outro grupo de professores que são contra ou têm duvidas em relação à sua inclusão na educação. Adicionalmente, os estudantes consideraram o uso dos smartphones necessários na educação, revelando uma perspetiva mais positiva no seu uso em comparação com os professores. Os dados da revisão de literatura estão em linha com os dos resultados dos inquéritos aplicados nas escolas selecionadas. Pela aplicação dos inquéritos, foi possível verificar que alguns professores provavelmente precisam de formação para usarem os dispositivos móveis na aprendizagem e que nem todos professores e instituições tenham explorado completamente os recursos e usos dos smartphones na educação, em particular no ensino secundário. Atendendo que Moçambique não fornece a tecnologia estipulada no seu Plano de Educação Tecnológica de 2011 (TEP / PET), devido à escassez de recursos financeiros, isso pode justificar o motivo para alguns professores não usarem tecnologia digital no contexto educativo. Os professores do estudo também referem que os smartphones são caros, o que pode estar na origem dos alunos terem estes dispositivos em maior quantidade do que a dos professores e, consequentemente, não terem condições para tirar benefício do seu uso em sala de aula. Do ponto de vista da literatura, pode ser que alguns professores sejam imigrantes; portanto, eles têm dificuldades em adotar ou se adaptar às novas tendências de inovação. O estudo sugeriu que é essencial experimentar alguns projetos, onde, por exemplo, se compare um contexto de ensino com smartphones com o ensino e a aprendizagem tradicionais.

Palavras-chave: Aplicações, Smartphones, Percepções, desafios, escolas secundárias,

DEDICATION

I dedicate this work to my wife, Edna, and son Gift Imwa for support and motivation. My life makes so much sense knowing that they are by my side.

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I extend my appreciation and gratitude to all teachers and students who participated in this study. Your input fills a gap in this area of research and has helped to map the future fields of study.

To ISET-One World leadership and all colleagues, I thank you for the support and for allowing me to have time to do this work. I hope this be an inspiration for others who want to contribute to the academic and intellectual world.

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Lastly, to my wife, you were very supportive, a cup of coffee or tea to cheer me up when I feel exhausted, and all the care and patience you provided made it possible for me to achieve this.

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ABREVIATION LIST

TEP – Technology Educational Plan

ICT's - Information Communication Technologies

ESP – Education Strategic Plan

ZPD - Zone of Proximal Development

DOAJ - Directory of Open Access Journals

SIST – Strategy for Innovation in Science and Technology

MINED – Ministry of Education

PC's – Personal Computers

ERIC – Educational Resources Information Center

UNESCO – United Nations Educational, Scientific and Cultural Organization

1. INTRODUCTION

Today, the Smartphone has become one of the most potent and vital devices in the educational field. With its capability to connect to the Internet and provide people with access to millions of websites, and access to a variety of both commercial and non-commercial, online and offline apps from Android and iOS platforms that account to over 4.4 million (Clement, 2020), makes it an ideal substitute for a physical library or physical classroom. Ozdamli (2012) claims that with the developments of mobile technologies such as smartphones, education is under transformation towards more learner-centric theories, i.e., constructivist, situated, collaborative, informal, and lifelong learning. Herrington & Herrington (2007) further argue that justifiable conditions exist that mobile technologies provide a medium for authentic learning (p.1). Smartphone apps such as telegram, WhatsApp, Facebook, and YouTube give the students ability to connect with different experts from different fields of learning while in their hospital beds, from the comfort of their own homes, and convenient zones, on the go, and from diverse time zones and geographical positions with ease. Peters (2005), argues that mobile technologies provide a “just enough,” “just in time,” and “just for me” model of flexible learning (p.3). That implies that students are free to choose what they want/need to learn without being forced to participate in class, which deems necessary for them.

The smartphone features and applications like photo/video/sound shooting and its storage capacity give it a tremendous educational value in promoting social, interactive, and collaborative learning. Students can store and retrieve, create, and share new knowledge, curiosity, findings, and reports through different multimedia modes. Also, since smartphones promote mobile learning, learning, therefore, becomes spontaneous, continuous, lifelong, and informal hence students do not need to be in physical schools or classrooms necessarily; instead, it is ubiquitous.

In different disciplines, such as Science and language education, smartphones have a significant role in improving and increasing the speed at which the learners may learn a new language. The applications such as Google Translate help students to learn a new

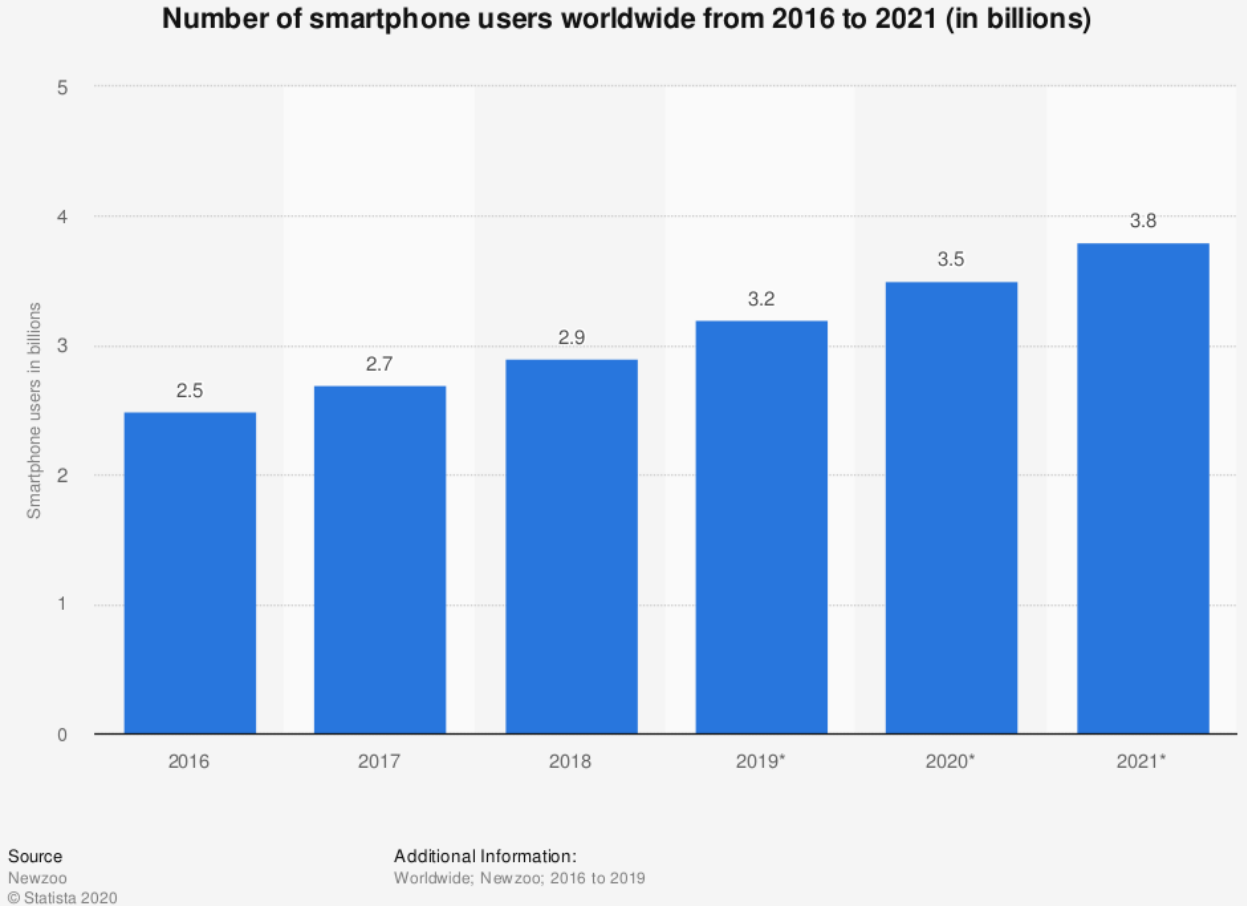
language instantly and effectively, hence, its ability to provide not only the translation but also the synonyms and correct audio pronunciation of the words in different languages. Apps such as Hello Pal, Babbel, and Duolingo have created a massive community of language students who wish to learn languages other than their mother tongues. Students can interact and learn exchange-ably with speakers from different language backgrounds. Math games, Khan Academy, and Grasshopper provide students with updated content, competitions, and tests that help them acquire new knowledge or cover the knowledge gap missed during classes at school. The Smartphone may help students to learn things ahead of their formal curriculum and stages, therefore allowing all categories of learners, i.e., fast, average, and slow, to learn at their own pace and finish the curriculum content with ease.

As smartphone ownership and use increase, thanks to affordability, connectivity, and internet expansion globally, it is no longer surprising to see both teachers and students owning a mobile or Smartphone even in developing countries such as Mozambique. Such penetration of mobile devices among the people is valuable in the implementation and delivery of education in this time when institutions, educators, and scholars are shifting to forms of social learning such as mobile, online, and e-learning. In a developing world like Mozambique, embracing mobile technologies such as a smartphone is paramount to improving the quality and quantity of teaching and learning.

The need to cope with the advancements in information and communication technology and transition to more learner-centered education, where the learners construct the knowledge than being transmitted to (Hamdan, 2014), the government of Mozambique through the ministry of education launched its educational, technological plan in 2011. The proposal recommended a shift from traditional (pedagogy of transmission) to the constructivist model, which supports interaction and collaboration in learning (PTE, 2011). Such a model encourages learners to create content and share it among them and regard teachers as one who map the way for learners to discover knowledge, “a facilitator,” “coaches,” and “co-learner” (Hamdani 2014, p.42). The PTE outlined the supplying of computers in schools where both teachers and students can have access to virtual

learning environments and digital learning materials and learn interactively with both teachers, specialists, and even at home. While the plan is realistic in this digital era, it is also challenging to implement it for a developing country, in this case, Mozambique. Computers are still expensive to purchase for all schools nationwide. However, considering the proliferation, ubiquity, and affordability of smartphones, perhaps an alternative is just a step away. According to O'Dea (2020), the year 2020 has over 3.5 billion smartphone users worldwide (see graph 1.1). In 2018, Mozambique, with a population of at least 30 million ("Mozambique Population (2020) - Worldometer", 2020), has at least 14 million mobile phone subscriptions (O'Dea, 2020), which includes over 6.5 million internet users as of the year 2020. The figures demonstrate excellent development in access to data in general. From the educational perspective, it is specifically a milestone as the presence of smartphones provides essential features and uses, which can improve secondary school education in Mozambique. But to establish concrete theories or practical principles around the use of smartphones in teaching and learning in the context of Mozambique, it is crucial to explore the features, uses, perceptions, and challenges around its use among the teachers and students.

Graph 1. 1 Number of smartphone users worldwide from 2016 to 2021 (in billions)



Source: Statista 2020

The following parts of this chapter will delve into the problem statement, main and specific objectives, research questions, and personal justifiable cause driving this study.

1.1. Statement of the Problem

Today, Smartphones have spread all around the globe, from cities to remote areas. They have become essential and an integral part of our lives in which their use has and keeps impacting the way we conduct businesses, politics, socializing, communicating, and information sharing. From the education perspective, smartphone technology has shown its potential in creating a mobile learning culture and enhancing a socio-constructivist pedagogical model. A lot of research, mainly from the developed world, has focused on the benefits of the Smartphone in higher education. A few have looked at other levels,

such as primary and secondary education. While most research has looked at the benefits, perceptions of teachers and students, and challenges that surround smartphones use in school, especially at higher education institutions, the context and setting are geographic and fewer studies are from the developing countries such as Mozambique. Despite those findings from previous research that can apply in other geographical or regional settings; still, there are limitations as each community or society is unique in regards to social, economic, and cultural factors, among others. There is a scarcity of specific studies around smartphone use in secondary school education, especially in developing countries like Mozambique; therefore, this study aims at contributing to the literature from a geographical perspective.

1.2. Objectives

1.2.1. General Objective

The general objective of the research is: to explore the potential of using Smartphone in teaching and learning in secondary schools in Maputo

1.2.2. Specific Objectives

The following particular objectives guide the study

- To identify the potential features and uses of smartphones in education in secondary schools
- To assess the perceptions of teachers and students on the use of Smartphones in teaching and learning in secondary schools
- To explore the challenges around the use of smartphones in secondary school education.

1.3. Research Questions

1. What potential features and applications do smartphones have, which can improve the quality of education in secondary schools?
2. How do teachers and students perceive the use of Smartphone in teaching and learning in secondary schools

3. What challenges do exist around the use of smartphones in secondary school education?

1.4. Justification

The advent of the personal computer with World Wide Web connections land-marked a new paradigm about how society conducts its business, communication, connect with the global community, and, in particular, how people learn. As technology has kept advancing, not long ago did the world experienced new powerful handheld computer gadgets such as tablets and smartphones. In just two decades, the presence of smartphones has rapidly increased and spread to almost all parts of the world, irrespective of developed and developing nations. Interestingly, the presence of smartphones in schools, especially in secondary schools and higher educational institutions, is seemingly increasing. Such development is crucial for promoting and implementing a social constructivist pedagogy. With smartphones, people can learn almost everything through the use of its online and offline applications and access to millions of websites.

My experience of using the mobile phone to learning Portuguese and currently coding is one of the reasons I have decided to explore more on this theme. I think that it is imperative to overlook the more significant opportunity that Smartphone gives us. I have used my Smartphone to improve written and speaking skills through features like autocorrecting that smartphones do offer. Applications such as Hello pal, Mondly French, Babbel is very intuitive and gives good content that can improve pronunciation, vocabulary, and listening skills. Google Translate and DeepL are some of the essential apps that have developed its algorithm where the text is translated in context, primarily when the text is written in a coherent manner and with no grammatical errors. Khan Academy and OpenStax applications contain quite a range of free updated books, lessons/courses, and tests which complement the teaching and learning process and are more valuable in poor or remote areas where government access to allocated school materials are scarce.

The increase in the presence of smartphones in schools among teachers and students is another reason that should give me the motivation to learn more about the pedagogical uses of smartphones. I think it is high time that instead of repelling from this reality that we are living in, we should embrace it and find possible means to change our ways and practices of teaching and learning. Smartphones provide us with the opportunity to learn from anytime and anywhere. This is important as it increases production in any aspect of life. It is about time to change our mentality that we sit in class only to learn; instead, we can have audio material to listen to while on the train, bus, or sports workouts.

Besides, I hope the results of the study will inform those who are adapting to this trend of mobile and constructive learning and those that are willing to change their ways and practice towards more progressive and digital-oriented and learner-centered education. The study can further provide teachers or educators with critical reflections towards finding solutions to the challenges that come with mobile technology use in education. In general, the study intends to shed light to all stakeholders such as Policymakers, practitioners, educators, teachers, student community on the opportunities that can revolutionize education in a developing country such as Mozambique.

1.5. Structure of the paper

The present paper contains six (6) chapters as follows:

1. The background of the research which highlights the aims, objectives, research questions, and justification of conducting this study.
2. Chapter two (2) presents the literature review. It includes the method used to source and gather the primary data and provides an in-depth analysis of the sourced literature in line with the study's objectives. The main headlines in the review are as follows:
    1. Smartphones and constructivist theory of learning
    2. The potential uses and applications of smartphones in education
    3. Teacher – Students' perceptions of smartphone use in education
    4. Education policy on ICT's Integration in Mozambique schools and
    5. The challenges that surround the use of smartphones in education

3. Chapter three (3) describe the methodology (descriptive method) of the research. It discusses the meaning of and its context. The section further addresses the study area, sample population, data collection tools, pilot study, ethical consideration, and how validity and reliability.
4. Chapter four delves into the results of the survey. It presents the actual picture of the results from both teacher and student surveys. All items are tabulated and where possible tables and graphs summarize the data.
5. Chapter 5 is about data presentation and discussion according to the objectives of the research and the survey. The section also presents Limitations of the study and areas of future studies
6. The last section is a general conclusion of the whole research. It provides a brief discussion and discoveries of the research project.

2. LITERATURE REVIEW

2.1. Introduction

In this review, the theoretical background of the theme in research is presented. This review brings different views, arguments, and supporting facts in response to the specific questions guiding this research. However, to get the most relevant evidence from various sources of data, a Scoping review method was used to gather literature from the three (3) selected databases, i.e., Google scholar, Eric, and Directory of Open Access Journals (DOAJ). The next paragraphs describe the meaning of the Scoping method and how to use it to collect suitable literature for review. This will be followed by an in-depth analysis of the literature selected for this study.

2.2. Method of the literature review collection: the scoping study method

There is still no fixed definition of the scoping review method, as mentioned by researchers such as Levac et al. (2010), Colquhoun et al. (2014), Pham et al. (2014), and Peters et al. (2015). The researchers agree with the fact that the method is still new but acknowledges its purpose in determining the extent and gaps in the existing literature. Despite the technique being commonly used in the medical field, its process is also valuable in research settings such as education, as it is a *"preliminary"* activity in any research investigation in as far as providing a theoretical foundation to the problem in question, is concerned. This is argued by Peters et al. (2015) that mentioned the need to have a method to rapidly *"reviewing literature which has not yet been comprehensively reviewed"* (p.141). In general, this means that the scoping technique is suitable to gather literature or evidence before the comprehensive review in any research. Through this method, the researchers may define the specific search, inclusion, exclusion, audience, level, and time among other criteria to ensure that the most relevant results are achieved.

2.3. Context

In the course of gathering literature to be reviewed concerning the specific objectives of this research, a particular search criterion was defined and followed. Specific research phrases and keywords, as shown in Table 2.1.

Table 2. 1 Research phrases and keywords

No.	Phrase	Keywords
1.	Teachers' and students' perceptions over the use of mobile/smartphones in teaching and learning?	Teacher, perceptions, mobile-phone, Smartphone, teaching, learning
2.	Constructivist Theory and Mobile/smartphones	Learning theory, mobile/smartphones, constructivist theory
3.	Education Policy on ICT's Integration in Mozambican Schools	ICT's Policy, Education, Mozambique
4	Potential uses of smartphones in the teaching and learning process	uses, Smartphone, teaching-process, education
5	Potential challenges in using mobile/smartphones in teaching and learning	Challenges, disadvantages, Smartphone, teaching, learning

Three (3) databases were selected; Google Scholar, Eric, and Directory of Open Access Journals (DOAJ). From each database, keywords from each question were entered and the first 10 to 15 results from the year 2010 to 2019 based on relevance to the topic in question, Open Access, full text, peer-reviewed, and published content mainly from different educational journals were considered for inclusion. The criteria saw no geographical boundary but disregarded all material which was published in none other than the English Language.

A quick reading to determine if the article, book, or magazine was fit for inclusion in the comprehensive literature review was done, and this also helped to control the quality of the literature sourced for evidence and arguments. Repeated results from the selected

databases were excluded. Table2.2 demonstrates an example of how the results from the database search were tabulated.

Table 2. 2 Literature search tabulation

Topic 1: Teacher perceptions on the use of mobile/smartphone in teaching process			
Keywords: Teacher, perceptions, mobile-phone, smartphone, teaching, learning			
Papers	**DB1: Google Scholar**	**DB2: ERIC**	**DB3: DOAJ**
Ismail, I., Azizan, S. N., & Azman, N. (2013). Mobile Phone as Pedagogical Tools: Are Teachers Ready? *International Education Studies, 6* (3), 36-47. doi:10.5539/ies.v6n3p36	X	X	
Nawi, A., Hamzah, M. I., & Rahim, A. A. (2015). Teachers Acceptance of Mobile Learning for Teaching and Learning in Islamic Education: A Preliminary Study. *Turkish Online Journal of Distance Education, 16* (1), 184-192. doi:10.17718/tojde.30611		X	
Apuke, O. D., & Iyendo, T. O. (2018). University students' usage of the internet resources for research and learning: Forms of access and perceptions of utility. *Heliyon, 4* (12). doi:10.1016/j.heliyon.2018.e01052			X

During the scoping review process, some challenges included: the lack of more filtering features, the specific research area, and the audience. Specifically, in Google scholar, where it was impossible to limit the search results to "Open Access" content, the challenges were substantial as compared to the ERIC and DOAJ databases. In the DOAJ database, it was challenging to get the results using the same number of keywords compared to the other two databases. Also, the nature of the research question, which seeks to explore the potential use of Smartphones in teaching and learning, the search commands returned many results from all areas of research. This was seen as a challenge to the researcher since it was necessary to reconsider and refine the search and selection criteria. In cases where search command returned zero results, such as in the DOAJ database, the keywords were reduced, or similar words were used to see if they could return relevant results alternatively. This helped and increased the number of literatures to be reviewed.

2.4. Summary of results from the literature search

The scoping study was done to gather the literature, which would be included in the comprehensive review. Each phrase had the specific keywords used to search the literature. Table 2.3 has a summary of articles from each database concerning particular objectives guiding this research.

Table 2. 3 Literature search results.

No	Questions	Key-words	DB1: Google Scholar	DB2: Eric	DB3: DOAJ	Total from the DBs
1	Students and Teachers perceptions on the use of mobile/smartphone in teaching process	Teacher; perceptions; mobile-phone; smartphone; teaching; learning	8	4	1	13
2	Constructivist theory and mobile/smartphones	Learning-theory, mobile/smartphones, constructivist theory	2	6	1	9
3	Potential uses of smartphones in teaching process	Potential, Uses, smartphone, teaching-process, education	9	8	3	20
4	Education Policy on ICT's Integration in Mozambican Schools	ICT's Policy, Education, Mozambique	3	0	0	3
5	Potential challenges in using mobile/smartphones in teaching and learning	challenges, disadvantages, smartphone, teaching, learning	6	6	1	13
Total			**28**	**24**	**6**	**58**

It is concluded from the results as shown above that 58 papers from the three databases, which include 54 journal articles, two dissertation papers, and two books were carefully selected for the comprehensive literature review. The next part of this chapter presents the actual analysis of the detailed study of the literature sourced.

2.5. Smartphones and Constructivist learning

In total, 11 papers which include 3 books, one conference article, 6 journal articles, and a Master Thesis were selected for the review around smartphones and Constructivist Learning.

Table 2. 4 Metadata from the inclusion and exclusion criteria

Articles				
Title	**Year**	**Peer-reviewed**	**Type**	**Designation**
Mind in society - the development of higher psychological processes	1978	✓	Book	*Cambridge, Massachusetts, Harvard University Press*
Constructivist Learning Theory	1991	✓	Conference article	*CECA (International Committee of Museum Educators) Conference -*
Learning theories: an educational perspective (6th Edition)	2012	✓	Book	*Pearson, Boston*
An Epistemological Glance At The Constructivist Approach: Constructivist Learning In Dewey, Piaget, And Montessori	2012	✓	Journal Article	*International Journal of Instruction*
Adoption and Application of Mobile Learning in the Education Industry	2013	✓	Journal Article	*Procedia - Social and Behavioral Sciences*
Textbooks and Constructivist Pedagogy in Saudi Arabian School Classrooms	2014	✓	Journal Article	*Journal of Curriculum and Teaching*
Technology Integration and Learning Theory	2015	✓	Journal Article	*American International Journal of Contemporary Research*
Handbook of research on educational technology integration and active learning	2015	✓	Electronic Book	*Information Science Reference, IGI Global*
The Current Perspectives, Theories and Practices of Mobile Learning	2016	✓	Journal Article	*The Turkish Online Journal of Educational Technology*
The effects of integrating mobile devices with teaching and learning on students learning performance: A meta-analysis and research synthesis	2016	✓	Journal Article	*Computers & Education*
Students' and Teachers' Perceptions of the Use of Mobile Technology in University Preparation Classes	2017	✓	Master Thesis	*Massey University, Manawatu Campus*

Smartphones, despite not being specifically designed for education, they have and still can improve the teaching and learning if adequately integrated, adapted, and adopted into the 21st-century classrooms. Constructivist Learning Approach is founded on Vygotsky's social-cultural theory, which posits that human development occurs through

socialization, culture transmission, and individual characteristics (Schunk, 2012). Vygotsky claims that during interaction/socialization, learners delve into different experiences, which help to bring reflections on different prior knowledge and to (re)constructing new knowledge. The theory further states that as children develop, they can do some tasks without assistance. In some cases, learners interact for help to solve their problems – a concept which he coined as Zone of Proximal Development (ZPD). From this point, it is clear that the fundamental principle behind the constructivist learning is that learners must construct their knowledge through interaction and engagement (Ultanir, 2012, Aldrich, 2017). A process that is against the popular traditional theory of learning most common before the 21st century, which supports the knowledge transmission where teachers assume the role of knowledge source and learners as passive recipients of it. Through constructive learning, learners, therefore, are involved in the process and all its learning activities. Teacher's role, therefore, is to facilitate, coach, and support the learning process. There is interaction with teachers and amongst the learners. Abdulkareem & Hentschke (2014) reports that through the constructivist curriculum, the learners are engaged in real-life activities to develop their higher-order thinking than memorizing bits of information (pg 15-16). Learning is through discussions, debates, experimentation, and above all, learners have the liberty of choosing how and what to learn. Hein (1991) explored further the principles of constructivist learning in which he explains that it is; social, active, mental, and contextual and an experiential act, among others.

Smartphone features do provide the people with the freedom to socialize and engage in different activities such as discussions via social media platforms like Telegram and Facebook. If such activities are adapted to teaching and learning, it is, therefore, no question that smartphones fit with the constructivist theory of learning. Researchers on mobile devices and pedagogy such as Keskin & Metcalf (2011), Hamdani (2014), and Aldoobie (2015) have all reported that technology, in particular, mobile technology such as smartphones are or can be integrated as pedagogical devices or tools. They cite that mobile technology aligns well with the constructivism theory as they expose the learners to a bottom-up type of learning where students are at the forefront of discovering the

knowledge other than being taught. Sung, Chang, and Liu (2016) reported that primarily mobile devices contribute to increased motivation and engagement among learners, and these are some of the principles of constructivist learning. They added that smartphones facilitate *personalized, informal, and formal education.* While formal learning can be organized in specific subjects, time, and exams, with smartphones, knowledge is seamless. Students can immerse themselves into different exciting material on their own. A good example is when watching some videos on YouTube where there is a lot of content, some similar and some wholly new and different and from different range of subjects. With the liberty of choosing what to watch/learn, learners can move from one topic to another informally and voluntarily, ending up with new learning, which is unguided.

Bidin and Ziden (2012), also provides some critical applications of smartphones in line with the constructivist learning approach. They argue that despite mobile games bringing *fun* to people, they are essential tools of engaging learners in the learning process. The fact that many games have different levels of difficulty where easy is preceded by the hard level etc.makes the learners (players) develop higher thinking levels to pass to the next level. Keengwe (2018) adds that since games are gamer/learner-centered, require engagement and more top cognitive skills, and are contextual and authentic; they align with constructivist theory (p. 4). Collaborative learning is another constructive-pedagogical advantage of smartphones where learners may team up to solve a critical problem or challenge or simply to research and document findings. Applications such as blogs and wikis may involve learners from different parts of the world at studying and documenting the findings. Through such collaboration, the research may have broader and diverse perspectives, which may give a more significant impact on generalizing the facts or results.

2.6. Education policy on ICT's integration in Mozambican schools

In total, 3 papers which include, one article from conference proceeding, 1 journal article, and a Gazzette were selected for the review around Educational Policy on ICT's integration in Mozambican Schools

Table 2. 5 Metadata from the inclusion and exclusion criteria

Articles				
Title	Year	Peer-reviewed	Type	Designation
MINED. Education Strategic Plan	2012	✓	Gazzette	*Academica LDA, maputpo*
ICTin Education in Africa - Myth or Reality: A Case Study of Mozambican Higher Education Institutions	2013	✓	Journal Article	*The African Journal of Information Systems*
Southern Africa Regional Meeting on Integrating ICTs in Teaching and Learning	2015	✓	Conference proceedings	*Southern Africa Regional Meeting on Integrating ICTs in Teaching and Learning*

Mozambique is one of the countries in the Southern Africa region that pioneered the adoption of global ICT integration in all of its government sectors earlier in 2000. The implementation later started in 2002 through its Strategy for Innovation in Science and Technology (SIST), which aimed at the expansion of ICT infrastructure and use on *improving the production process, service delivery, education and the living conditions of its citizens* (Muianga et al. 2013, p.110). In its initial phase, it can be observed that the integration was aimed at creating a network of information and the transition from manual to computerized processing of data in all sectors. In schools, plans were that computers be provided to develop laboratories so that students acquire some ICT knowledge and skills at the end of the school circle and in addition to improve the education administrative process, especially in those electrified areas.

In 2011, a strategic Technological Education Plan (TEP) was designed and adopted to be fully implemented in the Schools of Mozambique (UNESCO, 2015). The TEP has three main objectives, which include; *—mobilizing and training teachers to use ICTs in education, improving school management, and improve the quality of education through the introduction of ICTs as a tool for teaching different subjects* (Education Strategic Plan [ESP] – MINED, 2012, p. 47-48). The ESP also stipulates that its vision is to transition education towards e-learning. Although the Smartphone is not mentioned explicitly in the TEP, it is embedded in the ICT's as one of the examples. For eLearning to occur, mediators such as personal computers, laptops, tablets, smartphones, and internet connection must be available.

While the TEP is and still under implementation, it can be noted that not all schools have been integrated or are implementing the plan. The process is slow as some schools still face challenges of electrification and lack of ICT equipment since the government is the primary provider. It can be observed that urban schools are at an advantage of implementing ICT integration compared to those in remote areas citing lack of sufficient funds to secure the ICT equipment and capacity of teachers to teach and use ICTs in teaching and learning (UNESCO, 2015). In addition to the challenges, Muianga et al. (2013), also discovered in their study that despite the presence of the TEP and SEP, no legislation obligates teachers to use ICTs as a tool for teaching and learning in the classrooms (p. 110). Such a situation demonstrates that some rigorous actions in terms of legislation and specific pedagogical means must be defined to aid total integration of the ICT's in Mozambican education.

2.7. Potential uses of smartphones in teaching and learning

Under this topic, twenty-two journal articles and one master thesis were included for thorough review (see table 2.6).

Table 2. 6 Metadata from the inclusion and exclusion criteria

Articles				
Title	Year	Peer-reviewed	Type	Designation
20 Ideas for Using Mobile Phones in the Language	2010	✓	Journal Article	*ELT Forum*
The Potential of Mobile Technologies for (English) Language Learning in Nepal	2012	✓	Journal Article	*Journal of NELTA Technology*
iDocument: How Smartphones and Tablets are Changing documentation in Preschool and Primary Classrooms	2012	✓	Journal Article	*Technology and Young Children*
The Smartphone in Medicine: A Review of Current and Potential Use Among Physicians and Students	2012	✓	Journal Article	*Journal of Medical Internet Research*
Learning to take the tablet : How pre-service teachers use iPads to facilitate their learning	2013	✓	Journal Article	*ASCILITE-Australasian Journal of Educational Technology*
The impact/s of Using Mobile Phone on English Language Vocabulary Retention	2013	✓	Journal Article	*International Research Journal of Applied and Basic Sciences*
Teaching via Mobile Phone: a Case Study on Malaysian Teachers' Technology Acceptance and Readiness	2013	✓	Journal Article	*The Journal of Educators Online*

"I don't think I would be where I am right now". Pupil perspectives on using mobile devices for learning	2013	✓	Journal Article	*Research in Learning Technology*
Software Socrative and Smartphones as Tools For Implementation of Basic Processes of Active Physics Learning in Classroom: An Initial Feasibility Study With Prospective Teachers	2013	✓	Journal Article	*European Journal Of Physics Education*
WhatsApp goes to school: Mobile instant messaging between teachers and students	2014	✓	Journal Article	*Journal of Information Technology Education*
Investigating the Use of Smartphones for Learning Purposes by Australian Dental Students	2014	✓	Journal Article	*JMIR MHealth and UHealth*
Mobile Phones As Useful Language Learning Tools	2015	✓	Journal Article	*European Scientific Journal*
Investigating teachers' adoption of signature mobile pedagogies.	2015	✓	Journal Article	*Journal of Computers & Education*
Exploring the Use and the Impacts of Social Media on Teaching and Learning Science in Saudi	2015	✓	Journal Article	*Procedia – Social and Behavioral Sciences*
Teaching and learning with mobile computing devices: Case study in K-12 classrooms	2015	✓	Journal Article	*TECHTRENDS*
Learners' Perceptions of the Use of Mobile Technology in a Task-Based Language Teaching Experience	2016	✓	Journal Article	*International Education Studies*
Exploring ELT Students' Perception of Mobile Phone through Figurative Language	2016	✓	Journal Article	*Sakarya University Journal of Education*
The Impact of Mobile Phones on English Language Learning: Perceptions of EFL Undergraduates	2016	✓	Journal Article	*Journal of Language Teaching and Research*
Students' and Teachers' Perceptions of the Use of Mobile Technology in University Preparation Classes	2017	✓	Master Thesis	*Massey University, Manawatu Campus*
The Use and Effects of Smartphones in Higher Education	2017	✓	Journal Article	*International Journal of Interactive Mobile Technologies (IJIM)*
University students' usage of the internet resources for research and learning: forms of access and perceptions of utility	2018	✓	Journal Article	*Heliyon,*
Use of mobile phones as supplementary teaching and learning tools to learners in South Africa	2018	✓	Journal Article	*Journal of Reading & Writing*
Web 2.0 for fostering students' social presence in online learning-based interaction	2019	✓	Journal Article	*Journal of Technology and Science Education*

The technological advancement of macro-computers, such as desktops and laptops to micro-computers such as tablets, smartphones, and smartwatches, has changed the way people access the internet, connect and socialize with people globally. The Internet has created a one global community (Apuke & Iyendo, 2018). Smartphones, with its mobility, portability, and capability of Wi-Fi and a mobile broadband connection; and the fact that

it can be used anywhere and at any time (Pegrum, Howitt & Striepe, 2013; Aldrich, 2017), have influenced people's choice over the type of computer to be used in daily life. Today, information and knowledge sharing have become more accessible through Smartphones and other handheld mobile devices in that through different web 2.0 tools such as Facebook available through these devices has promoted students' academic performance (Al-Dheleai &Tasir, 2019). It is of no question that there is a massive potential of using smartphones in teaching and learning as their features are unique and in line with education despite not being necessarily produced for such a purpose. Besides, it is imperative to deny the presence of the mobile/smartphones in the classrooms (Ngesi et al. 2018) as both students and teachers have access or have at one point used these devices.

Research conducted mostly in the western and Asian countries has documented several benefits about the potential uses of the Smartphone in general and in particular to different subjects such as Mathematics and English language learning. Calabrich (2016), mentions that smartphones offer a wide choice of ways of supporting English learning in the classroom as well as beyond the classroom. Senel (2016) supports the claim adding that smartphones provide liberty to students in terms of time and place of study since they can use their free time and informal situations in which they find themselves to learn a foreign or second language. Shrestha (2011), contrasts the benefit of using mobile or smartphones in teaching and learning the English language over desktop types of the computer from the perspective of mobility and flexibility. Also, the opportunity of 24 - hour learning material access and teacher feedback (El Hariry, 2015), is paramount when it comes to students' choice among communication technologies. Nalliveetil & Alenazi (2016) also mention the importance of mobile devices, especially those with internet access, which provide an opportunity of access to millions of websites with a higher degree of accuracy (p. 264). Of over 5 million Applications (www.statista.com), found on both Google-play and Apple stores, there exists a good number of applications which when integrated with the teaching and learning process within and outside the classroom can impact the learners' speed and efficiency at learning different subjects such as Mathematics, Science and languages. Hashenmi & Abbasi (2013) proved in their study

that with mobile phones, vocabulary retention increased among the students. Among other uses of mobile and smartphones in language learning include text messaging, voice response, and access to both online and offline content via the Applications (Shrestha, 2011). Reinders (2010) also described twenty ideas about using mobile phones in the language classroom. He included “phlogging,” where language learners may “call a number and leave a message on a website” (p. 23) and this activity is similar to Google AI – speak to the text where one can practice speaking. The app transcribes the audio into text, which can allow improving both oral and written skills in English learning. A study by Al Farweh and Jusoh (2017), found out that smartphones are preferred to other types of computers as they contain a bunch of applications in one unit. Applications such as email, helped the teachers and students to stay connected at all times. The digital calendar helped both students and teachers to organize their class activities.

One notable trend which is highly associated and supported by smartphones is m-Learning or Mobile learning. It is the model of education which is mediated by the mobile devices such as tablets, iPad, gamepads, and most commonly smartphones (iPhone inclusive), (Ismail et al. 2013; Pegrum, Howitt & Striepe, 2013; Kearney, Burden & Rai 2015). Smartphones may be the most preferred choice in mobile learning as they are ubiquitous and with higher processing speed and capability of both wireless and broadband internet connection. With smartphones, the students, while on the go, maybe listening to podcasts on different subjects and watching educational videos, such as experiments of science in nature. With a vast number of various applications, schools can take advantage of using some specific applications in line with the curriculum content to help bring different experiences in students learning, such as “bird-watching” and access to online museums (Ismail et al. 2013).

From another perspective, a smartphone can be regarded as the most commonly used medium of social media. Today information sharing just needs a few clicks before it reaches the end of those who need such information. Sharing buttons like tweeter, Facebook, WhatsApp, and Telegram makes it easier to share information and knowledge to the social media platforms, which today most people are accessing them through

smartphone applications. The collection of internet-based applications that facilitate the *creation and exchange* of *user*-g*enerated content* (Alabdulkareem, 2015, p. 215), allow teachers and students to engage in various educational groups to discover new knowledge, share experiences, and debates synchronously and asynchronously with the aid of a smartphone. Grant et al. (2015) reported that some teachers used smartphone apps like Evernote to document the students' work and progress and used it during the meetings with parents and guardians to show the development of their children. Parnell & Bartlett (2012) made a crucial case that demonstrates how preschool and primary school teachers can document young learner's progress to connect with parents for a continuous learning experience. They mentioned that by recording and sharing them with parents, parents will have the opportunity of viewing the learners' progress and may ask their children specific questions that could help children share what they have learned. In that doing, they internalize the knowledge. By recording the learners in the process, it allows teachers to assess different students objectively instead of evaluating the student product only (Parnell & Bartlett, 2012). Research by Walter (2013) also documented some positive results of students from two schools, one which allowed the use of mobile devices and the other, which did not recognize. The study revealed that students who used Google to search for supplementary learning content and Google Calendar to aid their learning performed better. Through apps such as FaceTime, students connected with their classmates to find help in some concepts such as mathematics and science problems, which they could not understand on their own.

Exploratory research by Bouhnik & Deshen (2014) found out that WhatsApp application, which is accessible via Smartphone, has now become one of the tools which facilitate communication worldwide. Bouhnik & Deshen documented that the WhatsApp groups were used as communication hubs, socialization environment, dialogue, information/material sharing, and learning platform. The research further mentioned that through the WhatsApp groups, students would ask/respond to questions and send photos of notebook sketches. In contrast, the teachers would post links to the study material. Coca & Slisko (2013) also provided some beneficial uses of the Smartphone through software called Socrative, which is accessible via both web and Smartphone, where

teachers ask questions and get responses in real-time. Coca & Slisko added that using a smartphone is cost-effective compared to other devices such as “clickers.” Schools and universities with higher student populations such as Anadolu University in Turkey and Ryerson University in Canada have reached out to their students through mobile services such as the mobile library, campus maps, and other important information (Yu,2012; Aldrich, 2017). Rung et al. (2014) explored other uses of smartphones for learning at a University in Australia and found out that the device was significant at helping students seek and access “*professional advice”* during their practicum away from the school. A similar situation is reported by Ozdalga et al. (2012) that despite a lack of profound evidence, smartphones through applications such as Epocrates, functioned as a reference to both Medical students and physicians.

2.8. Teacher – Student perceptions of smartphone use in teaching and learning

Under this subject, 15 journal articles, 1 master thesis, and one conference proceeding article, were selected for the extensive review (see table 2.7)

Table 2. 7Metadata from the inclusion and exclusion criteria

Articles Title	Year	Peer-reviewed	Type	Designation
The Use of Mobile Phones in Learning English Language by Sultan Qaboos University Students : Practices, Attitudes and challenges	2011	✓	Journal Article	*Canadian Journal on Scientific & Industrial Research*
Mobile/Smart Phone Use in Higher Education	2012	✓	Conference paper	*Southwest Decision Science Institute Conference*
iDocument: How Smartphones and Tablets are Changing documentation in Preschool and Primary Classrooms	2012	✓	Journal Article	*Technology and Young Children*
Learning to take the tablet : How pre-service teachers use iPads to facilitate their learning	2013	✓	Journal Article	*ASCILITE-Australasian Journal of Educational Technology*
Software Socrative and Smartphones as Tools For Implementation of Basic Processes of Active Physics Learning in Classroom: An Initial Feasibility Study With Prospective Teachers	2013	✓	Journal Article	*European Journal Of Physics Education*
The Intersection of Preservice Teachers ' Confidence , Perceptions , and Ideas for	2013	✓	Journal Article	*International Journal of Higher Education*

Using Instructional Technology for Teaching and Learning				
Mobile Distance Learning with Smartphones and Apps in Higher Education	2013	✓	Journal Article	*Educational Sciences: Theory & Practice*
Smartphones Promote Autonomous Learning in ESL Classrooms	2013	✓	Journal Article	*Malaysian Online Journal of Educational Technology*
Investigating the Use of Smartphones for Learning Purposes by Australian Dental Students	2014	✓	Journal Article	*JMIR MHealth and UHealth*
Opinions and Attitudes of Prospective Teachers for the Use of Mobile Phones in Foreign Language Learning	2015	✓	Journal Article	*Contemporary Educational Technology*
Learners' Perceptions of the Use of Mobile Technology in a Task-Based Language Teaching Experience	2016	✓	Journal Article	*International Education Studies*
The Impact of Mobile Phones on English Language Learning: Perceptions of EFL Undergraduates	2016	✓	Journal Article	*Education and Information Technologies*
Students' and Teachers' Perceptions of the Use of Mobile Technology in University Preparation Classes	2017	✓	Master Thesis	*Massey University, Manawatu Campus*
Mobile phone use in two secondary schools in Tanzania	2017	✓	Journal Article	*Education and Information Technologies*
The Impact of Experiencing a Mobile Game on Teachers Attitudes Towards Mobile Learning	2017	✓	Journal Article	*International Journal of Mobile and Blended Learning*
Using Mobile Phones in Learning English: The Case of Jordan	2017	✓	Journal Article	*Journal of Education and Human Development*
Students , Mobile Devices and Classrooms : A comparison of US and Arab Undergraduate Students in a Middle Eastern University	2017	✓	Journal Article	*Higher Educational Studies*
Attitude towards Mobile Learning in English Language Education	2018	✓	Journal Article	*Education Sciences*

2.8.1. Teacher Perceptions

The presence of smartphones in the teaching and learning environments is perceived differently among teachers. While some teachers advocate the use of smartphones in education, some are against and others are neutral, i.e., they think it can be used but only in specific situations which they believe it suits and not always and in any discipline. The advocates have at least explored and used smartphones on different occasions and subjects, and after weighing the pros and cons, they are satisfied that the devices are fit to be part of the teaching-learning process. The opposers may have (not) used the tools and that the cons outweigh the pros in their perspective and therefore decide not to use

them in the teaching and learning process. The following paragraphs discuss some of the reasons leading to this division.

According to Aamri & Suleiman (2011), advocates of smartphones in the teaching and learning process believe that smartphones offer a medium of realia to students, which therefore provides a stimulating learning environment. They cited examples of some smartphone features such as camera and multimedia messaging functions, which promotes student collaboration in the learning process. Yu (2012) supports the fact that learning through *collaboration* is crucial than when done in *isolation*, and with mobile devices, it becomes more *effective* and *efficient* (p.836). Aamri & Suleiman added that smartphones "*helps to remove some of the formality from the learning experience and engages reluctant learners* (p.144). The point is vital since students who are shy, nervous, or slow to think or process in face to face classrooms due to time factor, may have an opportunity to participate more when online as the process is synchronous and gives time for them to participate fully. In other ways, this means that mobile learning through smartphones may contribute more to inclusive education.

A study by Cakir (2015) found out that language teachers perceived smartphones as crucial in learning a foreign language. He noted that smartphones allow teachers and learners to practice the new language without the constraints of time and space. Such a critical observation changes the definition of learning space by "class" to "seamless learning spaces" where not only teachers can initiate learning but students too (Pegrum, Howitt & Striepe, 2013, p. 472). Aldrich (2017) gives a situation where voluntarily, students choose specific App and interact or use it to learn something new, thereby creating a personalized learning situation. Apart from language, the teachers, Coca & Slisko (2013) in there on Socrative and smartphones in Physics subject with the prospective teachers, argued that smartphones were significant at helping the students to engage in debates and critical thinking. In the study, they found that students' participation was high via Socratic App on a smartphone compared to the web-based app. Students brought in different ideas, opinions, and arguments than when having the regular class time, where it was only possible to see the progress of the few students due

to time factor. By using the app, it allowed the teachers to view the students' progress and assessed them in real-time.

In a workshop by Meishar-Tar and Ronen in 2016, where teachers were introduced to an educational game on smartphones, the teacher's attitude changed towards positive. The teachers in the process of playing the game expressed *satisfaction*, engagement, and competition and added that it was one way of *learning new things* (p.38). Meishar-Tar and Ronen concluded that playing mobile games via smartphones increases collaboration and knowledge as learners' transition to more difficult levels. Aldrich (2017) also defends the use of smartphones in the teaching and learning process by pointing out that the student community of today has grown up with the technology and regard it as a "right" to use it. Therefore, they expect that digital devices such as smartphones should be used in learning as they have an educational function (p.1). That means that despite the flows that come with smartphones, teachers should find a way of embracing smartphones by finding more pedagogical means which can contribute to more meaningful learning.

Parnell & Bartlett (2012) perceives the use of smartphones as not only is the medium of instruction but tools which can support the teacher's work. The article further, described how through the use of smartphones and tablets to document the learners' or students' work, extends the real-time progress of learners to the parents and guardians and thereby involving them in the teaching and learning process. They mentioned that documenting (in this case – through video or audio recording with smartphones/tablets), learners feel accommodated that they are achieving the learning goals. Similarly, as online communities from different social platforms such as Facebook, and telegram grew, smartphones make it possible to connect to these online communities. A good example is where students and teachers connect with different experts, educators, and students from around the world where the exchange of experiences, ideas, solving problems, etc. is collectively done, leading to collective intelligence.

Despite the perceptions mentioned above of the advocates of smartphone use in teaching and learning, research shows that a particular group of teachers are skeptical about its usefulness. Some think that smartphones are distraction tools in the classroom. Nalliveetil & Alenazi (2016) contend that students' overdependence on mobile devices discourages cognitive skills and students instead of concentrating on classwork. They may just be googling from their phones. Joyce-Gibbons et al. (2017) also mentioned some perspectives that teachers have, which include the fear that the students may be using smartphones in a manner that deteriorates good behaviors such as viewing and sharing pornography or socializing via Facebook, and other social platforms instead of learning. Such a similar idea is presented by Yu (2012), who says some teachers are reluctant to use the devices because their design and features are mostly targeted at providing *entertainment and pleasure* (p.838). While this could be true, taking advantage of the entertainment feature to create a meaningful learning experience could be much better than ignoring it.

Yu (2012) makes another vital point of teachers' incline to the use of smartphones in teaching and learning. He points out the difference between teachers and students by categorizing them as *digital immigrants* and *digital natives*. By digital immigrants means most teachers who were born before digital technology or who haven't interacted with digital technologies such as the internet and smartphones, and who believes in traditional means of teaching and learning. In other ways, these types of teachers are authoritarian and are in charge of transmitting knowledge. The digital natives imply mostly the students born during and within the development of digital technologies such as the internet, mobile/smartphones. They interact with the devices, connect with people, and access and share data from and around the world. That means that teachers, therefore, *are working with students that have – far greater experience, expertise, and comfort levels with mobile, wireless technologies and the new media* (Yu, 2012, p.837) than them and to keep their confidence and comfort they may resort to overlook its utility.

Furthermore, a study by Nadelson et al. (2013) described some common factors which influence the teachers to overlook the advantages which technologies such as

smartphones have in teaching and learning. They mentioned that while some teachers have the notion of its positive impact but have no capacity training, will distance discourage themselves from using the technology in the classroom. Unless the government put pressure by designing strategies and pedagogical means of using smartphones, and capacity training, some teachers will still lag behind its potential.

2.8.2. Students Perceptions

Compared to teachers, most research reveals that students have a higher positive perception of the use of smartphones in teaching and learning. Perhaps they are the generation which has and still is growing with the technological advancements (Aldrich, 2017: Yu 2012). A study by Ababneh (2017) and Aamri (2011) on using mobile phones in learning English, found out that while students expected to use smartphones in learning, their teachers were against it. In the two studies, students registered many ways in which they used the mobile/smartphones in learning English which included:

- Listening and watching English movies and songs
- Searching and Reading British and American literature
- Learning the correct pronunciation of new English words

Vazquez-Cano (2014) also found out that students at his university saw the smartphone use to be crucial in the learning process, and the fact that the university provided learning content via the Smartphone made it a more educational tool. In Vazquez-Cano's study, at least 70 percent of the students agreed to the development of competencies such as autonomous, cognitive, communicative, and interpersonal competencies via smartphones and applications. Ramamuruthy & Rao (2015) revealed similar results and emphasized on students becoming independent and *lifelong learners*. Tindell and Bohlander (2012) are quoted by Taleb et al. (2017) expressing their results that students liked the use of smartphones in teaching and learning except in cases where its use during lessons, such as texting, was only for individual use as it distracted other students from concentrating. For the dental students in Australia, they too expressed their opinions that smartphones were useful learning tools (Rung et al., 2014). They added that during their time in the field, they could connect with different practitioners for professional advice

and resolution of problems. Calabrich (2016) found out that students preferred more the Mobile-Assisted Learning Tasks compared to the paper-based, with at least 70 percent of polling adding that using the internet through the Smartphone in the learning made the experience a more realistic one. Smartphones provide an excellent opportunity to search for information at an instant. In cases where teacher's colleagues may use vocabulary which is yet unknown to some students, they may record such words and look for meanings later. Through smartphones and the internet, students search responses to some questions when away from people who can respond to us. Search engines such as Google, Safari, and Firefox, which indexes millions of websites with different types of information, it makes it easier to say that the knowledge is just at the fingertips.

Another study by Yurdagul and Oz (2018) tried to investigate the attitudes of students towards smartphone use in learning from different perspectives such as; general attitudes towards mobile learning via Smartphone, whether gender affects the choice, and whether faculty or discipline affects the choice among others. The study revealed that in general, students had positive attitudes towards smartphones and mobile learning and that gender had nothing to do with the decision on whether a smartphone can be used in teaching and learning. However, the study revealed that most students found the smartphone's role in educational faculty/programs/subjects such as the English language compared to science and arts.

2.9. Challenges that surrounds the use of smartphones in the teaching and learning process

Under this topic, three articles from conference proceedings, four journal articles one master thesis and one article form semantic scholar were selected for a thorough review (see table 2.8).

Table 2.8 Metadata from the inclusion and exclusion criteria

Articles Title	Year	Peer-reviewed	Type	Designation
Mobile Learning in Saudi Arabia - Prospects and Challenges	2011	✓	Semantic Scholar	*Semantic Scholar*
The Potential of Mobile Technologies for (English) Language Learning in Nepal	2012	✓	Journal Article	*Journal of NELTA*
Learning with Smartphones: Students' Lived Experience of Using Smartphones	2012	✓	Conference proceedings	*Int'l Conference on Mobile Learning*
Activities and reflection for influencing beliefs about learning with smartphones	2013	✓	Conference proceedings	*Critical CALL – Proceedings of the 2015 EUROCALL Conference, Padova, Italy*
The Impact of Mobile Phones on English Language Learning: Perceptions of EFL Undergraduates	2016	✓	Journal Article	*Journal of Language Teaching and Research*
M-Learning: Promises Perils and challenges for K-12	2016	✓	Journal Article	*. New horizons for learning*
Students' and Teachers' Perceptions of the Use of Mobile Technology in University Preparation Classes	2017	✓	Master Thesis	*Massey University, Manawatu Campus*
Effectivity of E-Learning through WhatsApp as a Teaching Learning Tool	2017	✓	Journal Article	*MVP Journal of Medical Sciences*
A Swot Analysis of Bring Your Own Devices in Mobile Learning	2018	✓	Conference proceedings	*14th International Conference Mobile Learning*

Source: by the author

No technology invention, despite its vast number of benefits goes without its challenges. As for mobile technologies, smartphones, in particular, some problems have been discovered.

Shrestha (2011) presents three challenges that come with mobile technologies, which include; resources, stressing that though the devices are regarded as ubiquitous, its availability in the developing nations is comparable to the developed countries. Also, lack of human resource which can "*repurpose*" or "*adapt*" the available resources to fit the different learning environments. Secondly, while mobile or smartphones may be available, there may be a lack of content which is significant to the users need. For instance, many of the applications found from the app stores have been produced from technologically advanced countries such as Europe, the USA, Canada, and South Africa.

Therefore, the content and context base are from such specific countries. Shrestha (2011) pointed socio-cultural context as another challenge wherein some societies, teachers still have the power to transmit knowledge to learners, and this contradicts the use of smartphones where students may wander through cyberspace in search of what they deem relevant in their learning. Nalliveetil & Alenazi (2016) also mention a disadvantage of mobile technology, citing that students may spend a tremendous amount of time surfing irrelevant stuff, which then may affect their educational performance. Similarly, Aldrich (2017) mentions that due to the size of mobile phones, typing errors are common and, in some cases, technical glitches such as failure to connect to the internet. Aldrich (2017) adopts additional challenges, which include technicability and "how easily a student is distracted" (p. 26) while using the devices for learning.

Another study by Criollo-C & Lujan-Mora (2018) argued on the benefits of smartphones in learning and, on the other hand, described the challenges which mobile devices bring in Education. The study revealed, among others, that several applications exist and only functional on specific mobile/smartphones. That can also be said that some apps are only compatible with one operating system like Android, which does not support iMessage, an app based on iOS only. The study added that economic factor is also a challenge in that some capable smartphones may be too expensive for the lower class in the society to acquire. In some cases, the educational applications may be introduced without testing, examining, and evaluating its pedagogical aspects.

Gon & Rawekar (2017) documented some challenges which surround smartphones and their applications. They listed three primary problems, which included; Technical, educational, and instructional. In situations where few teachers and students own the devices, likely, its use is hardly promoted. For instance, a learning activity via WhatsApp application will require almost all students to have access to the device. Gon & Rawekar (2017) also mentioned that "message flooding and "time consumption" may create discomfort, as students and teachers find it annoying to read all the texts. Besides, it can be costly in terms of data bundles required to send and receive such amount of messages. The use of inappropriate language was mentioned as an educational

challenge where some participants might not want to sensor what and how they write before sending. On the instructional part, it was said that some participants might just share whatever material to the group without checking its significance to the learning activity. Besides this, Cochrane (2015) posits that despite the students being positive about the use of smartphones, they cannot use it effectively and, therefore, spend a lot of time socializing and entertaining themselves.

A study by Chan, Walker-Gleaves, & Remedios (2013) on learning with Smartphones concluded that despite the profound and extensive learning which goes with smartphones due to its capability of internet access plus vast sources of information available, students confuse the meaning of knowledge to information. In some cases, students are found plagiarizing consciously. They may access information from different sources and present it as their own, which becomes difficult some times for teachers to realize. Some researchers argued that smartphones improve the skill of multitasking, i.e., listening to music and the same time responding or sending a text message/email and watching an educational video and the same time attending to a call. Contrary to that, other researchers have found out that this may lead to poor performance. They contended that some acts create distractions for other activities (Wallace, 2012). Wallace quotes an example of End et al. (2010), which revealed that when students were given a learning task, those who got phone or text notification during the activity performed worse than those who were not distracted. Students' lack of understanding of mobile learning and how it influences learning is another challenge mentioned by Chanchary and Islam (2011). It is understood that some students may be accustomed to teacher-centered/ physical classroom learning mode and find it difficult to learn via mobile.

2.10. Chapter conclusion

This literature demonstrates different perspectives on smartphone use in teaching and learning from different levels of education. It has positioned the smartphones into theoretical perspectives by associating it with the theory of constructivist learning, which is based on Vygotsky's Social-cultural theory. The fact that constructivist learning emphasizes that learners construct their knowledge by themselves through interaction

and engagement puts smartphones on par with its features of encouraging communication and involvement of people in various activities such as games. Since learning is a social activity, smartphone features and applications are better positioned to function as a tool which supports learning from any place and any time.

The chapter has further revealed that Mozambique has some policies over ICT use in all its sectors to improve the service delivery and the livelihood of its citizens. In Education, the government has implemented the TEP, which aims at awareness and mobilization of teachers and educators to use or integrate technology in teaching and learning. However, it is noted that the plan faces challenges as technology equipment such as computers has not reached all parts of the country due to funds scarcity and electrification, among others. Besides, no legislations or obligations on technology use, smartphones in particular, in classrooms are put in place to enforce its use and benefits in teaching and learning.

Finally, the review has brought in several pedagogical advantages of smartphones use in education, and it is imperative to overlook smartphones with its impressive potential of improving teaching and learning practices in general. However, it is noted that there are mixed reactions among teachers and students. The student community seems to perceive the use of the Smartphone in education manner at a higher degree. Still, not all educators/teachers do welcome the use of the devices in their teaching practices as they seem to regard them as distractive. In some cases, factors like lack of capacity training among teachers make them unprepared to adopt and adapt to the new trend. Another possible cause may be that institutions have not exploited all the affordances that technology such as smartphones can bring to teaching and learning. It may be reasonable to view smartphones from the perspective that its use is what matters and not the device itself (Senel, 2016). With that in mind, it is possible to exploit all means and ways in which smartphones may function as progressive and constructive pedagogical tools.

3. METHODOLOGY

3.1. Introduction

This chapter describes the methodology of this research. It begins with highlighting the meaning and context of the descriptive research method, its approaches from both the qualitative and quantitative perspectives. Furthermore, the chapter describes the context of the study, the participants, and the design. The threats to validity and reliability of the research findings are discussed and presented. The chapter also describes the ethical considerations and how data is processed and displayed.

3.2. Research Design

As described by Kothari (2005), the research design is the “blueprint” or “advance-planning” for the collection, measurement, and analysis of data. It implies that the researcher decides on what the research aims to achieve, where it will take place, what kind of data is needed, where to find the data, what type of population and sample to be involved, with consideration of time and other associated costs (p. 31-32). Research design entails on analysis of data and its form of presentation. This research is a descriptive study that focuses on exploring the potential of the Smartphone in teaching and learning in secondary schools.

3.3. Meaning and context of Descriptive Research method

Among the different definitions of descriptive research method, the core or basic definition remains that it is research which answers the question *what* instead of *how* and *why something has happened* (Nassaji, 2015, p.129) or *why reality is showing itself this way* (Lans & Van der Voordt, 2002, p.53). Loeb et al., 2017 stretch the definition by arguing that descriptive research is concerned with the study of *real-world needs, which can warrant policy and intervention* (p.2). In other ways, researchers study the phenomena under peoples' perceptions. In the context of this research, such a phenomenon is the Smartphone, and exploring its potential use concerning teaching and learning in secondary schools defines the focus of this study. Descriptive study is, therefore, suitable as it tries to exploit facts, opinions, perceptions, and attitudes (Nassaji,

2015: Loeb et al., 2017: Lans & Van der Voordt, 2002) of teachers and students in the selected schools of Maputo province, Mozambique.

Knupfer & McLellan 2001: Lans & Van der Voordt, 2002: Loeb et al., 2017, and Nassaji, 2015, all agree that descriptive research data can be collected and analyzed from both qualitative and quantitative contexts. Descriptive research registers the opinions, facts objectively, and perceptions from study participants in a qualitative manner, but the data analysis is quantifiable, such as checking the frequency of views, events, or attitudes to determine a percentage level that leads to a generalization of phenomena in context. This study deploys a descriptive method as it fits its objectives well. The data collected from the study is both qualitative and quantitative.

3.4. Study Area

The researcher chose two secondary schools from Maputo province to conduct the research. The criteria for the choice and inclusion of the schools include the geographical and political position. Maputo is a capital city of Mozambique and provides a more significant opportunity in terms of technological advancement. There is a presence of internet and communication devices such as smartphones, PCs, tablets, among the population. Some schools, both public and private, have computers and internet installed to provide students and teachers with access to virtual learning platforms and promote interactive learning models, which put students at the center of learning and, together with their teachers, construct knowledge. Besides, the selected schools are affiliates of the organization where the researcher is employed, and this has given him the chance of access to the schools without bureaucratic hindrances as the case may be. The distance to the selected schools was within reach for the researcher to afford logistics such as transport.

3.5. Population

According to Kothari (2005), before deciding the sample size, the researcher should define the population (set of subjects) explicitly. The population can be finite where the number of subjects in the population can be countable, such as the specific school

population. The population can also be infinite where the set of subjects is uncountable such as stars (p.56). This study involved a finite population, i.e., both the teachers and students from the selected secondary schools. The total population of the schools was around two thousand (2000), which includes 56 teachers. The students were in two shifts, i.e., grade 9 and 10, which starts at 13.00 hours and finishes at 17.00 hours, whereas grades 11 and 12 starts at 07.00 hours and finishes at 12.00 hours. However, the researcher decided to involve only grade 11 and 12 students as a way of ensuring that there is a higher chance of response rate among the students who participate in the study. Age was another factor that made the researcher prefer the two upper classes as most students had 16 years of age or higher and, therefore, did not need the parents' consent to participate in the study.

3.6. Sample Size and Technique

While it could be highly useful for the whole population of the selected schools to be involved in the study, so that the results could bear a higher generalizability effect, challenges such as *logistics, time restrictions, and budgetary limitations* (Martinez-Mesa et al. 2016, p.327) made it impossible. Therefore, the researcher sampled 60 students from grades 11 and 12 and 30 teachers (90 in total) through a non-probabilistic sampling technic which does not oblige the researcher to single out individual participants for the research systematically. Instead of making generalizations from the analysis of the results, the only hypothesis generated to help instruct future paths or directions of research since the sample is not necessarily the representative of the total population (Alvi, 2016: Martinez-Mesa et al. 2016). The researcher made an introduction to the study to both teachers and students. It included what the research was about, why conducting it, and how they can participate. The researcher asked both students and teachers to voluntarily decide to join by filling in the questionnaire and returning it. It was made clear to them that should they feel the need to not participate even after receiving the survey questionnaire, they were free to return it blank.

3.7. Gender characteristics of respondents

The following table presents the characteristics of the respondents who participated in the survey. Among them, 36 are males and 37 are females.

Table 3. 1 Gender characteristics

	Males	**Females**	**Total**
Teachers	8	10	18
Students	28	27	55
Total	**36**	**37**	**73**

Source: by the author

3.8. Data Collection Methods

This study used both primary and secondary sources of data. Online journals, books, and websites with information aligned with the topic in the research provided the secondary data. The data reviewed is presented in the literature review chapter. The questionnaires, where respondents answered closed-ended questions, which mostly demanded their level of agreement or disagreement with the items therein, are the sources of primary data.

3.9. Questionnaires

The researcher produced two questionnaires to source the necessary information. One questionnaire was specifically for students and the other for teachers. The students' questionnaire contained 12 items where the first two sources, demographic information such as age, sex, class, and School. The other ten items were under the specific objectives of the research. The teachers' questionnaire also included the same elements but added two more demographic details such as academic level and years of work experience.

3.10. Pilot Study

The pilot study is a *small-scale* or trial *study or pretesting* of research instruments (Teijilingen & Roland, 2002). Pilot studies are useful as they help to correct the problems with the research protocols, such as Interviews or questionnaires (Hassan et al. 2006). The issues to be checked may include finding out if the data collection tools contain all

items which respond to the research questions, the clarity, and the simplicity of language used in the tools. In this research, the researcher conducted a pilot study that involved 4 participants, which included two teachers and two students at one Secondary School. The reason was to see if the questionnaire was clear and straightforward in the language hence initially produced in English and translated to Portuguese, if the flow of questions did not confuse the respondents, and also to determine how much time it would take for one to complete the questionnaire. Generally, both student and teacher questionnaires revealed that some of the questions were clear with simple language, which did not confuse the respondents but needed correction in the student questionnaire on item number 7, where the instructions were confusing. The pilot study also revealed that, on average, one needed 15 minutes to finish the survey. The problem was corrected, and the questionnaire was made ready for full data collection.

3.11. Ethical Considerations

The collection of data in this research was anonymous. The questionnaires' cover-page contained the introduction of the study, including the statement about the way the researcher would use the data. The respondents were asked not to expose their identity, such as names on the questionnaire. The page also included the declaration of informed consent, and it demanded the respondents to mark X as a way of accepting the invitation to participate in the research.

3.12. Validity and Reliability

Any research must be valid and reliable since it is not only the researchers who will use its findings to inform themselves of the best course of action but also every other person interested in the topic. The research can only be valid when the researchers "*measure what is intended to be measured*" (Field, 2005 in Taherdoost 2016, p 28). Validity implies how far the concept is accurately measured (Heale & Twycross, 2015, p.66). Concerning this research, validity was checked by ensuring that all items in the specific objectives guiding the study were included in the data collection tools—having the two questionnaires for teachers and students, making it possible for each party to speak for itself other than for the other. Out of the 60 students who received the questionnaires, 55

returned them filled, representing 93.3 percent. Of the 30 teacher questionnaires distributed, 18 responded, and this represented a 60 percent response rate. On average, there was a 77 percent response rate from teachers and students.

This study used the closed-ended questionnaire, which includes already formulated responses. In questions whose answers needed the respondent level of agreement, the researchers used the Likert scale. Likert scale is significant at measuring the attitudes and perceptions of individuals. Since such items are part of this study, the researcher created a scale that consisted of 5 levels of agreements. With the Likert scale, respondents positioned themselves according to the statement, which is different from Yes or No answers, which may be too limited or inflexible (Likert, 1932). Besides, using closed-ended questions helped respondents to return the questionnaires in time as they only had to choose responses based on their perceptions, which is different from open-ended questionnaires, which may demand more time and therefore reducing the response rate. The open inquiry helped the researcher to collect reliable data, which is within the context of the objectives guiding the research. Some items in the questionnaire only demanded respondents to choose the best response according to them. Using the closed-ended surveys with techniques such as the Likert scale, also helped to quantify and statistically present the data.

3.13. Chapter conclusion

This chapter has provided the methodological framework on which the research is based. It has provided the meaning and argument of why the descriptive method was adopted, including its data collection techniques, i.e., questionnaire. In total, seventy-three respondents provided crucial information in line with the research objectives. In the next chapter, data will be analyzed and presented.

4. RESULTS

4.1. Introduction

This chapter presents the results of the information collected from the population sample involved in the research. The data collection tools were questionnaires in which one was for the teacher and the other for the students. The researcher presents the findings from the two survey questionnaires below.

4.2. The Questionnaire

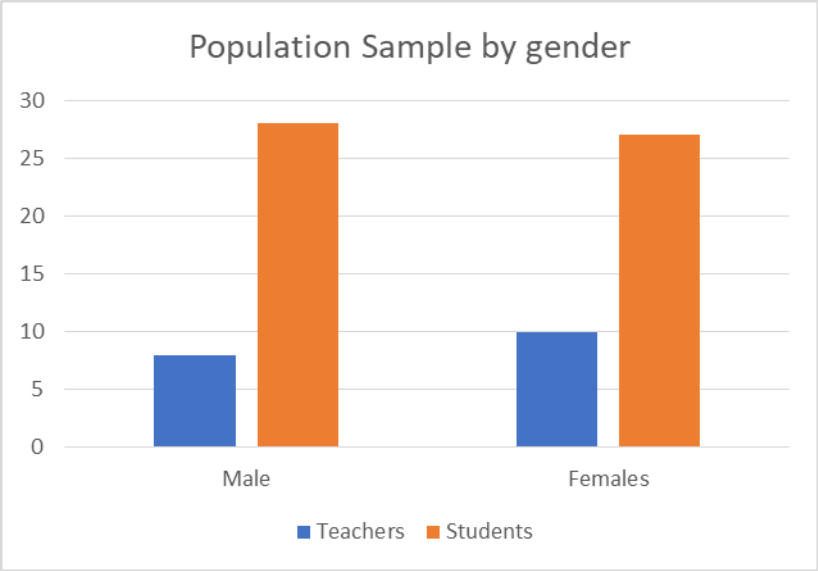
4.2.1. Population sample by gender and age range (Teachers and Students)

In general, seventy-three participants completed and returned the questionnaires, and this included 18 teachers and 55 students. Of the 18 teachers, 8 are males, and 10 are females. Among the students, 28 are males, and 27 are females. The students ranged from 16 to 25 years of age. The researcher has used the questionnaire to explore the benefits of using smartphones in teaching and learning and to discover the perceptions that students and teachers have around the use of smartphones in education. Besides that, finding the challenges in using the Smartphone and the different tasks that students and teachers perform is part of the goals of using the questionnaire to collect the data.

Table 4. 1 Population sample by gender

	Males		**Females**		**Total participants**	**Ratio Percentage**
	#	**%**	**#**	**%**		
Teachers	8	44	10	56	18	25%
Students	28	51	27	49	55	75%
Total	36	49	37	51	73	100%

Graph 4. 1 Representation of the population sample by gender



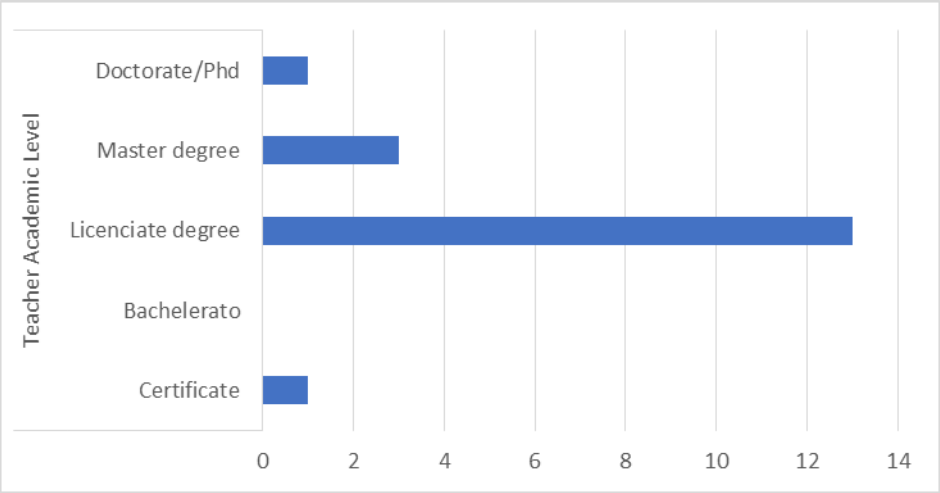
The population sample in this study demonstrates that the number of teachers was small compared to students with a ratio percentage of 25:75. However, the gap between male and female participants is insignificant as the margin is only 2 percent.

4.3. Teacher Questionnaire

4.3.1. Academic background and Years of Work experience

Apart from the characteristic of gender among the teachers, there are two more items, i.e., Academic level and years of work experience. The academic level was divided into five categories (see graph 4.2), with the highest being the Doctorate/Ph.D. To know the level of teachers' education is vital as it entails on the depth of their educational experiences and may also have an impact on their attitudes along with the technology. On the other hand, it was essential to learn about their years of work experience. Hence it can give insight on the skills they have come across around the topic and classroom reality.

Graph 4. 2 Teacher academic Level



From the chart above, 13 (72%) of the teachers make the majority with a licentiate degree. Three have a master's degree, and in the highest academic level, i.e., the Ph.D., only one has it. Only one teacher possesses the lowest level, which is the certificate. In general, 94 percent of the teachers have at least the Licentiate degree, which is most required to teach in secondary schools of Mozambique.

Graph 4.3 represents the frequency of years of work experience of the teachers who participated in this study. The study found that eight (8) teachers had at least six years, and only 5 had less than two years. In general, more than 70 percent of the teachers have a minimum of three years in their work practice. The result is crucial as the teachers may have different experiences in the way they, together with students, use smartphones in association with their teaching practices.

Graph 4. 3 Years of academic work Experience

4.3.2. General background of the politics of ICT in education at the study schools

It was essential to discover if the school has any transparent ICT policy and if all teachers are aware of it. The discovery would reveal the extent to which the school promotes the use of any ICT at its disposal to assist in improving the quality teaching and learning. Teachers had to choose; *Yes*, *No*, or *I do not know*, from the pre-inserted responses. Those who responded *yes* would later explain the policy in writing. The results (see table 2) show that majority (12) of teachers confirmed the existence of the ICT policy in the schools. Only two teachers responded *no* to the question, and the remaining four showed they do not know of the school's ICT policy.

Table 4. 2 School's policy on ICT in teaching and learning

	Yes	**No**	**I don't know**	**TOTAL**
Frequency	12	2	4	18

The answers were similar, as almost all of them said that they have a discipline/subject called ICT. The item gives theoretical knowledge concerning information and communication technology as the catalyst for development. It even teaches necessary ICT skills such as how to use programs like Microsoft office packages and computer operating systems such as Windows. In terms of practical knowledge, the teachers some teachers revealed that the schools have computer laboratories where learners can

practice. However, by analyzing the responses, one can see that both schools do not have their policy of ICT apart from the universal one set by the government. The lack of unison statements in the responses and having some teachers denying the existence of the policy at the school further proves the point.

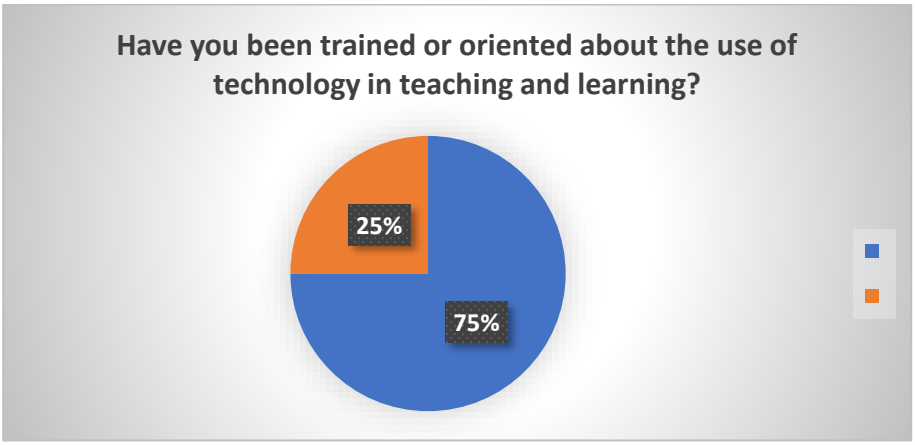
In question 3, the writer wanted to discover whether the schools promote the use of ICT in teaching and learning, despite not having a clear ICT policy. Interestingly all 18 teachers responded positively to the question demonstrating their awareness of the potential of ICT in improving teaching and learning.

The researcher asked the teachers in question 4 to list down any type of technology that the schools possess, which aids teaching and learning. All 18 teachers responded with *Yes* and listed the following technologies:

- Thin clients/desktops – for students use during lessons
- Cellphone/Smartphone – for the school's daily communication
- Television with a paid subscription – for both teachers and students entertainment and learning
- Projector – for classroom/school presentations

In the literature review, the researcher found out that some barriers to the use of smartphones in the classroom are lack of training among teachers on how to use the devices as pedagogical tools. Moreover, this leads to reluctance and perception that smartphones are distractive devices to teaching and learning. In question 5, the researcher aimed at finding out whether the teachers in the study schools have had any training on technology in the classroom. Participants were supposed to mark Yes or No in response to the questions. The results indicated that 13 (72%) teachers had had training in technology use, and only five (28%) did not have (see graph 4).

Graph 4. 4 ICT orientation/training among teachers



Questions 6 to 10 are directly formulated, along with the specific objectives of this study. The goals include: exploring the potential of smartphones in teaching and learning, identifying the perceptions teachers and students have towards smartphones in education, describing the challenges associated with the use of smartphones in teaching and learning. The results from each question will be discussed and presented in the following paragraphs.

4.3.3. Potential characteristics of the Smartphone

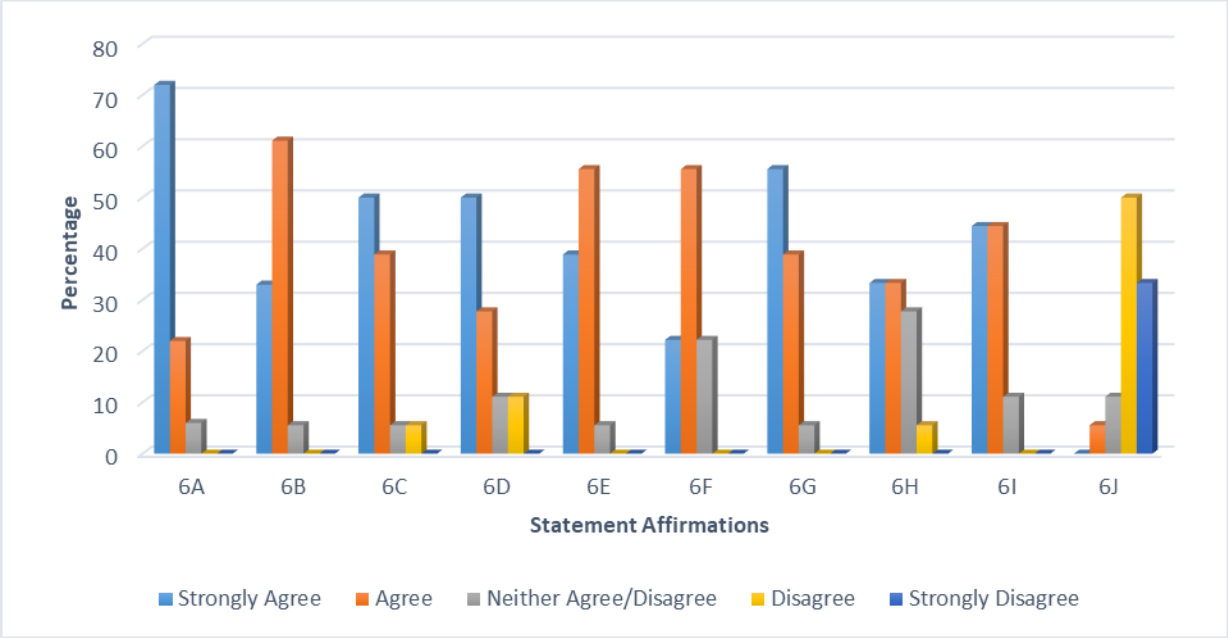
Question number 6 delved at recording level of agreement or disagreement about the inherent characteristics of smartphones, which can impact the teaching and learning process among the teachers. There are ten statements under this question (refer to the questionnaire in the appendices), put on a Likert scale with **strongly agree** the highest determination, and **strongly disagree**, showing zero agreement. The first nine statements (6A – 6I) are about the potential use of the smartphone in different ways and situations in the teaching process. The last statement (6J) is about whether some teachers have never had a reflection on the potential of a smartphone in teaching and learning. An assumption that some teachers may be neutral or against the first nine statements. So, in that case, the participant may confirm or remain undecided in statement number 6J on whether he has had any thought or reflection towards the device. In table 3, each statement demonstrates quantitatively by frequency and percentage of how teachers responded by the level of affirmation. **Graph 4.5** represents

the same data graphically with a focus on the rate of each level of the Likert scale. Figure 2 provides a comparison of the difference between those who strongly agreed to those who only agreed.

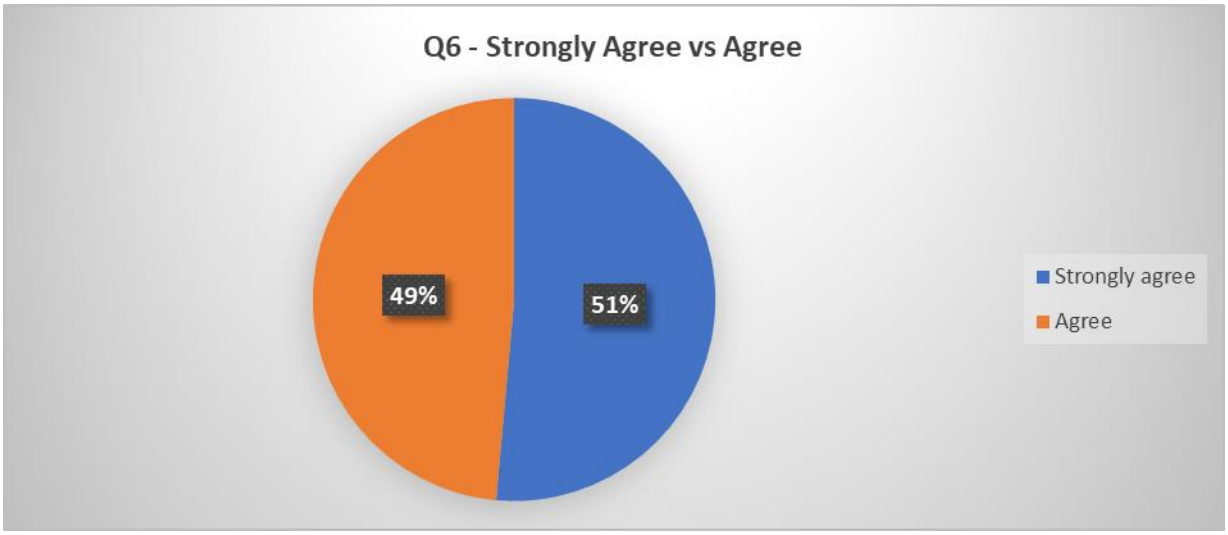
Table 4. 3 Statements about potential characteristics of the smartphone which may affect the way you teach and learn

Q6	Statement		Strongly Agree	Agree	Neither Agree/Disagree	Disagree	Strongly Disagree	Total
6A	The use of Smartphones allows learning anywhere and at any time	Frequency	13	4	1	0	0	18
		Percentage	72	22	6	0	0	100
6B	Internet and mobile connectivity allows me to continuously interact and engage with my students and	Frequency	6	11	1	0	0	18
		Percentage	33	61	6	0	0	100
6C	Smartphones allow access to immense teaching and learning content on the Internet, complementing the limited resources of my physical classroom.	Frequency	9	7	1	1	0	18
		Percentage	50	39	6	6	0	100
6D	I can quickly use my smartphone to search through pertinent questions that arise from my students and help them with explanations and concrete answers	Frequency	9	5	2	2	0	18
		Percentage	50	28	11	11	0	100
6E	Teaching becomes easy as I keep in touch with my students, even after class, through group discussions via WhatsApp, Telegram and other instant messaging	Frequency	7	10	1	0	0	18
		Percentage	39	56	6	0	0	100
6F	I can ask my students to do some tasks, for example language tasks in Duolingo, Babbel and Hello Pal etc. to keep them involved and promote their skills using their smartphones.	Frequency	4	10	4	0	0	18
		Percentage	22	56	22	0	0	100
6G	With smartphones, I can send short videos explaining different topics for them to watch and continue learning in their comfort zones.	Frequency	10	7	1	0	0	18
		Percentage	56	39	6	0	0	100
6H	I connect my students with other schools or experts around the world via Facebook or other platforms so they can learn or exchange and discover new experiences.	Frequency	6	6	5	1	0	18
		Percentage	33	33	28	6	0	100
6I	In cases where my school does not have experimental materials, I can use the Internet via smartphone to watch scientific experiments on platforms such as YouTube or Khan Academy so that my students can see the process than just explain them theoretically.	Frequency	8	8	2	0	0	18
		Percentage	44	44	11	0	0	100
6J	I never thought about using smartphones to improve my teaching and student learning.	Frequency	0	1	2	9	6	18
		Percentage	0	6	11	50	33	100

Graph 4. 5 Graphical representation of the statements about potential characteristics of the smartphone which may affect teaching and learning



Graph 4. 6 Variation to "Strongly agree and Agree to Q6."



Looking into the results as presented in table 3 and two figures, it is clear that teachers do know the potential of the smartphone in their work practice. Out of the nine (9) statements, four (4) ranked higher, getting the minimum 50 percent with 6A receiving a 72 percent affirmation compared to 3 statements, which got a mere affirmative (Agree).

6H got on par percentage (33%) between the mere and strong assertion while 6F got the lowest Strong affirmation of 22% only.

In general, more than 80 percent on average agreed to the statements 6A – 6I, and interestingly 51 percent (figure 2) made strong affirmations to the question. In general, 83 percent of respondents disagreed with the statement 6J, which may imply that they do know the potential the smartphones have in education. Eleven percent of the teachers remained neutral, and another 6 percent agreed to the statement 6J, which may imply to the outcome of some neutral or non-affirmative responses to statements 6A – 6I.

4.3.4. Teacher perceptions about the use of smartphones in Secondary School Education

Understanding the perceptions that teachers have around smartphones in education is one crucial specific objective of this research. It entails whether the teachers deem the devices as pedagogical tools or not. Question 7 explored the correlation between what the literature review discovered and the reality from the geographical perspective of this study. The literature reviewed that some teachers are advocates of smartphone use in teaching and learning. Contrary, some teachers opposed the use of smartphones in education, arguing that the device may cause distraction, promote the sharing of illicit content. Others regarded the devices being suitable only in universities and colleges.

The researcher made 18 perceptive statements around what the review of the literature found—the positive statements include 7A - 7J, while statements 7K – 7R are negative. The statements were put on five levels Likert scale asking the respondents (teachers) to read and rate their level of affirmation. Table 4 represents the findings by frequency and percentage of each level of assertion on the Likert scale. At the same time, graph 4.7 presents the results graphically.

Graph 4.7. Representation of Teacher perceptions towards smartphone in secondary school education

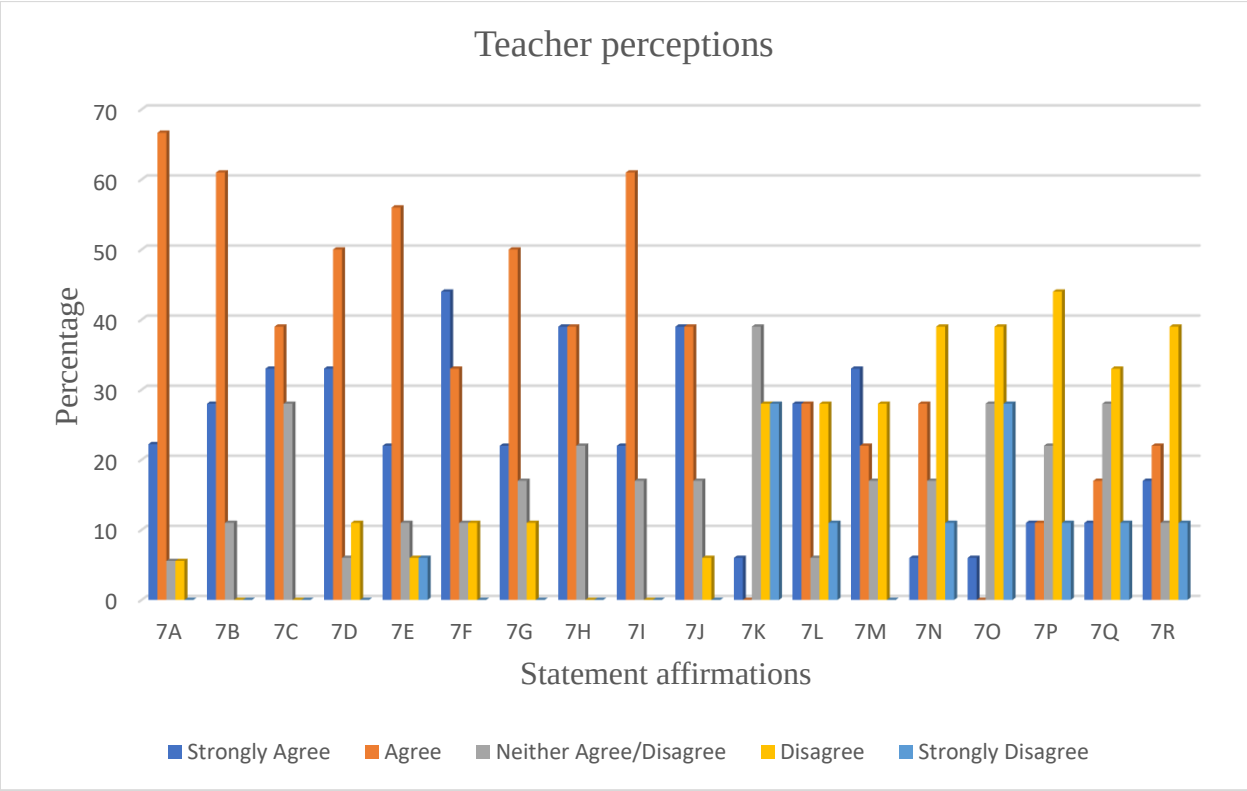


Table 4. 4 Teacher perceptions towards smartphone in secondary school education

Q7	Statement		Strongly Agree	Agree	Neither Agree/Disagree	Disagree	Strongly Disagree	Total
7A	Smartphones offer a personalized learning environment	Frequency	4	12	1	1	0	18
		Percentage	22	67	6	6	0	100
7B	Smartphones promote effective collaboration between students in learning activities	Frequency	5	11	2	0	0	18
		Percentage	28	61	11	0	0	100
7C	Smartphones do / can involve shy students in learning activities.	Frequency	6	7	5	0	0	18
		Percentage	33	39	28	0	0	100
7D	The smartphone extends the physical classroom to cyber classes, making learning a social and informal activity.	Frequency	6	9	1	2	0	18
		Percentage	33	50	6	11	0	100
7E	Smartphones are crucial for specific subjects, such as language learning (e.g. Portuguese / English)	Frequency	4	10	2	1	1	18
		Percentage	22	56	11	6	6	100
7F	Depending on a learning activity, smartphones can be used in almost any subject.	Frequency	8	6	2	2	0	18
		Percentage	44	33	11	11	0	100
7G	While playing via smartphones, students can improve or learn new skills (e.g. Simcity)	Frequency	4	9	3	2	0	18
		Percentage	22	50	17	11	0	100
7H	With the smartphone, I can organize a debate or discussion with my students via WhatsApp / Telegram and moderate the activity sufficiently compared to class schedules, which are not enough to involve all students	Frequency	7	7	4	0	0	18
		Percentage	39	39	22	0	0	100
7I	Smartphones are important in creating autonomous students who can start their activities and learning situations.	Frequency	4	11	3	0	0	18
		Percentage	22	61	17	0	0	100
7J	With smartphones, I can easily and quickly connect with parents and students' caregivers on issues related to students' education	Frequency	7	7	3	1	0	18
		Percentage	39	39	17	6	0	100
7K	I think smartphones are tools of distraction and therefore should not be allowed in schools	Frequency	1	0	7	5	5	18
		Percentage	6	0	39	28	28	100
7L	Students spend a lot of time socializing (e.g. via Facebook / Twitter) instead of learning	Frequency	5	5	1	5	2	18
		Percentage	28	28	6	28	11	100
7M	Students use smartphones to share illicit content in the classroom, so this can destroy their psychological and emotional abilities for learning.	Frequency	6	4	3	5	0	18
		Percentage	33	22	17	28	0	100
7N	Students use / may use smartphones in the classroom to intimidate others and therefore allowing their use may promote abuse	Frequency	1	5	3	7	2	18
		Percentage	6	28	17	39	11	100
7O	Smartphones are generally designed for entertainment and therefore have no place in education	Frequency	1	0	5	7	5	18
		Percentage	6	0	28	39	28	100
7P	I think using the smartphone in teaching will take a lot of time because it is difficult to control what students are doing during the learning activity.	Frequency	2	2	4	8	2	18
		Percentage	11	11	22	44	11	100
7Q	I think students can use the smartphone in their own way, whether at home or anywhere except in school or in the classroom.	Frequency	2	3	5	6	2	18
		Percentage	11	17	28	33	11	100
7R	I think the smartphone should be used in higher education, like at university, because students are more mature than in high school	Frequency	3	4	2	7	2	18
		Percentage	17	22	11	39	11	100

After analyzing the results of question 7, teachers demonstrated having positive attitudes towards the use of smartphones in teaching and learning. However, there are some cases in which teachers perceive the devices as detrimental to teaching and learning.

Between statements 7A and 7J, at least 70 percent of teachers responded between merely and strongly affirmative to the statements. In other words, they advocated the potential that the smartphone has in teaching and learning in secondary schools. Statement 7C had the highest percentage (28%) of those who neither agreed/disagreed. It implies that perhaps there is a need to investigate further to find out the extent to which all learners are involved in the learning activities via smartphone and digital platforms.

Between statements 7K and 7R, at least 40 percent of teachers demonstrated disagreement with the statements which regard smartphones as distraction tools, or intimidation tools, or entertainment tools or complicated tools to use in teaching and learning. The teachers agree that the smartphone should be in use at all levels of education. Furthermore, results indicate that teachers know how to use them and manage their learning activities via smartphones. However, the results also showed that teachers understand the challenges that students may use smartphones to share illicit content and spending more time on activities other than learning. A good percentage of teachers stood undecided on statements such as 7K (39%), 7O (28%), 7P (22%) 7Q (28).

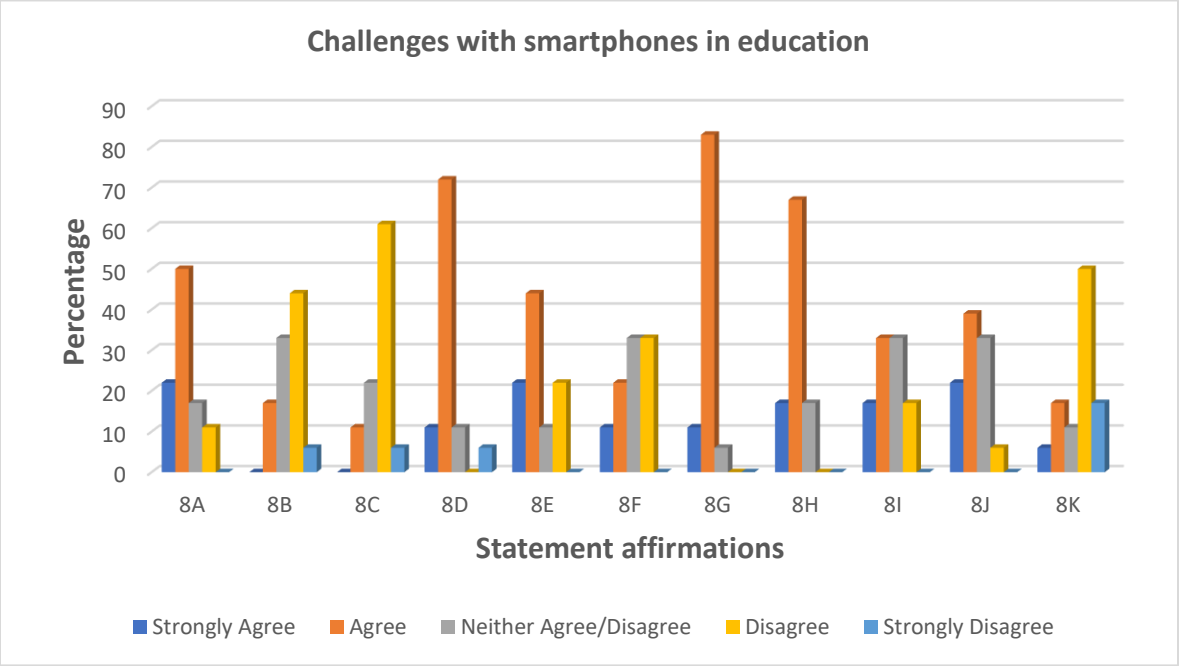
4.3.5. Challenges around the use of smartphones in secondary schools

The objective behind question 8 was to discover what teachers consider to be the barriers, problems, and challenges around the use or adoption of smartphones in teaching and learning in secondary school. Under this question, 11 statements 8A - 8K were created based on what the review of literature narrated. The statements included whether the cost is a challenge, the ease of use, connectivity, and flooding of information, among others. See table 5 and figure 4 for the representation of the results

Table 4. 5 Challenges with smartphones in teaching and learning

Q8	Statement		Strongly Agree	Agree	Neither Agree/Disagree	Disagree	Strongly Disagree	Total
8A	Smartphones are expensive and not everyone can afford	Frequency	4	9	3	2	0	18
		Percentage	22	50	17	11	0	100
8B	There is a lack of learning content that is contextualized to my reality in App Stores, making it difficult to select appropriate	Frequency	0	3	6	8	1	18
		Percentage	0	17	33	44	6	100
8C	Smartphones are difficult to use, so teachers may find it difficult to use in learning situations	Frequency	0	2	4	11	1	18
		Percentage	0	11	22	61	6	100
8D	The cost of the Internet is higher and most schools do not have an Internet connection, which makes it a barrier to access important content related to learning activity	Frequency	2	13	2	0	1	18
		Percentage	11	72	11	0	6	100
8E	Lack of network connectivity in rural schools makes it meaningless to own a smartphone	Frequency	4	8	2	4	0	18
		Percentage	22	44	11	22	0	100
8F	Students can easily stop learning due to mass information and social platforms unrelated to education.	Frequency	2	4	6	6	0	18
		Percentage	11	22	33	33	0	100
8G	In some cases, students and teachers do not have the technical knowledge to use the smartphone as a pedagogical tool	Frequency	2	15	1	0	0	18
		Percentage	11	83	6	0	0	100
8H	Not all applications are compatible with different existing operating systems and, even if available, one may need to purchase to use	Frequency	3	12	3	0	0	18
		Percentage	17	67	17	0	0	100
8I	Time consumption / flooding of information, e.g. WhatsApp group discussions can be boring in some way.	Frequency	3	6	6	3	0	18
		Percentage	17	33	33	17	0	100
8J	There is a lot of plagiarism as students tend to copy the information and consider it as their own rather than in-depth research and argumentation.	Frequency	4	7	6	1	0	18
		Percentage	22	39	33	6	0	100
8K	It is difficult to find the most needed information and therefore not efficient.	Frequency	1	3	2	9	3	18
		Percentage	6	17	11	50	17	100

Graph 4. 7 Representation of what teachers think are challenges with smartphones



Overall, statements 8A, 8D, 8E, 8G, 8H, 8I, and 8J have registered at least 50 percent of the respondents concurring to the challenges. Seventeen (17) teachers who represent 84 percent agreed that lack of technical knowledge among them is the greatest challenge. Second is the incompatibility of some applications and the cost of some useful apps (84%), and thirdly, the higher cost of the internet (83%). Fifty percent of teachers disagreed on the point that there is a lack of learning content in context and according to the geographic reality, and six teachers (33%) remained undecided at the same point. Twelve teachers (67%) disagreed with the statement that smartphones are difficult to use in learning situations. Another 67 percent also disagreed that it is difficult to find information on the internet using smartphones. Results are distributed equally on whether students may stop learning due to mass information such as through social platforms like Facebook and WhatsApp. In general, statements 8B, 8F, 8I, and 8J got the 33 percent of teachers (highest) who remained indecisive while 8G only had one respondent (6%) uncertain.

4.3.6. Teachers use of smartphone concerning their profession

To better understand the teachers' daily activities with their smartphones or cellphones concerning their work, the researcher listed 14 activities. The researcher asked the teachers to rank the top 5 essential activities which apply to each of them. The aim is to help discover if the perceptions link to the everyday use of smartphones. Such actions may reflect the functions that teachers are likely to promote in teaching and learning. Table 6 provides the results of the question.

Table 4. 6 Teachers use of smartphone concerning their profession

Q9	Use	Frequency	Percentage
a	Translate texts from or into different languages	12	14
b	SMS - Send text messages to my students and colleagues about different learning tasks	8	9
c	Dictionary - Use for teaching vocabulary	12	14
d	YouTube - Watch videos on complex topics before my teaching	12	14
e	Listen to Music	4	5
f	Taking pictures/videos of my student during class for references and evaluations	2	2
g	Take notes	2	2
h	Reminder	1	1
i	Calculator	5	6
j	Learn new languages	1	1
k	Social networking - for example, Facebook / WhatsApp	3	4
l	Read books / news / audiobooks	10	12
m	Playing games-entertainment	2	2
n	Search for information on the Internet	11	13
	TOTAL	**85**	**100**

From table 6, the results, in general, show teachers perform the listed tasks perhaps daily and in specific times. The proof is that teachers selected all activities. However, through analyzing the figures, five activities have a higher frequency of at least ten, and thus, text translation (12), Dictionary (12), YouTube (12), reading books/news/audiobooks (10) and browsing information on the internet (11). Texting messages got the frequency of 8, and the rest were below the scale of 5. The results entail that perhaps the activities are applicable in teaching and learning and that the teachers may likely use the top 5 ways to engage the students in learning activities via smartphone. Furthermore, the results demonstrate that not all teachers have exploited all the functions of smartphones, which relates to their work.

4.3.7. Teachers perceptions of the suitability of smartphones in disciplines

In question 10 of the teacher's survey, it pleased the researcher to find out whether the teachers perceive the use of smartphones in all subjects or some specific subjects. The literature review found that some teachers advocated the use of smartphones in all learning subjects. In contrast, others concur with the use of smartphones in particular subjects, more especially languages. Under this question, four options were put for teachers to mark which disciplines they think suits bests with smartphones. The teachers are not limited to the specific number of choices, and if they feel all discipline suits, they are free to mark all. The results have indicated that, in general, smartphones fit in all disciplines. However, language subjects scored the highest with 31 percent, followed by science subjects with 27 percent. Humanity subjects and Arts subjects got 20 and 22 percent respectively. See table 4.8

Table 4. 7 Which disciplines do teachers think smartphones are most suitable?

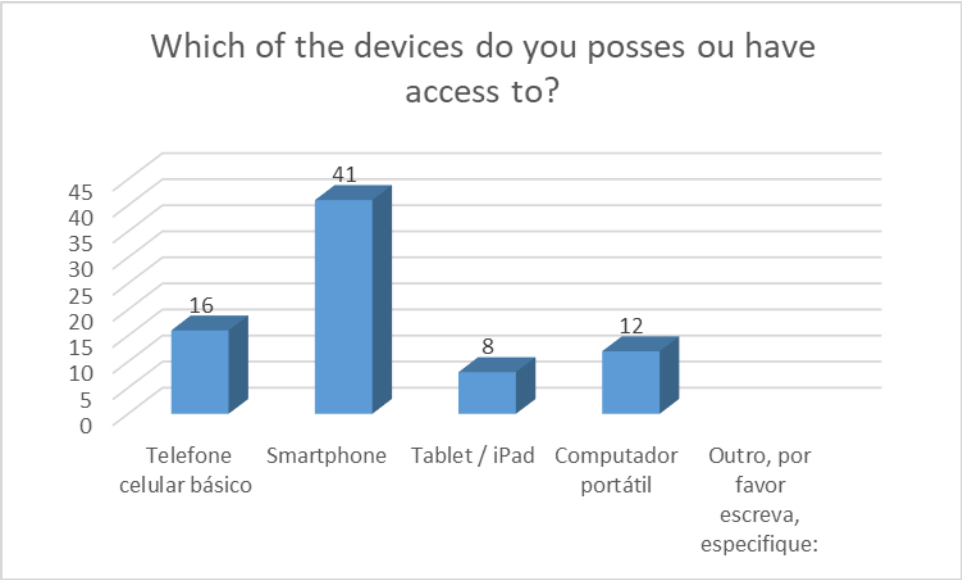
	Question 10	Frequency	Percentage
10A	Language disciplines (e.g., English, French, Portuguese)	14	31
10B	Disciplines of Humanity (e.g., Geography)	9	20
10C	Arts disciplines (e.g., Music)	10	22
10D	Scientific disciplines (e.g., mathematics, chemistry, biology and physical sciences)	12	27
	TOTAL	**45**	**100**

4.4. Student questionnaire

4.4.1. Categories of devices which students possess or have access

To establish the base of student's attitudes towards smartphone use in teaching and learning, the researcher needed to find out the types of devices students have access to or possess. The list of devices includes Cell phones, Smartphones, Tablets/iPad, and laptops. The writer asked students to choose the devices they have and were not limited to one choice. See graph 4.9 for a graphical presentation of the results.

Graph 4. 8 Devices that students possess or have



The survey found that of the 55 student participants, 41 possessed/had access to smartphones representing 53 percent. Sixteen students have a cellphone, 8 have tablets (iPad inclusive), and 12 possessed a laptop. The results show that some students acquire at least two devices.

4.4.2. The available technologies in the study Schools

In question 2, the researcher needed to discover if the school, in general, understands the importance of technology integration in the process of teaching and learning. That will also prove if the government and other stakeholders do help in providing such technologies in schools instead of academic policies only. The fact that the curriculum includes the ICT subject meant that students could not only learn theoretically but also through actual practice, and that demands the availability of proper materials and equipment.

Under this question, students will choose between Yes and No, and if yes, they would mention the technology that the school provides to aid in teaching and learning. Among the 55 students, ten responded No. The 45 students said technologies such as computers (28), Internet (5), and thin-Clients (12). (Thin clients are remote-type desktops with the central processor (server in most cases) where students can access the learning content by using the intranet)

4.4.3. What do students think about the smartphone as a learning tool?

The researcher wanted to find out students' attitudes towards the use of smartphones in their learning or as an entertainment tool. Two statements were put on five levels Likert scale (See table 4.8). The results showed that in general, 49 students agreed that a smartphone is a vital tool for learning. Five students disagreed, and one student stood undecided. On whether the smartphone is relevant for leisure or not, 45, in general, agreed. In contrast, six neither agreed nor disagreed, and four disagreed. The results paint a picture that students are aware of the importance of the device in their learning adventures in addition to using it as an entertainment tool.

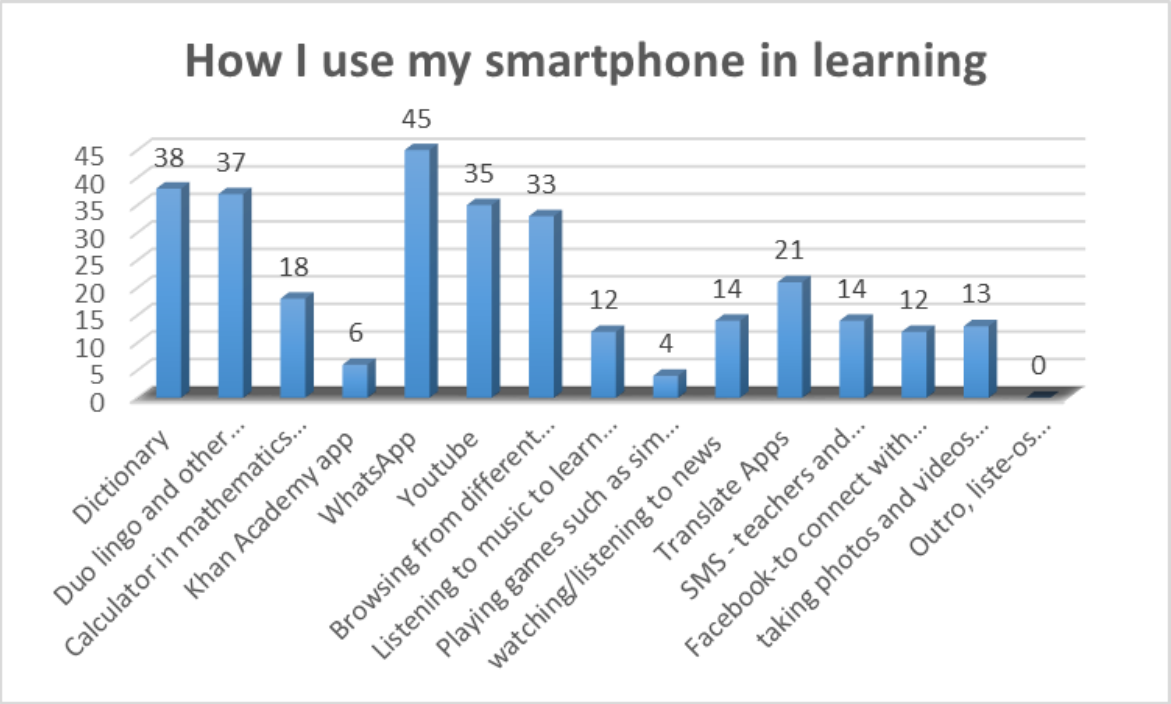
Table 4. 8 Is the smartphone an essential tool in your learning?

Q3	Statement		Strongly Agree Agree		Neither Agree/Disagree	Disagree	Strongly Disagree
3A	O Smartphone é uma ferramenta significativa para a minha aprendizagem	Frequency	27	22	1	5	0
		Percentage	49	40	2	9	0
3B	Os smartphones são relevantes para o meu tempo de lazer ou entretenimento	Frequency	12	33	6	4	0
		Percentage	22	60	11	7	0

4.4.4. Student's use of the smartphone in the process of learning

The next question demanded the students to rank the activities which they perform on their smartphones that link to learning. The researcher made a list of 14 functions (see graph 4.9) and asked students to select the top five features or activities which apply to them. The results indicate that WhatsApp (45), Dictionary (38), Duo lingo (37), YouTube (35), and Internet surfing (33) are the most used platforms in students learning. In Contrast, Khan Academy's application and playing games on smartphones are the least platforms that students use to learn or improve some skills. In summary, students have the notion of the different applications and platforms which are of significance to learning. However, it appears that some apps are not well known, or perhaps some challenges prevent the students from using them.

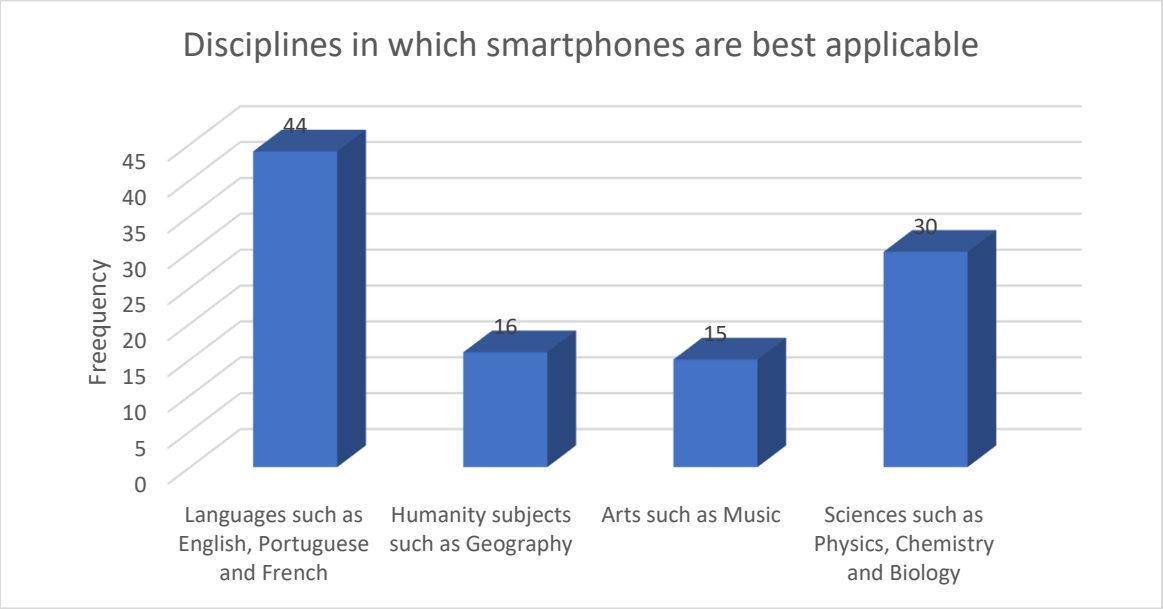
Graph 4. 9 How I use my smartphone in learning



4.4.5. Students' perceptions on the suitability of smartphones in disciplines

The literature review demonstrates that smartphones are essential pedagogical tools in all learning subjects depending on the type of activity or and situations. However, most teachers claim that the devices are most suitable in language disciplines, perhaps because, in principle, the smartphone is a communicative device. In the interest of this study, the researcher opted to explore the perceptions of students on whether the smartphone is suitable only in language subjects or not. The results demonstrate that students, too, perceive the smartphones as being ideal in language learning and scientific disciplines such as chemistry and biology compared to arts and social subjects such as geography with the frequency of 44 and 30, respectively. Graph 4.10 gives a summary of the results.

Graph 4. 10 Disciplines in which smartphones are best applicable.



4.4.6. Students' average time spent on smartphone

Time spent on the smartphone may be a barrier and counterproductive to learning, depending on what students do when in possession. There are claims that in some cases, students tend to spend much time doing nothing beneficial to learning other than watching or sharing illicit information or being immersed in a pool of data. In this question, the researcher wanted to establish how much time students spend on their smartphones per day with the assumption that too much time may deviate students' attention to learning. While there is no standard amount of time recommended, which can affect students' learning yet, this study only shows the results but will not take a stand on whether such amount of time is enough or not. The researcher made four categories, i.e., Less than one hour, between 2 – 3 hours, 3 – 5 hours, and More than 5 hours a day. The results showed that 60 percent (33) of the students spend between 2 – 3 hours on their smartphones doing different things, which may include those listed in Question number 4. Twenty percent (11) of the students spent less than one hour, Seven percent (4) spent between 3 – 5 hours, and only 13 percent (7) spend at least 5 hours.

4.4.7. Rules around the use of smartphones at the school or in classroom

Next, the researcher aimed at finding out if the school or teachers prohibit the use of smartphones at the school or in classrooms. The survey indicates that 65 percent (36) of the students responded *yes* to the question, 22 percent (12) responded *no*, and 13 percent (7) responded that they do not know.

In the follow-up question to know the rules enforced at the schools, students mentioned that they are allowed to bring their smartphones but should be switched off during the lessons or except when the teacher instructs them to use in certain activities (See the table 4.11).

Table 4. 9 Rules around the use of smartphones at the school or in classroom

Rules	Frequency	Percentage
Do not bring mobile devices to school	0	0
You can bring phone but must be switched off during the lessons	19	45
You can bring the phone but must be switched off unless instructed by the teacher	20	48
You can bring to the school but should not be used within the school premises	3	7

For students who responded that they do not know, the researcher asked them in question 9 to take a stand on whether permitting the use of smartphones during lessons is significant or not. Interestingly, 78 percent of the students agreed, and only 22 percent declined.

Question 10 of the survey allowed students to express their opinion on whether they are against the rules that the school or teachers put around smartphone use in the classroom. Three statements were made and put on the Likert scale for students to affirm or disagree with each. One of the statements was about whether smartphones are distraction tools or not in teaching and learning. In statement 10A on allowing smartphone use in the classroom to help students with research and complex problem solving, 23 students strongly agreed, and 26 merely agreed to represent 89 percent of affirmation. Only three (3) students neither agreed nor disagreed, and two disagreed. Statement 10B asked students whether allowing smartphones in classrooms can cause unnecessary

distraction, and the sharing of illicit content. Forty-nine (49) percent in total agreed, 33 percent remained undecided, while 18 percent disagreed. Such a response demonstrates that the students are quite aware of some behaviors which are promoted by the use of smartphones, which may be a barrier to learning. In the last statement (10C) on whether smartphones are tools that can help supplement the learning materials such as lack of books, Eighty-six percent (47) of the students agreed to the point. Seven percent (4) of the students neither agreed nor disagreed. Five percent (3) of the students disagreed, and 2 percent (1) strongly disagreed (See table 10). Overall, students were optimistic that smartphones allow them to do instant research and supplement teaching and learning materials. Only less than 50 percent of the students agreed that smartphones might cause an unnecessary distraction to learning.

Table 4. 10 What is your stand about allowing the use of smartphones in the classroom?

Q10	Statement		Strongly Agree	Agree	Neither Agree/Disagree	Disagree	Strongly Disagree	Total
10A	Allowing the phone / smartphones in the classroom will help me do instant research on complex issues / problems	Frequency	23	26	3	2	1	55
		Percentage	42	47	5	4	2	100
10B	Allowing mobile phones / smartphones in the classroom will cause unnecessary distractions in learning (increased sharing of unnecessary content)	Frequency	10	17	18	10	0	55
		Percentage	18	31	33	18	0	100
10C	Mobile devices / smartphones will facilitate the challenge of lack of learning materials, such as books	Frequency	34	13	4	3	1	55
		Percentage	62	24	7	5	2	100

In general, students highly promote the use of smartphones in teaching and learning. While challenges exist in the process, there seems to be a good percentage of students who have learned to overcome the difficulties hence 18 percent disagreeing that smartphones can cause distraction.

5. DISCUSSION

5.1. Introduction

In this chapter, the data results from chapter 3 are interpreted and discussed following the research objectives and questions that relate to the existing literature reviewed in chapter 2. The chapter further presents the limitations of the research and proposes areas of future research.

5.2. Potential characteristics and uses of the smartphone in secondary school education

Research Question #1: What are the inherent features and applications of smartphones in teaching and learning in secondary schools?

It is evident from the results of the study that both teachers and students know the potential that the smartphone has in teaching and learning. But an in-depth analysis also shows that not all teachers have explored the characteristics and functions that smartphones have.

First, teachers in the study have agreed that smartphones allow teaching and learning without geographical, time, and space constraints. The smartphone has proven to promote teacher- students interactivity and engagement. Through applications such as WhatsApp and Facebook, teachers maintain efficient communication and extend their classrooms to cyberspace by sending audio and video clips of educational importance to their students.

The research has further demonstrated that teachers use applications such as; Translator and dictionaries across different languages, YouTube for inspiration videos across the range of educational topics, digital/audiobooks for updated information, and internet

surfing. All the mentioned traits and uses are in line with the discoveries made in the literature review where authors such as Pegrum, Howitt & Striepe, 2013; Aldrich, 2017; and Al-Dheleai &Tasir, 2019 described the similar uses and characteristics. The results here are significant as perhaps implying the possibility of teachers allowing students to use the devices in the learning process, be it school or after school. Besides, the results of the study demonstrate a vital probability that teachers are aware that smartphones can be used in all disciplines and subjects depending on the teaching or learning activity.

In contrast, it may seem that some teachers have not fully exploited other essential characteristics or uses of smartphones in teaching and learning. Functions such as taking photos, videos audios calculator, learning new languages, and taking notes as mentioned by authors such as Shrestha (2011), El Hariry (2015), Nalliveetil & Alenazi (2016) and Reinders (2010), despite their significance, were not frequently mentioned in the survey. Perhaps such a situation supports the claims by other researchers such as O'Bannon et al. (2017), that if teachers do not have knowledge or training or simply are afraid of change, they may not bring it to students. Such a situation can imply that some teachers won't promote or allow students to use such functionalities in the classrooms.

The study has further demonstrated the similarity between teachers and students on how they perceive the suitability of smartphones in other subjects or disciplines. It came out that both teachers and students feel that smartphones are incorporated well in Language disciplines seconded by Science subjects compared to Human and Arts Subjects. But, the results showed a vital gap between teachers and students in that students ranked languages at 41 percent compared to teachers at 31 percent. Such findings may entail that perhaps a lot of research surrounds the use of smartphones in language disciplines compared to the rest of subjects, therefore, encouraging attitudes that such is the reality. Also, the findings support what the literature found, where many articles easily give examples that suit language learning activities. Furthermore, the study observes that students' use of smartphones is similar to the teachers' use as they engage themselves

most in using language related apps such as Translator, dictionary, and WhatsApp and duo lingo app for learning languages.

5.3. The perceptions of teachers and students towards the smartphone in secondary education

Research question #2: What attitudes do teachers and students have towards smartphones in teaching and learning in secondary schools?

Overall, both students and teachers have similar and general perceptions that smartphones are essential and that they should be incorporated as pedagogical tools in teaching and learning. However, it should be observed that both parties have their reservations. Despite students having only two statements about whether smartphones are learning tools than entertainment tools, interestingly, students ranked learning compared to entertainment tool with a 7 percent margin. Furthermore, students supported the stand in the subsequent questions where they agreed that if teachers or schools allow them to use smartphones in the classroom, it will help them in doing instant research of pertinent issues and minimizing the lack of learning materials such as books. In contrast and support of the previous research highlighted in the literature review, some students do agree that the devices can cause distraction in learning or can lead to the sharing of illicit or unnecessary content. However, in a twist, 33 percent of the students were undecided about whether the devices are distraction tools or not. Such is a call that needs further investigation of establishing the extent to which smartphones can hinder learning.

Teachers' responses support the claims the previous research has found. Teachers believe that smartphones offer personalized learning, promote active collaboration among students in learning activities, and develop different skills such as mathematical, scientific, and linguistic. Teachers further agree that the classroom is no longer the four-walled and roofed structure. Instead, it is everywhere because, with applications such as WhatsApp and telegram, students and teachers can debate while on the zones of their

comfort. Just as many researchers have reported in the literature review, teachers perceive that smartphones create autonomous learners as they can initiate their learning activity without being dictated and out of curiosity. One crucial observation is that while a significant percentage of teachers agreed that doing learning activities via smartphones can engage shy learners, an essential 28 percent of the teachers remained undecided. That may mean that the situation exists to some extent, which may or may not significant for teachers to take a stand. That raises some questions as to what causes the shyness and how shy or timid learners can fully be engaged in online learning activities, thus shaping the need to explore strategies which can be used to ensure full participation of all learners

5.4. Challenges around smartphone use in secondary school education

Research question #3: What are the challenges around smartphone use in Secondary school education?

The results of the study support claim by some researchers about the challenges of technology in the classroom. Teachers in this study admitted that lack of tech-knowledge of smartphones as a pedagogical tool is the greatest challenge that impedes the use of smartphones in teaching and learning in secondary schools. The study discovered that the compatibility issues of some educational applications exist. Teachers observed that some apps are only compatible with iOS than Android and vice versa, such as the iMessage. Other challenges included the higher cost of the internet, which makes schools have no access unless the government or other stakeholders provide them. Such a problem is likely to discourage the use of smartphones in teaching and learning as teacher's students have to cover the cost individually, therefore deciding by themselves how they want to use it. The smartphone price was deemed higher and meant that not all students or teachers could afford it. That implies that in some cases, teachers or school authorities may ban its use in schools to avoid disparities among students unless proper measures are set so that all students have access. With internet expansion and an

increase in mass information, plagiarism is one of the challenges reported, and such is the case in this study where the teachers agree that this behavior seems to exist.

Smartphones are mobile devices, and therefore, people get accustomed to surfing the internet, watching videos, listening to music, and playing different games in whatever place they are. Such a scenario can cause uncontrollable use of the devices, especially in situations of learning. Some researchers reported that some students might spend a lot of time on their mobile devices, in this case, smartphones, doing different things unrelated to learning, and that affects their performance. This study found that most students spent, on average, 3 hours a day on their smartphones. However, this can be considerably less time to affect their performance. Still, it should not be underestimated as the study did not focus on what they do with their smartphones concerning their learning or whether such amount of time includes learning activities initiated by their teachers or by themselves. It can be said here that time is still a factor which can contribute to poor performance if the activities done on the phone are not moderated.

As opposed to some findings in the literature review, teachers disagreed on the lack of contextualized or geographical content from the app stores such as Google Play and Apple Store, and that is a proper development as it tells that teachers are exploring the content. Besides, there are many people producing content from a geographical perspective, which is real and authentic. The notion that smartphones are sophisticated devices, therefore tricky to operate in learning situations, was disproved. Such a result implies that both smartphone and App developers have perhaps improved the way people should interact with smartphones, i.e., from user friendly to the device itself and the applications too.

Finally, a significant percentage of teachers remained uncertain about:

a. whether time consumption or information flooding on social platforms such as WhatsApp or Facebook is a challenge or not,
b. whether there is insufficient content in the App stores or not,
c. whether students engage in plagiarism as a result of smartphones and the internet.

5.5. Limitations of the Study

Firstly, this study involved 73 participants, including 18 teachers from only two schools in Maputo. Such a sample though representative of the whole population, is too small compared to the size and number of schools in Maputo province and let alone Mozambique as a whole. Besides, the sample only targeted the students from grades 11 and 12 with a focus on 16 years of age and above. Therefore, the sample size in this study presents a challenge as the results cannot be generalized to a grand scale. Second, to increase the chances of questionnaire return from the students, the number of items had to be minimum and only crucial to the research questions. From the teachers' survey questionnaire, the number of items was higher, and that overwhelmed some respondents and caused them to withdraw from participating hence the limited number of teacher participants. Third, some items, such as the types of mobile devices that the teachers possess, were not included. This meant that despite the results, we could not be sure of the percentage of smartphones which exist among the teachers. Also, the age range was omitted, which could be crucial at analyzing whether the teacher generation is digital natives or digital immigrants (Prensky, 2001) and therefore justifying some uncertainty in responses to some survey items. Lastly, the survey questionnaire involved presupposed answers where participants had to choose only without necessarily giving their own formulated responses. In that case, it may have prevented the discovery of some pertinent issues around the use of the smartphone in teaching and learning in secondary schools.

5.6. Areas of further/future Research

Based on the results of this study, the following are some recommendations for future research.

- There is a need for much more extensive research of the similar nature in Mozambique. An investigation that can involve teachers and students from remote areas, urban, and cities to check and compare the differences in attitudes towards incorporating mobile devices as pedagogical tools in classrooms.
- A rigorous capacity training for teachers on how they can use smartphones and other mobile devices as useful pedagogical tools in classrooms is highly essential; hence undermining the presence of the devices among students can compromise students' performance.
- The study recommends a Digital literacy campaign among students as it would help students effectively use smartphones in their education on top of daily communication. It can be expected that a literate student population will entirely be responsible and therefore reducing the malpractices such as sharing of illicit or unnecessary content
- A practical study on student engagement in online learning platforms to see how shy or timid learners participate in learning activities will help establish specific methods or techniques which can yield maximum participation results.
- The study further recommends an action type of research which tries out some specific smartphone applications in particular discipline or subjects and compare the performance of students taught without a mobile device. Such an inquiry would help project the level of motivation and engagement of students in different learning activities when mobile devices such as a smartphone are in use.

6. CONCLUSIONS

This study traversed the characteristics, uses, perceptions, and challenges which circumambient smartphone use in secondary school education among teachers and students. The literature review further delved into the ICT Policy on education in Mozambique, and the theory of constructivist learning and how it relates to smartphones as its tool to enhance teaching and learning. The actual survey findings demonstrate that not all features and functions of smartphones are in use, or perhaps have been fully exploited to benefit teaching and learning. Such features include photo/video camera, playing games, and other specific educational applications such as Khan Academy. WhatsApp and Facebook are found to be highly used. Unless specific activities and concrete evidence are presented, the study cannot confidently prove that what students do with the said apps is educational. By considering the time frame and human resources, limitations such as sample size were considered, and therefore it can be problematic to generalize the results. Overall, the findings should provide an inspiration window into similar or further investigation of issues such as those recommended in 5.6.

References

Aamri, A., & Suleiman, K. (2011). *The Use of Mobile Phones in Learning English Language by Sultan Qaboos University Students : Practices, Attitudes and challenges*. *2*(3), 143–152.

Ababneh, Sana. (2017). Using Mobile Phones in Learning English: The Case of Jordan. Journal of Education and Human Development. 6. 10.15640/jehd.v6n4a14.

Abbasi, M. & Hashemi. (2013). The impact/s of Using Mobile Phone on English Language Vocabulary Retention. International Research Journal of Applied and Basic Sciences. 4 (3), 541-547.

Al-Abdulkareem, R., & Hentschke, G. C. (2014). Textbooks and Constructivist Pedagogy in Saudi Arabian School Classrooms. *Journal of Curriculum and Teaching*, *3*(2). doi: 10.5430/jct.v3n2p13

Al-Abdulkareem, S. A. (2015). Exploring the Use and the Impacts of Social Media on Teaching and Learning Science in Saudi. *Procedia – Social and Behavioral Sciences, 182*, 213-224. doi:10.1016/j.sbspro.2015.04.758

Al-Dheleai, Y.M., Tasir, Z. (2019). Web 2.0 for fostering students' social presence in online learning-based interaction. Journal of Technology and Science Education, 9(1), 13-19. https://doi.org/10.3926/jotse.552

Aldoobie, N. (n.d.). Technology Integration and Learning Theory. *American International Journal of Contemporary Research* , *5*(6), 114–118. Retrieved from http://www.aijcrnet.com/journals/Vol_5_No_6_December_2015/16.pdf

Aldrich, S. T. (2017). *Students' and Teachers' Perceptions of the Use of Mobile Technology in University Preparation Classes* (Master Thesis, Massey University, Manawatu Campus, 2017) (pp. 1-163). Manawatu, New Zealand: Massey University. Retrieved July 23, 2018, from

https://mro.massey.ac.nz/bitstream/handle/10179/11539/02_whole.pdf?sequence=2&isAllowed=y.

Alfawareh, H. M., & Jusoh, S. (2017). The Use and Effects of Smartphones in Higher Education. *International Journal of Interactive Mobile Technologies (IJIM)*, *11*(6), 103 – 107. doi: 10.3991/ijim.v11i6.7453

Alvi, M. H. (2016). A Manual for Selecting SamplingTechniques in Research. *A Manual for Selecting SamplingTechniques in Research*. Munich: Munich Personal RePEc Archive.

Apuke, O. D., & Iyendo, T. O. (2018). University students usage of the internet resources for research and learning: forms of access and perceptions of utility. *Heliyon*, *4*(12), 1–34. doi: 10.1016/j.heliyon.2018.e01052
Australian Association for Research in Education (AARE) 2007 Conference

Bidin, S., & Ziden, A. A. (2013). Adoption and Application of Mobile Learning in the Education Industry. *Procedia - Social and Behavioral Sciences*, *90*, 720–729. doi: 10.1016/j.sbspro.2013.07.145

Bllaca, N. (2016). Smartphone use in English Language Learning. In *Smartphone use in English Language Learning* (pp. 305-315). International Conference on Linguistics, Literature and Culture. Retrieved May 8, 2018, from https://dspace.aab-edu.net/bitstream/handle/123456789/306/30-Nuhi-Bllaca-Smartphone-use-in-English-Language-Learning.pdf?sequence=1&isAllowed=y.

Bouhnik, D., & Deshen, M. (2014). WhatsApp goes to school: Mobile instant messaging between teachers and students. Journal of Information Technology Education: Research, 13, 217-231. Retrieved from http://www.jite.org/documents/Vol13/JITEv13ResearchP217-231Bouhnik0601.pdf

Cakir, I. (2015). *Opinions and Attitudes of Prospective Teachers for the Use of Mobile Phones in Foreign Language Learning*. *6*(3), 239–255.

Calabrich, S. L. (2016). Learners' Perceptions of the Use of Mobile Technology in a Task-Based Language Teaching Experience. *International Education Studies, 9*(12), 120-136. doi:10.5539/ies.v9n12p120

Chan, N. N., Walker-gleaves, A., & Remedios, R. (2013). *Learning With Smartphones : Students' Lived Experience Of Using Smartphones*. Int'l Conference on Mobile Learning 2013. 163–167.

Chanchary, F. H., & Islam, S. (n.d.). *Mobile Learning in Saudi Arabia - Prospects and Challenges.* Retrived from: https://pdfs.semanticscholar.org/d7b2/17e309cf25f7e9929c7e821fd0d093f12fa0.pdf

Chhikara, M. (2015). Use of Tablets and Smart Phones Towards Learning English as A Foreign Language. *Indian Journal of Research, 4*(7), 16-17. Retrieved July 08, 2018, from https://www.worldwidejournals.com/paripex/recent_issues_pdf/2015/July/July_2015_1435994033__07.pdf.

Clement, J. (2020). Number of apps in leading app stores. Retrieved March 2, 2020, from https://www.statista.com/statistics/276623/number-of-apps-available-in-leading-app-stores/

Coca, M. P., & Slisko, J. (2013). *Software Socrative and Smartphones as Tools For Implementation of Basic Processes of Active Physics Learning in Classroom: An Initial Feasibility Study With Prospective Teachers*. EJPE *4*(2), 17–24.

Cochrane, R. (2015). Activities and reflection for influencing beliefs about learning with smartphones. In F. Helm, L. Bradley, M. Guarda, & S. Thouësny (Eds), *Critical CALL – Proceedings of the 2015 EUROCALL Conference, Padova, Italy* (pp. 138-143). Dublin: Research-publishing.net. http://dx.doi.org/10.14705/ rpnet.2015.000323

Colquhoun, H. L., Levac, D., Obrien, K. K., Straus, S., Tricco, A. C., Perrier, L., . . . Moher, D. (2014). Scoping reviews: Time for clarity in definition, methods, and reporting. *Journal of Clinical Epidemiology, 67*(12), 1291-1294. doi:10.1016/j.jclinepi.2014.03.013

Criollo-c, S., & Luján-Mora, S. (2018). *A Swot Analysis Of Bring Your Own Devices in Mobile Learning*. 14th International Conference Mobile Learning 2018.148–152.

El Hariry, N. A., PhD. (2015). MOBILE PHONES AS USEFUL LANGUAGE LEARNING TOOLS. *European Scientific Journal, 11*(16), 6/15, 298-317. Retrieved July 21, 2018, from https://eujournal.org/index.php/esj/article/view/5870.

Gon, S., & Rawekar, A. (2017). *Effectivity of E-Learning through Whatsapp as a Teaching Learning Tool*. MVP Journal of Medical Sciences, Vol 4(1), 19–25. DOI: 10.18311/mvpjms/2017/v4i1/8454

Grant, M.M, Tamim, S., Brown, D.B., Sweeney, J.P., Ferguson, F.K., & Jones, L.B (2015). Teaching and learning with mobile computing devices: Case study in K-12 classrooms. *TechTrends: Linking Research and Practice to Improve Learning*, 59(4), 32-45. DOI: http://dx.doi.org/10.1007/s11528-015-0869-3

Hamdani, D. (2014). A Constructivist Approach to a Mobile Learning Environment. *International Journal of Computer Applications, 93*(4), 41-46. doi:10.5120/16206-5500

Hassan, Z. A., Schattner, P., & Mazza, D. (2006). Doing A Pilot Study: Why Is It Essential?. *Malaysian family physician: the official journal of the Academy of Family Physicians of Malaysia*, *1*(2-3), 70–73.

Heale, R., & Twycross, A. (2015). Validity and reliability in quantitative studies. *Evidence-Based Nursing*, *18*(3), 66–67. doi: 10.1136/eb-2015-102129

Hein, G. E. (2016, October 7). Constructivist Learning Theory. Retrieved from https://www.exploratorium.edu/education/ifi/constructivist-learning

Herrington, A. & Herrington, J. (2007). Authentic mobile learning in higher education.

Ismail, I., Bokhare, S., Azizan, S. N., & Azman, N. (2013). Teaching via Mobile Phone: a Case Study on Malaysian Teachers' Technology Acceptance and Readiness. *The Journal of Educators Online*, *10*(1), 1–38. doi: 10.9743/jeo.2013.1.3

Joyce-Gibbons, A., Galloway, D., Mollel, A., Mgoma, S., Pima, M., & Deogratias, E. (2017). Mobile phone use in two secondary schools in Tanzania. *Education and Information Technologies*, *23*(1), 73-92. doi:10.1007/s10639-017-9586-1

Kearney, M., Burden, K., & Rai, T. (2015). Investigating teachers adoption of signature mobile pedagogies. *Computers & Education*, *80*, 48–57. doi: 10.1016/j.compedu.2014.08.009

Keengwe, J. (2015). Handbook of research on educational technology integration and active learning. Hershey: Information Science Reference, IGI Global.

Keskin, N. O., & Metcalf, D. (2011). The Current Perspectives, Theories and Practices of Mobile Learning. The Turkish Online Journal of Educational Technology, 10, 202-208

Knupfer, N.N.,& McLellan, H. (2001). Descriptive Research Methodologies. In D.H. Jonassen (Ed.), Handbook of Research for Educational Communications and Technology(pp. 1196-1213). Mahwah, NJ: Lawrence Erlbaum Associates.

Kothari, C. R. (2005). *Research methodology*: *methods and techniques*, 2nd edition, New Delhi: Wiley Eastern.

Lans, W. & Van der Voordt, T. (2002). Ways to study - Descriptive research.

Levac, D., Colquhoun, H., & Obrien, K. K. (2010). Scoping studies: Advancing the methodology. *Implementation Science, 5*(1). doi:10.1186/1748-5908-5-69

Likert, R. (1932). A technique for the measurement of attitudes, *Archives of Psychology* 140

Loeb, S., Dynarski, S., McFarland, D., Morris, P., Reardon, S., & Reber, S. (2017). Descriptive analysis in education: A guide for researchers. (NCEE 2017–4023). Washington, DC: U.S. Department of Education, Institute of Education Sciences, National Center for Education Evaluation and Regional Assistance.

Martínez-Mesa, J., González-Chica, D. A., Duquia, R. P., Bonamigo, R. R., & Bastos, J. L. (2016). Sampling: how to select participants in my research study?. *Anais brasileiros de dermatologia*, *91*(3), 326–330. https://doi.org/10.1590/abd1806-4841.20165254

MINED. Education Strategic Plan 1–142 (2012). Maputo: Academica LDA. Retrieved from http://www.mined.gov.mz/Legislacao/Documents/PEE_2012-2016_EN.pdf

Mozambique Population (2020) - Worldometer. (2020). Retrieved 7 May 2020, from https://www.worldometers.info/world-population/mozambique-population/

Muianga, Xavier; Hansson, Henrik; Nilsson, Anders; Mondlane, Avelino; Mutimucuio, Inocente; and Guambe, Alsone (2013) "ICTin Education in Africa - Myth or Reality: A Case Study of Mozambican Higher Education Institutions,"The African Journal of Information Systems: Vol. 5: Iss. 3, Article 5.Available at:http://digitalcommons.kennesaw.edu/ajis/vol5/iss3/5

Nadelson, L., Howlett, C., & Oswalt, S. (2013). *The Intersection of Preservice Teachers' Confidence, Perceptions, and Ideas for Using Instructional Technology for Teaching and Learning*. International Journal of Higher Education, 2(4), 77 – 90 doi:10.5430/ijhe.v2n4p77

Nalliveettil, G. M., & Alenazi, T. H. (2016). The Impact of Mobile Phones on English Language Learning: Perceptions of EFL Undergraduates. *Journal of Language Teaching and Research, 7*(2), 264-272. http://dx.doi.org/10.17507/jltr.0702.04

Nassaji, H. (2015). Qualitative and descriptive research: Data type versus data analysis. *Language Teaching Research*, *19*(2), 129–132. doi: 10.1177/1362168815572747

Ngesi, N., Landa, N., Madikiza, N., Cekiso, M. P., Tshotsho, B., & Walters, L. M. (2018). Use of mobile phones as supplementary teaching and learning tools to learners in South Africa. *Reading & Writing*, *9*(1), 1–12. doi: 10.4102/rw.v9i1.190

O'Bannon B. W., Waters S., Lubke J., Cady J., & K. Rearden (2017) Teachers and Students Poised to Use Mobile Phones in the Classroom, Computers in the Schools, 34:3, 125-141, DOI: 10.1080/07380569.2017.1347454

O'Dea, S. (2020). Mozambique mobile cellular subscriptions 2000-2018 | Statista. Retrieved 5 May 2020, from https://www.statista.com/statistics/500997/number-of-mobile-cellular-subscriptions-in-mozambique/

O'Dea, S. (2020). Smartphone users worldwide 2020 | Statista. Retrieved 5 May 2020, from https://www.statista.com/statistics/330695/number-of-smartphone-users-worldwide/

Ozdamli, F. (2012). Pedagogical framework of m-learning. *Social and behavioral Sciences 31*(2011), 927–931. https://doi.org/10.1016/j.sbspro.2011.12.171

Parnell, W., & Bartlett, J. (2012). iDocument: How Smartphones and Tablets are Changing documentation in Preschool and Primary Classrooms. Young Children, 67(3), 50-59

Pegrum, M., Howitt, C., & Striepe, M. (2013). Learning to take the tablet: How pre-service teachers use iPads to facilitate their learning. *Australasian Journal of Educational Technology*, *29*(4). doi: 10.14742/ajet.187

Peters, K. (2005, January 1). *Learning on the move: Mobile technologies in business and education*. Canberra: Commonwealth of Australia.

Peters, M. D., Godfrey, C. M., Khalil, H., Mcinerney, P., Parker, D., & Soares, C. B. (2015). Guidance for conducting systematic scoping reviews. *International Journal of Evidence-Based Healthcare,13*(3), 141-146. doi:10.1097/xeb.0000000000000050

Pham, M. T., Rajić, A., Greig, J. D., Sargeant, J. M., Papadopoulos, A., & Mcewen, S. A. (2014). A scoping review of scoping reviews: Advancing the approach and enhancing the consistency. *Research Synthesis Methods,5*(4), 371-385. doi:10.1002/jrsm.1123

Prensky, M. (2001). Digital Natives, Digital Immigrants Part 1. *On The Horizon*, *9*(5), 1-6. doi: 10.1108/10748120110424816

Ramamuruthy, V., & Rao, S. (2013). *Smartphones Promote Autonomous Learning in ESL Classrooms*. Malaysian Online Journal of Educational Technology *3*(4).

Reinders, H. (2010, March). Twenty Ideas for Using Mobile Phones in the Language ... Retrieved July 23, 2018, from https://www.bing.com/cr?IG=F3B86207CB3D429CBDD7F8AEA45B037F&CID=109F32325C006DC01B4E3E095DFD6C7E&rd=1&h=dZ9MILMuUrHRsTbtBplO9KORw70W14bOMhwTuhwkJAw&v=1&r=https://americanenglish.state.gov/files/ae/resource_files/48_3_4_reinders.pdf&p=DevEx.LB.1,5525.1

Rung, A., Warnke, F., & Mattheos, N. (2014). Investigating the Use of Smartphones for Learning Purposes by Australian Dental Students. *JMIR MHealth and UHealth*, *2*(2). doi: 10.2196/mhealth.3120

Schunk, D. H. (2012). *Learning theories: an educational perspective* (6th ed.). Boston: Pearson.

ŞENEL, M. (2016). Exploring ELT Students' Perception of Mobile Phone through Figurative Language. *Sakarya University Journal of Education, 9*(25), 9-25. http://dx.doi.org/10.19126/suje.92706

Shrestha, P. (2012). The Potential of Mobile Technologies for (English) Language Learning in Nepal. *Journal of NELTA, 16*(1-2), 107-113. doi:10.3126/nelta.v16i1-2.6134

Sung, Y.-T., Chang, K.-E., & Liu, T.-C. (2016). The effects of integrating mobile devices with teaching and learning on students learning performance: A meta-analysis and

research synthesis. *Computers & Education*, *94*, 252–275. doi: 10.1016/j.compedu.2015.11.008

Taherdoost, H. (2016). Validity and Reliability of the Research Instrument; How to Test the Validation of a Questionnaire/Survey in a Research. *SSRN Electronic Journal*, *5*(3), 28–36. doi: 10.2139/ssrn.3205040

Taleb, A. M. R. B., Coughlin, C., Romanowski, M. H.,Semmar, Y. & Hosny, H.K. (2017). *Students, Mobile Devices and Classrooms : A comparison of US and Arab Undergraduate Students in a Middle Eastern University*. Higher Educational Studies, *7*(3), 181–195. https://doi.org/10.5539/hes.v7n3p181

Tindell, D. R., & Bohlander, R. W. (2012). The Use and Abuse of Cell Phones and Text Messaging in the Classroom: A Survey of College Students. *College Teaching*, *60*(1), 1–9. doi: 10.1080/87567555.2011.604802

Ultanir, E. (2012). An Epistemological Glance At The Constructivist Approach: Constructivist Learning In Dewey, Piaget, And Montessori . *International Journal of Instruction*, *5*(2), 195–212. Retrieved from https://files.eric.ed.gov/fulltext/ED533786.pdf

UNESCO. (2015). Southern Africa Regional Meeting on Integrating ICTs in Teaching and Learning. In *Southern Africa Regional Meeting on Integrating ICTs in Teaching and Learning*. Retrieved from http://www.unesco.org/new/fileadmin/MULTIMEDIA/FIELD/Harare/images/ICTRegionalMeeting_Reporting_15122015.pdf

Van Teijlingen, Edwin & Hundley, Vanora. (2002). The Importance of Pilot Studies. Nursing standard (Royal College of Nursing (Great Britain): 1987). 16. 33-6. 10.7748/ns2002.06.16.40.33.c3214.

Van Teijlingen, Edwin & Hundley, Vanora. (2002). The Importance of Pilot Studies. Nursing standard (Royal College of Nursing (Great Britain): 1987). 16. 33-6. 10.7748/ns2002.06.16.40.33.c3214.

Vázquez-cano, E. (2014). *Mobile Distance Learning with Smartphones and Apps in Higher Education*. Educational Sciences: Theory & Practice *14*(4), 1505–1520. https://doi.org/10.12738/estp.2014.4.2012

Walker, R. (2013) “I don't think I would be where I am right now". Pupil perspectives on using mobile devices for learning', Research in Learning Technology, vol. 21, pp. 1-12. DOI: 10.3402/rlt.v21i2.22116

Wallace, P. (2012). *M-Learning: Promises Perils and challenges for K-12.*PDF.

Yu, F. (2012). Mobile/Smart Phone Use in Higher Education. In M. Rao (Ed.), Southwest Decision Science Institute Conference(pp. 831–839). Houston, Texas, USA: Decision Sciences Institute. Retrieved from http://www.swdsi.org/swdsi2012/proceedings_2012/papers/Papers/PA144.pdf

Yurdagül, C., & Oz, S. (2018). *Attitude towards Mobile Learning in English Language Education*. Education Sciences.8(142), 1–14. https://doi.org/10.3390/educsci8030142

Annex 1. Questionnaire for teacher participants

QUESTIONÁRIO DO PROFESSOR

O meu nome é ***Mphatso Imwa***, tutor assistente no ISET-One World, Changalane - Maputo e estudante de mestrado na Universidade Aberta, Portugal. Estou a elaborar uma pesquisa que visa explorar o potencial do uso do **smartphone** no ensino e aprendizagem em escolas secundárias.

A pesquisa se concentra em descrever os benefícios dos smartphones no ensino e na aprendizagem, explorando as percepções que professores e alunos têm, descrevendo os desafios associados aos smartphones e possíveis considerações para a incorporação de smartphones na educação. Os resultados desta pesquisa podem ajudar a mapear o futuro da tecnologia em sala de aula, recomendando como certas tecnologias, como Smartphones, podem ser usadas no processo pedagógico para melhorar o ensino e aprendizagem.

Esta é uma pesquisa acadêmica e os dados coletados aqui serão usados apenas para esse fim. Existe total confidencialidade no processo de coleta de dados, portanto, os entrevistados são solicitados a não divulgar seus nomes ou identidade.

Espera-se que os resultados e o relatório desta pesquisa estejam prontos a partir do mês de junho de 2020 e estarão disponíveis em cópias digitais e possivelmente, serão publicados em plataformas de acesso aberto, como periódicos. Se você estiver interessado em obter a cópia dos resultados, não hesite em me escrever neste endereço de e-mail: imwaphiri@gmail.com

CONSENTIMENTO INFORMADO

A participação nesta pesquisa é voluntária e se você optar por participar, leia a seguinte declaração e marque a caixa correspondente para declarar sua participação.

Declaro que fui informado da pesquisa e da maneira como as informações coletadas serão usadas: ☐

O POTENCIAL DO USO DO SMARTPHONE NO ENSINO E APRENDIZAGEM EM ESCOLAS SECUNDÁRIAS - UM ESTUDO DE ESCOLAS EM MAPUTO

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i. **Escola**: _____

ii. **Sexo**: Masculino ☐ Feminino: ☐

iii. **Nivel academico**: Certificado ☐ Bachelarato ☐ Licenciado ☐ Mestrado ☐ Doutor ☐

iv. **Experienca de Ensino**: Menos de 1 ano ☐ 1-2 anos ☐ 3-5 anos ☐ 6 anos mais ☐

1. A escola possui **alguma política de TIC** relacionada ao ensino e à aprendizagem? Marque a sua resposta

Sim ☐ **Não** ☐ **Não Sei** ☐

2. Se a **sua resposta na pergunta 1 foi SIM**, que políticas estão dfinidas sobre o uso das TICs no ensino e na aprendizagem?

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3. A escola apoia / promove o uso de qualquer tecnologia para dar apoio ao ensino e à aprendizagem?

Sim ☐ **Não** ☐

4. Sua escola fornece tecnologia para ser usada em suas aulas?

Sim ☐ **Não** ☐

Se a **sua resposta na pergunta foi SIM,** Mencione a tecnologia _____

5. Você já **foi treinado ou orientado sobre o uso da tecnologia** para apoiar o ensino e a aprendizagem?

Sim ☐ **Não** ☐

6. Identifique seu nível de concordância nas seguintes afirmações sobre se esses recursos podem afectar a maneira como ensinamos e aprendemos:

No.	**Afirmações**	**Concordo plenamente**	**Concordo**	**Nem concordo, nem discordo**	**Discordo**	**Discordo totalmente**
1	O recurso a dispositivos móveis permite aprender em qualquer lugar e a qualquer momento					
2	A conectividade à Internet e ao celular me permite uma interação e um envolvimento contínuos com os meus alunos e colegas					

3	Os dispositivos móveis permitem o acesso a imensos conteúdos de ensino e aprendizagem da Internet, complementando os recursos limitados da minha sala de aula física.					
4	Posso pesquisar rapidamente sobre questões pertinentes que surgem dos meus alunos e ajudá-los com explicações e respostas concretas					
5	O ensino se torna fácil à medida que eu mantenho contacto com os meus alunos, mesmo depois das aulas, através de discussões em grupo via WhatsApp, Telegram e outros aplicativos de mensagens instantâneas.					
6	Eu posso pedir aos meus alunos para fazerem algumas tarefas, por exemplo tarefas de línguas no Duolingo, Babbel e Hello Pal etc. para mantê-los envolvidos e promover suas habilidades usando os seus **smartphones**.					
7	Com os smartphones, eu posso enviar vídeos curtos explicativos sobre diferentes tópicos para eles assistirem e continuarem a aprender em suas zonas de conforto.					
8	Eu conecto os meus alunos com outras escolas ou especialistas em todo o mundo via Facebook ou outras plataformas para que eles aprendam ou troquem e descubram novas experiências.					
9	Nos casos em que a minha escola não possui materiais experimentais, eu posso usar a Internet via **smartphone** para assistir as experimentos científicos em plataformas como o YouTube ou a Khan Academy para que os meus alunos vejam o processo do que apenas explicá-los teoricamente					
10	Nunca pensei em usar **smartphones** para melhorar meu ensino e aprendizagem dos alunos.					

7. Que **percepções tem** sobre o uso de smartphones na educação? Identifique o seu nível de concordância com as seguintes afirmações:

No	**Afirmações**	**Concordo plenamente**	**Concordo**	**Nem concordo, nem discordo**	**Discordo**	**Discordo totalmente**
1.	Os smartphones oferecem um ambiente de aprendizagem personalizado					
2	Os smartphones promovem uma colaboração eficaz entre os alunos nas atividades de aprendizagem					

3	Os smartphones fazem / podem envolver alunos tímidos, nas actividades de aprendizagem.					
4	O smartphone estende a sala de aula física às aulas cibernéticas, tornando o aprendizagem uma actividade social e informal.					
5	Os smartphones são cruciais para disciplinas específicas, como a aprendizagem de línguas (por exemplo, português / inglês)					
6	Dependendo de uma atividade de aprendizagem, os smartphones podem ser usados em quase todas as disciplinas.					
7	Enquanto jogam via smartphones, os alunos podem melhorar ou aprender novas habilidades (por exemplo Simcity)					
8	Com o smartphone, posso organizar um debate ou discussão com meus alunos via WhatsApp / Telegram e moderar a actividade suficientemente em comparação com os horários da sala de aula, que não são suficientes para envolver todos os alunos					
9	Os smartphones são importantes na criação de alunos autônomos que podem iniciar suas atividades e situações de aprendizagem.					
10	Com smartphones, posso me conectar de maneira fácil e rápida com os pais e encaregados dos alunos em questões relacionadas à educação dos alunos					
11	Eu acho que os **smartphones** são ferramentas de distração e, portanto, não devem ser permitidos nas escolas					
12	Os alunos passam muito tempo socializando (por exemplo, via Facebook / Twitter) em vez de aprender					
13	Os alunos usam **smartphones** para compartilhar conteúdo ilícito em sala de aula, portanto, isso pode destruir as suas habilidades psicológicas e emocionais para a aprendizagem.					
14	Os alunos usam / podem usar smartphones em sala de aula para intimidar outras pessoas e, portanto, permitir seu uso pode promover o abuso					
15	Os smartphones geralmente são projetados para entretenimento e, portanto, não têm lugar na educação					
16	Eu acho que usar o smartphone no ensino exigirá muito tempo, pois é difícil controlar o que os alunos estão a fazer durante a actividade de aprendizagem.					
17	Eu acho que os alunos podem usar o smartphone do seu jeito, seja em casa ou em qualquer lugar, excepto na escola ou na sala de aula.					
18	Eu acho que o smartphone deve ser usado no ensino superior, como na universidade, pois os alunos são mais maduros do que no ensino secundário					

8. Quais os **desafios que considera que os professores podem enfrentar** no ensino e na aprendizagem através do uso de smartphones? Identifique o seu nível de concordância com as afirmações abaixo

No	**Afirmações**	**Concordo plenamente**	**Concordo**	**Nem concordo, nem discordo**	**Discordo**	**Discordo totalmente**
1.	Os smartphones são caros e nem todos podem pagar					
2.	Há falta de conteúdo de aprendizagem que esteja contextualizado à minha realidade nas App Stores, dificultando a seleção de conteúdo adequado para ensino e aprendizagem					
3	Os smartphones são difíceis de usar, portanto, professores podem achar difícil usar em situações de aprendizagem					
4	O custo da internet é mais alto e a maioria das escolas não possui uma conexão a internet, o que torna uma barreira para acessar conteúdos importantes relacionados à actividade de aprendizagem					
5	A falta de conectividade de rede nas escolas rurais torna sem sentido possuir um smartphone					
6	Os alunos podem facilmente deixar de aprender devido a informações em massa e plataformas sociais não relacionadas à educação.					
7	Em alguns casos, alunos e professores não têm conhecimento técnico para usar o smartphone como ferramenta pedagógica					
8	Nem todos os aplicativos são compatíveis com os diferentes sistemas operacionais existentes e, mesmo que disponíveis, um pode precisar comprar para usar					
9	Consumo de tempo / inundação de informações, por exemplo discussões em grupo do WhatsApp de alguma forma podem ser aborecidas.					
10	Há muito plágio, pois os alunos tendem a copiar as informações e considerá-las como suas, em vez de pesquisas e argumentações profundas.					
11	É difícil encontrar as informações mais necessárias e, portanto, não é eficiente.					

9. Reflita sobre **como você usa seu celular / smartphone em relação à sua profissão**: (**Selecione as 5 tarefas mais importantes que se aplicam a você**

No.	**Uso**	**Tique**
1.	Traduzir textos de ou para diferentes idiomas	
2	SMS - Enviar mensagens de texto para os meus alunos e colegas sobre diferentes tarefas de aprendizagem	
3	Dicionário - Uso para ensinar vocabulário	
4	YouTube - Assistir vídeos sobre tópicos complexos antes do meu ensino	
5	Ouvir música	
6	Tirar fotos / vídeos do meu aluno durante as aulas para referências e avaliações	
7	Tomar notas	
8	Lembrete	
9	Calculadora	
10	Aprender novas linguas	
11	Redes sociais - por exemplo Facebook / WhatsApp	
12	Ler livros / notícias / audiolivros	
13	Jogar jogos-entretenimento	
14	Procurar informações na internet	

10. Em **quais disciplinas você acha que os smartphones são mais adequados**? marque a sua resposta na tabela

A	Disciplinas de linguas (por exemplo, inglês, francês, português)	
B	Disciplinas de Humanidade (por exemplo, Geografia)	
C	Disciplinas artes (por exemplo, Musica)	
D	Disciplinas científicas (por exemplo, matemática, química, biologia e ciências físicas)	

Annex 2. Questionnaire for student participants

QUESTIONÁRIO DO ESTUDANTE

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(se maior de 16 de idade)

Declaro que fui informado da pesquisa e da maneira como as informações coletadas serão usadas: ☐

Assinatura do Pai / Responsável: .....

O POTENCIAL DO USO DO SMARTPHONE NO ENSINO E APRENDIZAGEM EM ESCOLAS SECUNDÁRIAS - UM ESTUDO DE ESCOLAS URBANAS EM MAPUTO

Definição de conceitos

Smartphone:
O Smartphone é um telefone celular que, além de fazer apenas ligações e enviar mensagens de texto, pode ser usado para acessar a Internet, jogar jogos online, interagir com pessoas por meio de videochamada e muito mais. Os smartphones usam sistemas operacionais como Android e iOS.

i. Escola _____ Classe _____ Idade_____

ii. Sexo: Masculino ☐ Feminino ☐

1. Você possui ou tem acesso aos seguintes dispositivos (coloque um círculo na sua resposta ou suas respostas)
   a. Telefone celular básico
   b. Smartphone (Android ou iOS - com acesso à Internet ou smartphone)
   c. Tablet / iPad
   d. Computador portátil
   e. Outro, **por favor escreva, especifique**: _____

2. Sua escola fornece tecnologia para ser usada em suas aulas?

   Sim ☐ Não ☐
   Se a sua resposta na pergunta foi SIM, Mencione a tecnologia _____

3. Você acha que o **smartphone é uma ferramenta que pode melhorar a sua aprendizagem**? Selecione seu nível de concordância com as seguintes afirmações abaixo:

No.		Concordo plenamente	Concordo	Não concordo nem discordo	Discordo	Discordo totalmente
1.	O Smartphone é uma ferramenta significativa para a minha aprendizagem					
2.	O Smartphone é apenas uma ferramenta de distração na minha aprendizagem					

4. **Que actividades você realiza com o seu celular / smartphone no seu processo de aprendizagem?** (Selecione as **5 tarefas mais significativas** que se aplicam a você)

No.	Afirmações	**Tique**
1.	Eu uso o dicionário para aprender novas palavras	
2.	Eu uso aplicativos de idiomas diferentes, por exemplo Duo Lingo, para aprender outras línguas	
3.	Eu uso a calculadora para resolver problemas de ciências e matemática	
4	Eu uso aplicativos como a Khan Academy para ler livros sobre diferentes disciplinas e tópicos	
5.	Eu uso o WhatsApp para comunicar e compartilhar materiais de aprendizagem com os meus amigos	
6.	Uso o aplicativo do YouTube para assistir a apresentações ou vídeos sobre certos tópicos de aprendizagem	
7.	Pesquiso informações de sites diferentes por meio do smartphone	
8	Eu escuto música para melhorar o meu inglês	
9.	Eu jogo alguns jogos, por exemplo puzzles de línguas ou ciências	
10.	Eu assisto / ouço notícias do meu telefone / smartphone	
11.	Eu uso o tradutor App para traduzir de ou para o idioma que não falo	
12	Envio mensagens de texto ao meu professor / colegas sobre questões relacionadas à minha aprendizagem / lição de casa	
13	Uso o Facebook e outras redes sociais para ter contacto com pessoas que me deem acesso a mais conhecimentos	
14	Tiro fotos ou vídeos de situações importantes de aprendizagem para revisão	
15.	Outro, liste-os aqui:_____ _____ _____	

5. Em **quais disciplinas** você acha que os smartphones são mais adequados? marque todas as respostas na tabela que considere correta

A	Disciplinas de línguas (por exemplo, inglês, francês, português)	
B	Disciplinas de Humanidade (por exemplo, Geografia)	
C	Disciplinas artes (por exemplo, Música)	
D	Disciplinas científicas (por exemplo, matemática, química, biologia e ciências físicas)	

6. **Quanto tempo você gasta** no seu celular / smartphone para aprender em um dia: marque a resposta exigida da tabela

A	Menos de 1 hora	
B	Entre 2 e 3 horas.	
C	Entre 3 e 5 horas	
D	Mais de 5 horas por dia	

7. **Existem regras** na escola que inibem o uso de dispositivos móveis / smartphones no processo de ensino e aprendizagem?
   (a) Sim (B) Não (c) Eu não sei

   Se a sua resposta foi <u>Sim</u>, vá para a pergunta 7

   Se a sua resposta foi <u>Não</u>, vá para a pergunta 9

   Se a sua resposta foi <u>Eu não sei</u>, vá para a pergunta 8

8. Coloque um círculo na regra que melhor se adequa ao seu contexto.
   a. Não traga celulares / smartphones na escola
   b. Você pode trazer, mas deve desativá-los durante as aulas.
   c. Você pode trazê-los, mas deve desativá-los durante as aulas, a menos que instruído pelo professor
   d. Você pode usá-los para fins educacionais fora das instalações da escola

   Vá para a pergunta 9

9. Se **<u>não sabe</u>**, você acha necessário permitir o uso de celulares / smartphones na escola e na sala de aula <u>apenas</u> para fins de aprendizagem?
   (a) Sim (b). Não

10. Selecione seu nível de concordância com as seguintes afirmações abaixo:

No.		Concordo plenamente	Concordo	Não concordo nem discordo	Discordo	Discordo totalmente
1	Permitir o celular / smartphones na sala de aula me ajudará a fazer pesquisas instantâneas sobre questões / problemas complexos					
2	Permitir celulares / smartphones nas salas de aula causará distrações desnecessárias na aprendizagem (aumento da partilha de conteúdo desnecessário)					
3.	Dispositivos móveis / smartphones facilitarão o desafio da falta de materiais de aprendizagem, como livros					