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A Mobile-based parent portal for public primary schools in Nairobi County, Kenya.

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A Mobile-Based Parent Portal for Public Primary Schools in Nairobi County, Kenya

By

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Declaration

I declare that this work has not been previously submitted and approved for the award of a degree by this or any other University. To the best of my knowledge and belief, the thesis contains no material previously published or written by another person except where due reference is made in the thesis itself.

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Dedication

I dedicate this dissertation to myself for not giving up along the way, for the many hours, and the commitment I have put in my academic journey. Besides, I devote this work to my teachers, family, and friends. My gratitude goes to my loving parents James Ong'udi (late), Maren Juma (late) and Milka Aoko whose words of encouragement and push for tenacity ring in my ears.

I dedicate this work and give special thanks to my wife Doreen Nekesa and son Elon James. Both of you have been my best cheerleaders.

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Abstract

Parental involvement in a child's education and learner's success are directly related. Because of this relationship, experts have developed different technologies to intervene and improve parental engagement efforts. For instance, the growing use of Internet and smartphones in Kenya has opened new and better technologies to improve parent involvement, especially in the public schools in Kenya. However, since many public primary schools rely on funding from the government and donations, it has been difficult for them to adopt technology in the learning environment because of a shortage of funds. Parents still have to make physical visits to schools to get updates on their child's progress. Such challenges have impeded effective parental involvement in public primary schools. Hence, poor performance of learners and low public primary to secondary school transition compared to their private school's counterparts. Therefore, affordable and easy to use products can be made to help the public primary schools achieve their academic goals and aid learning institutions to compete favourably with private schools. Thus, this study proposes a solution using a mobile based parent portal for public primary schools in Nairobi. The product will be developed based on the academic needs of the schools and reviews of the products that are already being used by learning institutions in other parts of the world. The parent portal will improve connection between schools and homes, enhance parental involvement, and ensure learner's achievement.

Key Words:

Parental-involvement, parent portal, learner, and learner achievement

Definition of Terms

Parental involvement: is defined as a general term that is used to imply the parent's effort to take an active role in their children's education (Cheng & Chen, 2018). In this sense it takes many forms such as communication with school, volunteering at school and helping their children with school assignments among others.

Learner: Kaptich et. Al. (2019) define a learner as someone who is learning a subject or a skill. In this study, learner refers to the primary school students in Kenya.

Parent portal: is the parent login system where parents can log in and access their children's academic information (Cheng & Chen, 2018). For the purpose of this study, the parent portal is used for communication between parents and teachers.

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Chapter 1: Introduction

1.1 Background

Many successful schools embrace and support the involvement of parents in the education of their children. Cheng and Chen (2018) argue that children are shaped by their parents long before they join school. The primary role of parents in a child's life translates into success in life. When the child joins school, he or she is introduced to nourishment under the tutelage of learned adults.

In Kenya, the contribution of primary education to the development of human capital cannot be overlooked. In fact, economists and education planners have provided evidence between primary education and the ability of a learner to effectively get involved in economic activities (Hornby, 2011). As a result, the government and other investors have invested heavily in this sector by funding the free and compulsory primary education (FCPE), which was introduced in 2003 (Hornby, 2011). Even though FCPE has boosted enrolment and growth in some schools, the increasing demand for quality education poses various challenges, both internally and externally.

Despite the existing shortcomings, the primary schools in Kenya are under immense pressure to produce quality education, which is often measured through learner's performance in Kenya Certificate of Primary Education (KCPE) examination. Hornby (2011) highlights that parents are one of the main stakeholders in the education system; hence, the burden of quality education falls on them. Parental involvement has now gained great recognition as one of the main processes in children's learning. Thus, different strategies have been developed to re-enforce parental involvement in education. Some of the strategies have been to include parents in school boards, help learners with homework, and attend learner's clinics. Therefore, developing a tool that will improve participation of parents using the limited resources will enable them to access the learner's data, exchange correspondences with school, and receive recommendations from learning institutions.

Education is one of the vital mechanisms for providing people with necessary skills, competencies and knowledge. Hornby (2011) posits that digitization of the education system is critical in student's learning. A report from the Education Council of the Netherlands has revealed that researchers are still seeking suitable levels and appropriate methods of digitization. The same report attributed technology for the improved performance in secondary schools. This observation has created the need to innovate easy to use and affordable solutions that can be employed in schools. According to Bordalba & Bochaca (2019) some of the indicators that can be used to measure the effectiveness of technology in education include:

i. Rise in enthusiasm, interest, and creativity.

ii. An increase in the number of decisions to make

iii. The speed of information access because of the development of Internet infrastructure and other networking technologies.

iv. Improvement in students' performance which is often measured using grades attained by the student in an examination.

Parental involvement through use of technologies such as parent portals improves education outcomes for students. African countries such as South Africa, Kenya, and Uganda have public policies that support parental involvement (Bordalba & Bochaca, 2019). For example, in Kenya, the Basic Education Act of Kenya 2013 requires the School Boards to assess school needs with full participation of parents. The idea that parental involvement helps in improving students' academic performance is appealing to an extent that all the education stakeholders have collectively agreed that it is important for resolving the various challenges that are currently facing education systems across the globe. It is crucial to develop technological tools that foster parental involvement.

1.2 Problem Statement

Low involvement of parents in the education of their children is one of the main contributors to poor performance in public primary schools in Kenya. This phenomenon is attributed to ineffective communication between the schools and parents/homes (Bordalba & Bochaca, 2019). Further, the shortcoming has driven the parents to avoid providing the necessary support for the academic well-being of their children. Besides, teachers have not received feedback from the parents. This lack of relationship among these stakeholders is always evident at the end of primary education when affected learners fail to perform well in the national examination. Similarly, many public primary schools in Kenya are grappling with inadequate funding, and under-staffing among other challenges. Such situations make the parent's involvement in education difficult, and, hence, impede learners' success. Developing a tool that will ensure that schools and homes are interlinked and make parents collaborate with teachers in the education of their children will not only improve learner's performance but also help in the successful implementation of Competency-Based Curriculum (CBC) (KICD, 2019).

1.3 Research Objectives

i. To investigate the current tool used by schools to enhance parent's involvement in education
ii. To review the frameworks, models, and applications used in the parent portal applications for schools
iii. To develop a mobile-based parent's portal for public primary schools
iv. To test the functionality of the parent portal

1.4 Research Questions

i. What are the tools used by schools to enhance the parent's involvement in education?
ii. What frameworks, models, and applications are used in the parent portal applications for schools?

iii. What methodology will be used to develop the parent portal?
iv. What techniques will be used to test the functionalities of the parent portal?

1.5 Justification

This work will help in improving parent's involvement in the education of their children. Improved parental engagements through the portal will lead to better performance in public primary schools. Besides, administrators, teachers, parents, and learners will have an improved understanding of the parent portal and the impact it may have on the learner's achievement. Additionally, the portal will help the government to implement CBC successfully. To policymakers, the portal will promote social equity and responsibility by providing inclusive and equitable access to quality education by learners. Lastly, this work will help policymakers and implementers to achieve the Basic Education Act of 2013, which gives parents and guardians the right to participate in the character development of their children.

1.6 Scope of Work

This work is aimed to strengthen parental involvement in education for learners in public primary schools in Nairobi. It is limited to communication between school and parents on the learner's academic progress. The devices to be used are android-based smartphones with Internet capability. The application will be developed for public primary schools within Nairobi County.

Chapter 2: Literature Review

2.1 Introduction

Parental involvement in education plays a key role in the success of students both academic and career life. This explains why governments have come up with policies and curriculums that make parents part of the learning process. Technology wise, a number of products have been developed to help improve parental involvement in education. Among the products are line used in Japan, Thailand, Taiwan, and Indonesia, school websites, social media such as Facebook and WhatsApp and text and voice messaging. Still, there is room for improvement and to come up with technological products that offer user specific experience for both parents and teachers. Jilcha (2020) points out that technology is an important part of curriculum because of the popular belief that technology enhances learning.

2.2 Theoretical Review

Parental involvement is the active participation of parents in school activities and interest in the academic and social life of students. This engagement is based on the premise that schools and teachers influence or direct parental involvement. Parental participation can also be defined as the communication between schools and parents (Kaptich et al., 2019). This definition focuses on the link between schools and parents in the form of communication. Therefore, effective parental involvement requires strong communication links between schools and parents. The authors add that parental involvement includes such activities as parenting style, motivation, home rules, parental supervision, helping with homework, visiting schools to talk about the student's academic progress, and general conduct, among others.

One of the main contributions to the poor performance in public primary schools in Kenya is lack of support from parents on the educational activities of their children. Kaptich et al. (2019) posit that parental support is vital for the cognitive, social, and mental capacity that most public primary schools in Kenya are yet to achieve. Many parents are not keen enough to see that their children have a moral foundation. Some parents defend unscrupulous behaviour both at home and in schools. Instilling discipline in students is mainly the parental responsibility because they spend most of the time with the children. Therefore, it is negligent to bestow the duty of child's castigation on teachers.

A significant relationship exists between parental involvement in educational activities and the students' academic performance in public primary schools. Lin (2019) emphasizes that helping with homework, attending academic clinics, buying learning materials, and attending school meetings have a positive impact on the academic performance of the students. When learning institutions work together with parents to support learning, learners succeed both in school and throughout life. Shahzad et al. (2016) assert that a parent's role in learners' academic activity may come out as a strong initiator at all levels of education. At every stage of learning, children undergo various cognitive and physiological changes that require a strong piece of control and grooming to help to get the best out of the learners. Shahzad et al. (2016) add that learners can show improved outcomes if they are stimulated by their parents. Parental participation has a significant impact on

the development and success of learners. Success is evident to the children who constantly get encouragement and support from their parents. However, many parents are still unaware of their position and influence in their children's education (Shahzad et al., 2016). Thus, children who do not receive support from their parents find it difficult to learn new skills in school.

Teachers play a critical role in contacting the children's biological parents and asking them to play an active role in their children's learning. This participation requires advanced technology to ease the communication between parents and teachers. Hornby and Blackwell (2018) posit that whenever parents face any issue regarding their children's education, they prefer to directly contact teachers and discuss the available options to help the children. The parents also admit that schools are doing splendid jobs to improve the academic performance of learners. This reaffirms that enhanced communication between schools and parents would go a long way into improving both academic and professional success of learners.

Various factors bar parental involvement in education. First, some parents believe that their participation is no longer needed in their children's education. In desire for independence, many adolescent learners start pushing their parents away. This makes some parents back-off in an attempt to give their children freedom and stay away from their academic life (Hornby & Blackwell, 2018). Despite the desire for independence, most adolescent learners still respect their parents and seek their advice in solving problems. Schools help parents navigate the challenges of their children's adolescence by providing them with special opportunities to study about learners' needs at various age groups and a forum to share their frustrations with other parents. Schools also run workshops that help students learn how to deal with peer pressure and make responsible choices. Second, parents feel they lack the required knowledge and skills to help their children with homework. With functioning parent-school communication, parents are provided with information about the school's program and they are engaged directly on their children's homework. This is nearly impossible for schools that still rely on analogue systems to communicate with parents. Parents need not to fully understand their children's homework but to provide encouragement and support. They can also arrange to have their children get help through peer groups, tutor, and other resources. Such initiatives are critical in encouraging parents to take part in their children's education. Third, a lack of knowledge by some parents on what constitutes primary level education also impedes parental involvement. Some parents attended the traditional education system which has since been changed to a new curriculum. If parents have a working knowledge that constitutes the primary level of education, they would be comfortable in supporting and participating in their children's homework.

The lack of resources to facilitate family-school partnership is a critical challenge for parent-school partnership. Schools can be inaccessible to parents because of different reasons such as structural, psychological, and socio-cultural aspects. Principals need to set aside some budget or raise funds to host events or pay for essential support to enable parents to learn more about their school activities. Putting into context public primary schools that solely rely on government funding and donations may be a challenge. As a result, most students have been wading through

the education system with bare minimum or no parental support and the result is evident when KCPE results are released. The public schools need parents' support more than ever to help them mould their student's character and assist them in school work. This is highly emphasized in the just rolled out competency-based curriculum in Kenya. According to Hornby and Blackwell (2018), some activities have been adopted by 11 schools they interviewed to improve parental involvement in education. Such strategies include regular newsletters, school websites, teacher-parent meetings, active Parents, Teachers, and Friends Association (PTFA), open days, new parents' evenings, school performance celebration events and assemblies, exhibition of works by learners, school fairs, school or class BBQ, and sports day. Horby and Blackwell (2018) insist that the majority of the schools reported using parent education classes, emailing or texting between teachers and parents, social media and being open longer hours to extend the time that parents collect their children given teachers and parents a chance to hold conversations.

Parent-teachers' associations can strengthen the good relationship between homes and schools. Afolabi et al. (2017) argue that some of the issues parents complained about include lack of time and ignorance on the school activities. To synchronize the poor school timing, the research by Afolabi et al. (2017) proposes the use of e-communication to synchronize communication between the schools and homes. Notably, many teachers have embraced the use of educational technology to enhance parental engagement.

2.3 Empirical Review

Technology has greatly changed how schools are run. Asongu and Odhiambo (2019) posit that the growth in IT in Africa has greatly contributed to reduction in equality in 48 African countries between the periods 2004 – 2014. The ICT indicators used include mobile phone penetration, internet penetration and fixed broadband subscription. However, Asongu and Odhiambo underpin that the poor primary education quality stifles the positive impact of mobile phone penetration in these African states. There is hope in making primary education better by leveraging on the high penetration of education and the increasing government spending on education. A report by UNICEF posits the deliberate efforts by governments to increase spending on public primary education has led to equitable benefits.

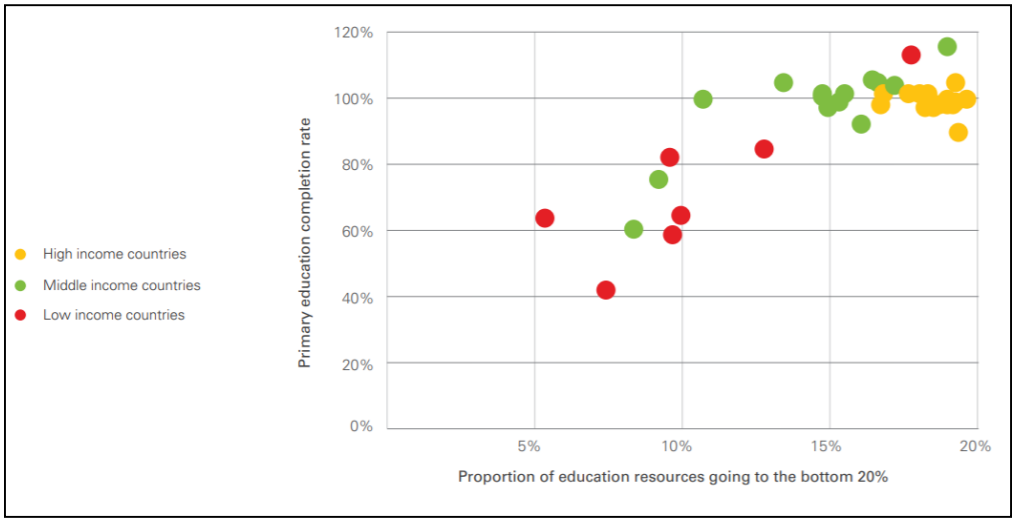

Figure 2. 1: Education resources. Source (UNICEF)

Figure 2.1 shows a strong relationship between education spending and primary school enrolment. The higher the spending the higher the enrolment. Employing ordinary least squares, Asongu and Odhiambo (2019) have established a positive correlation between mobile phone penetration and adoption of technology in education. This is a positive indicator as far as adoption of the parent portal is concerned.

Email has topped the list with a score of more than 70% as the most preferred communication tool between schools and homes (Gu, 2018). Table 2.1 shows the comparative preference of the communication tools by both parents and teachers.

Table 2 1: Parent-teacher communication tools by frequency of usage. Source (Gu, 2018)

Tool	Parent	Teacher
Email	71.2	94.1
Phone	31.7	88.2
Skyward	22.6	39.7
Newsletters	0.0	36.8
Texting	12.4	30.9
Schoology	6.0	27.9
Weekly/Monthly Folder	15.8	19.1
Webpage	4.2	14.7
Facebook	4.3	10.3

The study reaffirms that teachers and parents are comfortable to use technology for communication. Therefore, technology development is a key component of quality and equitable education in primary schools.

2.4 Solutions Used to Enhance the Parental Involvement in Education

Several tools have been developed to enhance parent's involvement in education. Xu et al. (2019) assert that with the emergence of globalization, parents are increasingly finding it difficult to be involved in their children's education because of the high demand to travel for work and business. Schools have responded to the changes by embracing the use of digital platforms to connect with the parents. Some of the tools suggested by Xu et al. (2019) are voice-calling systems, emails, websites, and parent portals.

2.3.1 School Websites

Even though many primary schools have websites, the perception of education stakeholders about the use of a website to enhance parental engagement differs. Bordalba and Bochaca (2019) assert that about 36 percent of parents confirmed that schools use institutional websites to communicate with them, even though 60% of school heads reported that teachers use the Internet this way. This discordance could be because of the difference between disseminating the communication to parents and allowing them to embrace a style of communication that is relevant to them. Besides, how homes and schools understand the use of the internet lies on the different perceptions of what either party considers need to be communicated and the regularity of communication. School websites can be effective in providing timely communication between parents and teachers if utilized optimally (Xu et al., 2019). Apart from using the website to communicate with existing parents, Gilleece and Eivers (2018) assert that websites are most likely the starting point when looking for a new school for a child. Such sites are vital in providing parents with information on ongoing activities within the school, including enrolment details.

School websites appear to offer one way to enhance and facilitate parental involvement and the information available to parents when making a decision on a school to enrol their children. Despite the many opportunities offered by school websites to enhance school-home communication, a study done in Singapore indicated that a few primary school websites actually fulfilled this function (Gilleece & Eivers, 2018). Gilleece and Eivers (2018) conducted a research on 100 Irish primary schools to consider how much they use their school websites. Of the 100 schools considered, 10 had no websites, 5 had some information included in a parish community website but no school website, and 85 had school websites and some blogs. Regarding key information like contact, most schools provided their postal and email addresses as well as the head-teacher's name. The websites were also having notable errors. For example, 8% of the school websites had school names that did not match the official names used in the DES school's database. The table below gives a summary of the findings by Gilleece and Eivers (2018).

Table 2 2: Percentages of primary school websites containing information about various types of parental involvement and resources for parents. Source: (Gilleece & Eivers, 2018)

Quality domain	Item	Percentage
Communication with parents	Uses Twitter	11%
	Uses Facebook	7%
	Report from principal or class teacher within the current academic year	72%
Parental involvement	Names of Board of Management (BoM) members	46%
	Summary of BoM meetings	4%
	Names of PA members	38%
	Contact details for PA	28%
Facilitating parental involvement in learning	Information on understanding student assessment	11%
	Any materials to support: Literacy development	23%
	Numeracy development	20%
	Learning in science	8%
	Religious education	4%

Table 2 3: Percentages of primary school websites containing basic contact details for the school, practical information, and information on school ethos, activities, and evaluations. Source: (Gilleece & Eivers, 2018)

Quality domain	Item	Percentage
School overview and contact details	Name matches 'official' name	92%
	Postal address	88%
	Email address	89%
	Roll number (unique identifier)	28%
	Principal's name	77%
	List of current teaching staff	47%
	List of ancillary staff	37%
	Gender composition	81%
Practical information	School annual closures	68%
	Opening and closing times	72%
Financial factors	Costs to parents ('voluntary contributions')	36%
	Availability of book rental scheme	51%
	Indication of uniform requirement	52%
	Booklist for 2014/15 or 2015/16	50%
Ethos and religion	Patron	56%
	Religion	88%
Inspection and planning	Whole school evaluation report	10%
	Evidence of self-evaluation or planning	42%
School activities	Evidence of school initiatives (e.g. participation in environmental initiatives)	77%
	Information on current school sports	66%

Collectively, Gilleece and Eivers (2018) emphasize that in Ireland, parents traditionally enrolled their children to the nearest primary school because many may not have required detailed information about schools. This aspect may have contributed to the school's websites providing

limited information and failure to realize that parents and students may need some depth of information to make their academic decisions. It would be valuable for schools to involve parents in designing the websites. This would make it easier to flag errors, such as different school names. Parents would also come to realize the significance of knowing practical information about a school. The parents would also help with defining translational facilities in cases where they have limited knowledge of the dominant language.

2.3.6 Texting and Voice Calling Systems

Voice calling systems allow parents to be sent communication to their preferred phone numbers. This type of communication can be through personal phone, home phone, or office phone (Lin, 2019). Constantly updated websites allow parents to catch up with what is going on in schools. The system is designed to call all parents within a scheduled time. The parents have the option to call back if they want to communicate with a particular teacher. Snell et al. (2020) posits that school-home engagement in the past have been facilitated by school meetings, home visits in-school activities, and correspondences being sent to parents on paper handouts. However, this has changed with the rise in Mobile Phone Technology. Texting has been widely used as a communication tool between schools and parents because of its adoption even among poor American communities (Snell et al., 2020). The researchers conducted a research among thirty family members in two focus groups in the United States to determine adoption of texting as a tool of communication with schools. The research revealed that 40% of teachers use their own mobile phones to communicate with parents. The common content of the texts was a follow-up to check on a student after absenteeism from school. The teachers showed preference in using texts to relay positive information. On discipline issues, the teachers preferred having face-to-face communication with the parents. The table below summarizes the findings by the two researchers

Table 2 4: Family Responses: Forms of communication used by parents (Snell et al., 2020)

	n	%
Frequency with which papers are sent home		
Papers brought home most or every day	23	77
Papers sent home once a week	7	23
*Family members' use of forms of new technology to communicate**		
Texting	25	83
Remind	6	20
Class Dojo	2	7
Facebook	11	37
Email	8	27
None	2	7
*Family communication preferences**		
No preference	4	13
Texting	25	83
Email	14	47
Paper	9	30
Family has a concern about cost of texting	1	3

Some parents, while positive about texting, saw it as a supplement to in person communication and not a replacement mostly when discussing personal and complex matters. Teachers argued that texting has helped them build an effective relationship with the parents. For example, one teacher expressed how a parent sent him a text "You are appreciated!" after a conversation over his learner's academic performance.

2.3.6 Line

Japan, Thailand, Taiwan, and Indonesia have embraced Line as an instant messaging (IM) app in their schools (Lin, 2019). In these four countries, there are approximately 169 million active users of the app. In Taiwan, over 90 percent of active Line users are above 40 (Lin, 2019). Line mainly supports one-on-one chat or group chats. Line provides attractive features that appeal to smartphone users. Given these features, Line has been successful in parent-teacher communication within the 4 countries. Instant messaging apps, such as Lines, foster connections and the development of social relations online (Lin, 2019). Lin (2019) concludes his research by saying that even though contact books, telephone, or face-to-face communication are used, the traditional teacher-parent communication is dominated by one-to-one conversation. However, the prevalence of face-to-face communication has significantly reduced because of progression in smartphone applications (Lin, 2019). This change has affected both mediums of communication and social relationships. Using one-to-one communication, the attention is mostly focused on the child while when digital communication, various types of relations occur concurrently to boost parent-teacher gratification in using instant messaging apps. Some of the issues that arise when using the IM apps include over participation by some parents which shifts the teacher's dominance in communication

flow (Lin, 2019). This can lead to demotivation and withdrawal from group participation by teachers and parents who are dominated over.

To test the effectiveness of Line in enhancing parental involvement, Cheng and Chen (2018) interviewed a focused group in Changhua County, Taiwan. The County primary school teachers were selected as the sample population for the questionnaire survey. A stratified and random testing method was employed. The table below shows the data that was collected by the researchers. Correlation among the indicators was evaluated using mean, standard deviation, correlation and Cronbach's α coefficient. Coefficient greater than .5 is high while a coefficient of .5-.3 is moderate and a coefficient of .3-.1 is low.

Table 2 5: Reliability of construct – Behaviour Intention (BI) (N=382) Source (Cheng & Chen, 2018)

Construct	Measure	Factor loading[a] (> .7)	Composite reliability (> .7)	AVE (> .5)
Usefulness	BI1: LINE for parent-teacher communication increases communication efficiency	0.796	0.914	0.641
	BI2: LINE for parent-teacher communication to understand each other's needs	0.848		
	BI3: LINE for parent-teacher communication to understand what students learn at home	0.783		
	BI4: LINE for parent-teacher communication can help parents understand their children's teachers' education philosophy	0.781		
	BI5: LINE for parent-teacher communication through text messaging	0.722		
	BI6: LINE for parent-teacher communication is helpful	0.865		
Ease of use	BI7: LINE for parent-teacher communication is convenient	0.82	0.909	0.667
	BI8: LINE for parent-teacher communication is flexible.	0.866		
	BI9: LINE can diversify parent-teacher communication.	0.819		
	BI10: LINE enables easy communication between parents and teachers.	0.825		
	BI11: LINE for class communication can enable parents and teachers to interact efficiently.	0.749		

Table 2 6: Reliability of construct – Parental Involvement (PI) (N=382) Source (Cheng & Chen, 2018)

Construct	Measure	Factor loading a (> .7)	Composite reliability (> .7)	AVE (> .5)
Family education	PI1: Parents' wishes to improve education at home for their children.	0.723	0.782	0.544
	PI3: Parents help their children to learn relevant data and materials.	0.719		
	PI5: Parents improve the counselling of children at home.	0.77		
School education	PI6: Parents increase the level of concern regarding school information.	0.771	0.859	0.604
	PI7: Parents participate in school activities.	0.815		
	PI8: Parents are happy to become members of the parent group.	0.75		
	PI10: Parents are happy to participate in school conferences.	0.77		

Table 2 7: Reliability of construct – Classroom Management (CM) (N=382) Source (Cheng & Chen, 2018)

Construct	Measure	Factor loading a (> .7)	Composite reliability (> .7)	AVE (> .5)
Teaching management	CM2: Parents' human resources increase teaching efficiency.	0.764	0.907	0.661
	CM3: Parents can create a supportive environment to facilitate the teaching process.	0.838		
	CM4: Improvements in education facilitate the achievement of teaching goals.	0.826		
	CM5: Enhancing parent-teacher communication may improve teaching standards.	0.833		
	CM6: Parents can communicate with teachers any time and understand their teaching needs.	0.801		
Discipline management	CM7: Discovery and prevention of improper and deviant behaviours among students.	0.873	0.901	0.752
	CM8: Control and minimize improper and deviant behaviours among students.	0.893		
	CM9: Guide and improve students' behaviours to minimize improper and deviant behaviours.	0.834		
Cohesion management	CM14: Teachers and students are willing to share and seek solutions when problems are encountered.	0.799	0.901	0.696
	CM15: Create a class atmosphere with a sense of security and belonging.	0.894		

Table 2 8: Reliability of construct – Classroom Management (CM) (N=382) Source (Cheng & Chen, 2018)

Construct	Measure	Factor loading a (> .7)	Composite reliability (> .7)	AVE (> .5)
	CM16: Create harmony and a relationship of mutual assistance between parents and teachers.	0.87		
	CM17: Provide parents with opportunities to get to know one another to promote classroom relationships.	0.768		

2.3.6 Email

Email addresses are extensively used by learning institutions all over the world. Ortega (2019) conducted a study in Spain, and the findings suggest that email technology is underutilized in fostering parental involvement in education. The author found out that miscommunication was rife when communicating with parents through email. According to Ortega (2019), the problem was mainly expressed by parents' complaints. Some of the parents interviewed stated lack of nonverbal cues as one of the contributors to misinterpretation of emails. The other challenges noted include burden in login to the digital platforms and difficulty in developing interpersonal relationships through email (Ortega, 2019). These findings point out some of the negative impacts of using digital media, particularly email, to enhance parental involvement. This underscores the findings by Lin (2019), which insisted instant messaging application as a success in parent teacher communication.

Parents have encountered some challenges when using email to communicate with the school. For example, families who do not have Internet connectivity may be left out. In some cases, finding email addresses that belong to the school and teachers may be tedious to some parents (Gilleece & Eivers, 2018). Unlike phone directory, which is properly organized, each email service provider keeps its own directory. Another challenge is the use of nicknames by people who would like to protect their privacy, which makes it difficult to find someone's email address. Lastly, if parents are responded to promptly, they get encouraged to continue using email addresses. Otherwise, they get discouraged and abandon using emails.

2.3.6 Social Media

Social media, such as LinkedIn and Facebook, are commonly used by learning institutions to communicate. The platform is interactive and user-friendly with prompt and lively interaction among users. For example, Nairobi Primary School has created a Facebook page that they use to keep parents and public at large with the ongoing activities in the school (Fig. 2.2).

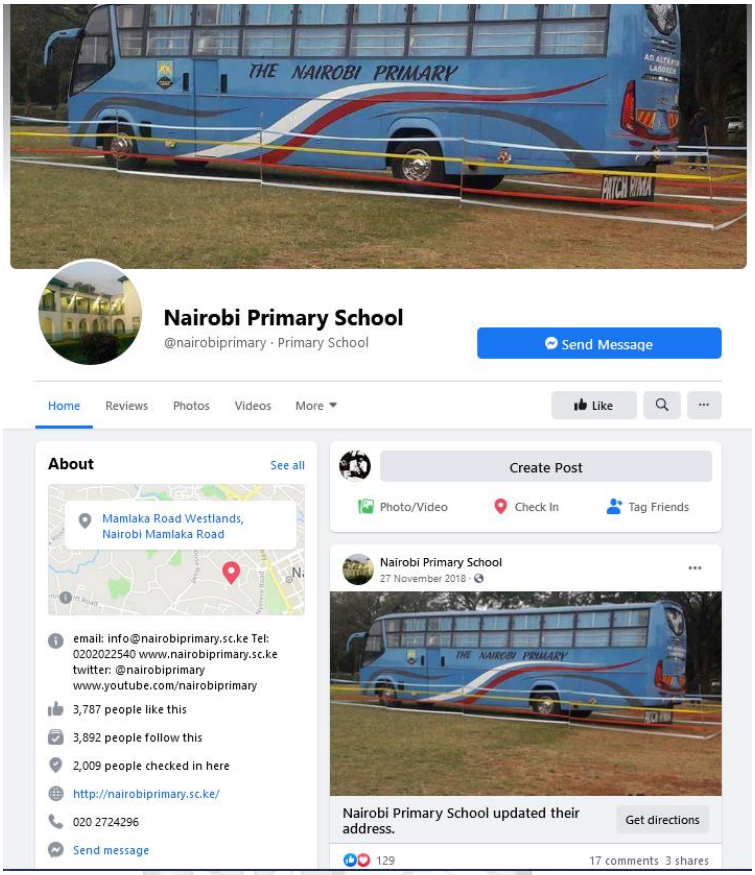

Figure 2. 2: The Facebook page by Nairobi Primary School (Source: facebook.com)

Social media has evolved to become an integral part of personal, social, and civic lives of people in the society. For example, the United States citizens use social media for various purposes, such as keeping up with families, protesting movements, democratic movement, charity fundraising, and disaster relief (Krutka & Carpenter, 2016). The changing social media ecosystem implies that learning institutions have to leverage the use of such platforms to reach parents, students, and other stakeholders. Badri et al. (2017) researched 31,109 students attending public and primary schools in Abu Dhabi and found out that learners spent an average of 5.2 hours a day on social media. The average number of hours increases with the students' age. The two main reasons why learners use social media is to keep up in touch with family and friends and to find information (Badri et al., 2017) emphasize that schools can take advantage of this and use the social media platforms to make parents more involved in their children. The parents also need to monitor the kind of information that the children consume online. The table below shows the extent to which learners use social media.

Table 2 9: Learners using various social media platform (Badri et al., 2017)

Applications	Percent said (Yes)	Gender		Type of school		Grade differences	
		χ^2	Sig.	χ^2	Sig.	χ^2	Sig.
Facebook	56.9 %	1454.780	0.001	1394.536	0.001	144.156	0.001
Twitter	50.0 %	155.021	0.001	345.542	0.001	1473.424	0.001
Google Plus	54.5 %	370.036	0.001	363.599	0.001	72.749	0.001
Tumblr	25.5 %	70.821	0.001	1.421	0.233	447.418	0.001
Instagram	75.1 %	1.227	0.268	479.206	0.001	776.575	0.001
Ask.fm	25.8 %	89.559	0.001	102.214	0.001	1077.141	0.001
Skype	72.5 %	12.651	0.001	16.596	0.001	284.936	0.001
SnapChat	70.5 %	0.302	0.583	793.160	0.001	743.163	0.001
YouTube	73.9 %	323.841	0.001	68.836	0.001	29.157	0.001

The social media pages allow parents to interact with the teachers and school administrators directly. Additionally, the pages allow schools to post announcements regarding enrolments and schools progress (Swindle, Ward, & Whiteside-Mansell, 2018). Therefore, social media supports communication between parents and teachers at no cost and the information is fast and efficiently delivered. One of the challenges faced by use of social media is imposters who may want to gain information about a student for criminal purposes (Swindle, Ward, & Whiteside-Mansell, 2018). This calls for stricter management of the social media accounts and policy development to help curb the criminals. Addi-Raccah and Yemini's (2018) study on Israeli primary schools aimed to reveal the content and the scope within parental WhatsApp chat groups and to determine the social cultural context within which the conversations occur. The findings reveal that through participation, parents can gain up-to-date information on what happens in classrooms. Access to such information was noted to have led to an improvement on parental engagement on their children's education. In this context, WhatsApp groups provide great potential to disadvantaged families who cannot seek help from their peers within the groups. Furthermore, the WhatsApp group was identified to promote a collective approach rather than an individualized framework to parental involvement in education. WhatsApp seems to be actively used by parents. Addi-Raccah and Yemini (2018) concluded that WhatsApp groups enable parents from both advantaged and disadvantaged families alike.

2.3.6 School Portal

Another tool used to enhance parental involvement is school portals. Lin (2019) defines a school portal as a web-based application that helps parents monitor student's activities and performance. For example, the portal enables parents to list homework and assignments to be done by students for a specific period. Parents and teacher's login to the portal using pre-assigned credentials. In Malaysia, the ministry of education has created an online attendance platform called

Sistem Kehadiran Murid (SKM) in all schools to keep track of the student's attendance in both primary and secondary schools (Ismail et al., 2019). The system only has one feature which is to track student's attendance. It is mandatory for schools to use this system except for those that do not have Internet connection (Ismail et al., 2019). There is also a mobile application-based version of the systems which teachers, students, and parents can install on their phones. This enables the stakeholders to conveniently track attendance of the students and also reason for absenteeism. Besides, portals allow parents to directly access a learner's homework, assignment, academic progress, teachers report on their conduct and any other communication from school. They can also give feedback directly to the schools.

2.5 Research Gap

There is a widespread recognition of the challenges faced by schools and by parents in trying to get involved in the education of their children, some of the challenges have made schools realize that they need to offer more specialized solutions to the problems. For example, coming up with money generating activities to compliment the funds they receive from the government. This helps schools develop simple tools such as school websites to enhance parental involvement in education.

Many tools cannot be used in silos because parents have their preferred communication tool. Blending the tools makes it effective when engaging with the parents. Dome tools like WhatsApp have functionalities like text, call, video, and recording. These features make such tools preferred over those that have a single function. Besides, traditional tools such as letters still have a place in today's schools. Some parents prefer receiving the correspondence in the form of letters. Some have also preferred face-to-face communication. Such parents argue that face to face communication is effective in discussing complex and personal issues. Lastly, the educational level of parents also affects the choice of tools for communication. Less educated parents prefer simple and easy to use tools. This implies that when developing a parent portal, the developer has to give priority to user experience over other things.

2.6 Architecture and Design of the Parent Portal

The design of a parent portal deals with data flow diagrams (DFD) and flow graphs. DFD is one of the main tools used in designing project tools. DFD uses defined symbols such as arrow, rectangles and circles to show data inputs and outputs, storage and routes between each point. Figure 2.3 is a representation of the data flow of the parent portal and shows communication between the system and the external entities.

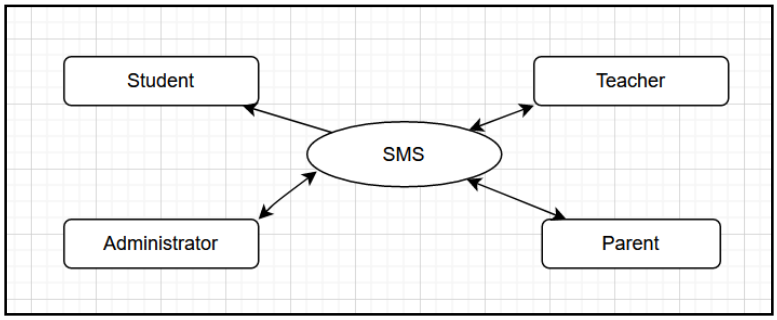

Figure 2.3: Data flow

The parent portal will be designed to have an application homepage that gives a pathway for all users to access the application. Every user will have a unique login information provided by the system administrator. The home page mainly has a login form through which a user can log into the system by entering a username and password. A new user cannot register by himself or herself. Figure 2.4 is a flowchart for the logging process.

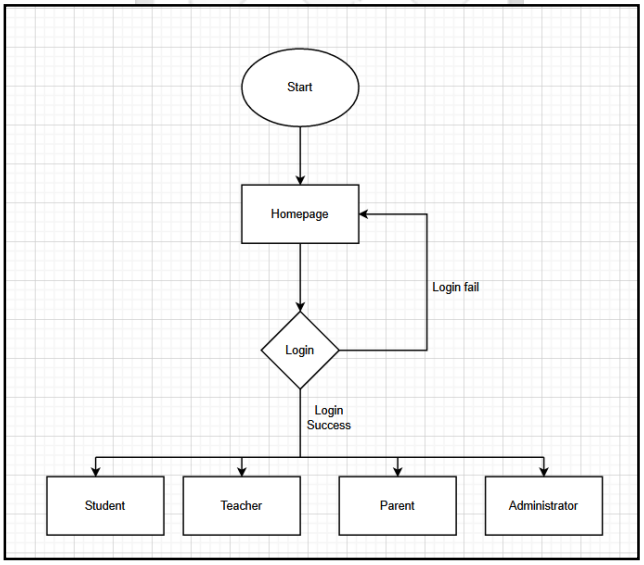

Figure 2. 4: Login

The application will have 4 features such as attendance, announcement, feedback and letter. There will be limited access to each of the modules per user.

2.7 Conceptual Framework

The parent portal will be designed in a mobile based application. Users will access the system by using a smartphone connected to an internet. The primary users will be parents and teachers. The diagram below illustrated the conceptual framework of the parent portal:

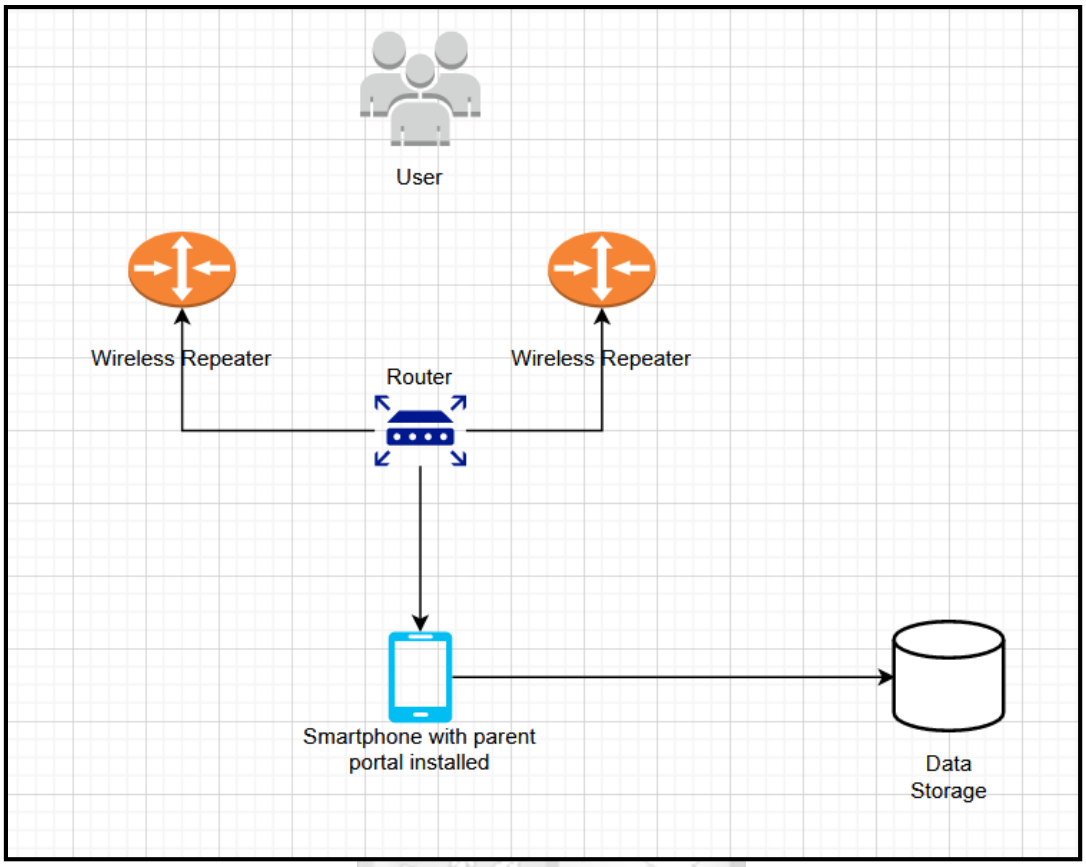

Figure 2. 5: System Framework

Users will include parents, teachers, administrators and students. Students will have the right to view communication but not to post or edit any communication. Parents and teachers will have equal authorization which will include to view personal details, view student details and post updates including uploading documents.

The administrator will have the overall administration of the application which includes creation of users, deletion, updating and displaying records. A study by Gu (2018) asserts that about 78.6% of mobile phone users in Kenya prefer android phones as compared to other operating systems. For that reason, this study has opted to adopt the android platform for the development of the application. The smartphone will be installed with the application which is to be used by all the users. The mobile phones will be connected to a wi-fi connection. Kilani & Kobziev (2016) defines wifi as a wireless radio waves technology that provides a high speed internet and network connection.

Chapter 3: Methodology

3.1 Introduction

Research methodology is the path through which a researcher plans to conduct a study. It shows the channel through which a researcher plans to formulate their problems and objectives and present a solution from the data collected during the study period (Sileyew, 2019).

3.2 Research Design

The research will employ both qualitative and quantitative methods of research. Quantitative research methods will help in giving first hand understanding through both face to face and online interviews with both parents and teachers. This will help in understanding the current challenges being faced by the homes in school. Besides, it will help in understanding the vital features to be incorporated in the parental portal. The quantitative method will be used to determine the population that thinks that the solution is important and they would want to implement it.

3.3 Methodology

Research methodology in information technology comprises areas such as technology, management, political science and strategy (Kilani & Kobziev, 2016). According to Kilani and Kobziev, research methodology is commonly classified into a qualitative and quantitative approach. Qualitative approach relies on the critical paradigm within social sciences. On the other hand, a qualitative approach includes interpretation of numeric data such as ratios and percentages using analytical tools.

There are a number of methodologies that have been used in the information technology field (Nayudu, 2019). Nayudu has identified 4 common methodologies as follows:

i. The experimental simulation. The methodology uses a closed simulation model to mirror a population in real life. The methodology records the nature and the timing of the experimental events.
ii. The laboratory experiment. Laboratory experiment manipulates independent variables and measures the effect of the independent variable on the dependent variables.
iii. The field experiment. This is carried out in the natural setting. The methods used in the field experiment include interviewing, observation and unobtrusive measures.
iv. The rapid application development (RAD). RAD makes use of prototypes and user involvement at the analysis, design, build and test phases of product development. The development lifecycle is compressed into a series of short and iterative development cycles. Due to the fast pace of this study, RAD will be the most suitable methodology. Hence, it will be employed in the development of the parent portal.

3.4 System Development Methodology

RAD is software development methodology that focuses on swiftly building a working model (Martínez-Fernández et al., 2018). The methodology is widely accepted in many companies for development of software projects. Martínez-Fernández et al. (2018) defines the three key

objectives of RAD as high-quality systems, fast software development and delivery, and low cost. This makes the methodology suitable for this research which is self-funded and does not have much delivery time.

Figure 3.1 depicts the methodology that will be applied when developing the parent portal. The development of the software will start by gaining a list of requirements from sample schools within Nairobi County. Based on the client feedback, each of the requirements will be prioritized to make it easier for the developer to design and develop the software. The highest priority will be designed, developed, and tested before the application is handed over to the schools for evaluation. Any feedback from the schools will be considered for modification if they lie within the scope. These processes will be iterated until the system is completely developed. The scope of the portal shall be as presented in table 3.1.

Table 3 1: Scope of the Parent Portal

Scope	Functionality
School Admin	Manage all the functionalities and control if any error happens in the system Manage student teacher announcement and subject information
Class teacher	Record the attendance of the students Able to edit and record the attendance of the students Can make an announcement View feedback made by parents View documents uploaded by parents
Subject teacher	View the attendance for the dedicated class View feedback from parents Assign homework for the class Can make an announcement to the dedicated class
Parents	View their children's attendance and performance View homework assigned to their children Can upload documents to the platform Can send feedback to the school Can view announcements
Student	Update attendance record Submit assignment

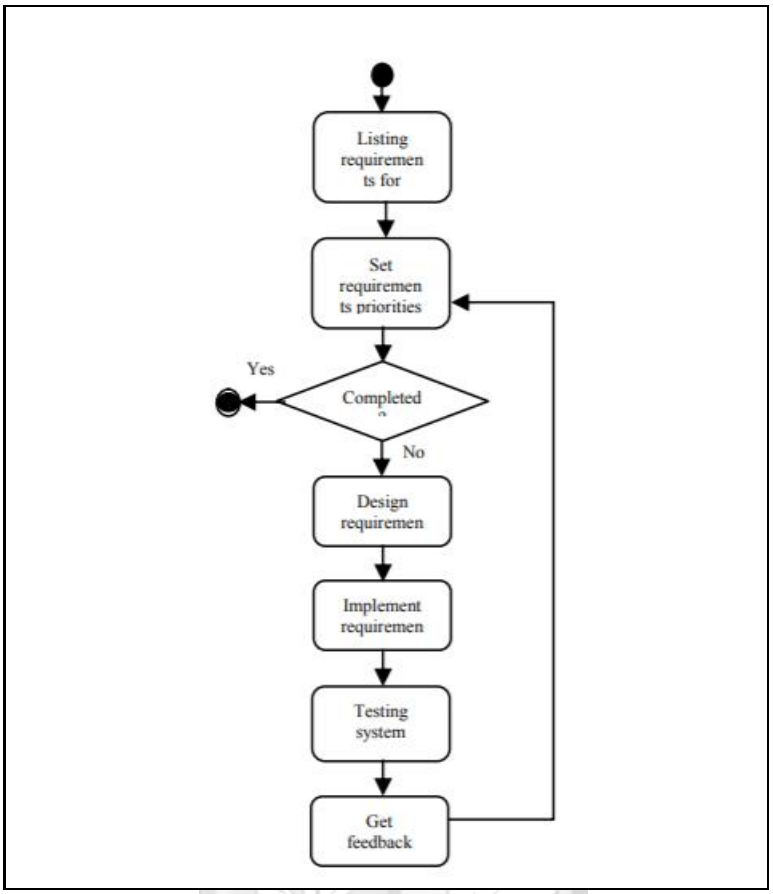

Figure 3 1: Rapid Application Development Methodology

RAD projects are normally of small scale and take a shorter period to implement, normally two to six months. The main reason is that projects that take more than six months to implement are likely to be overtaken by time. In general, it is suggested that no more than six-man years be assigned to a RAD project. The development of the Parent Portal is projected to take two and half months.

3.5 The Phases of Rapid Application Development Methodology

The methodology has 4 phases namely requirement/planning phase, design phase, construction phase, and cutover phase (Ismail et al., 2019). Figure 3.2 shows the four phases of RAD.

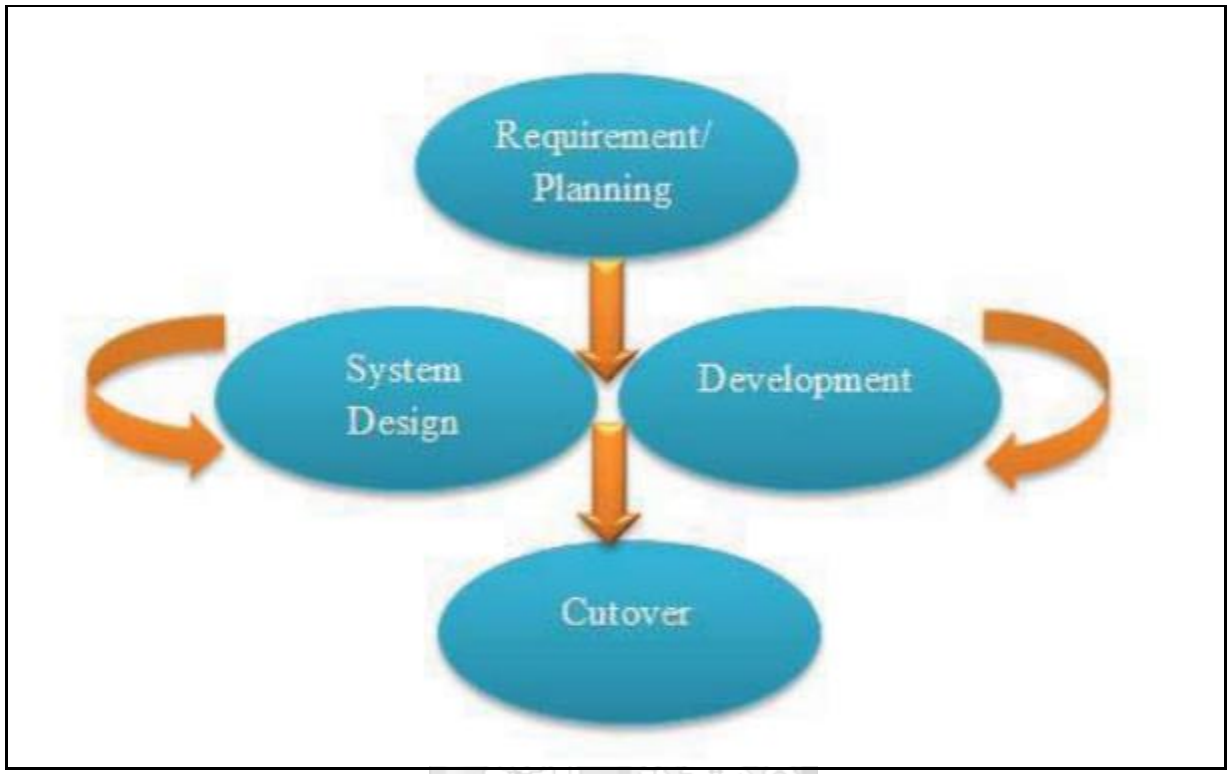

Figure 3 2: RAD Phases (Source: Ismail et al., 2019)

3.5.1 Requirements Planning

At this stage, RAD looks at the functions, data, and business processes that are currently being used in schools to help in designing the proposed solution. The research will cover 2 main areas: communication from teachers to parents and communication from parents to teachers. Using semi-structured interviews and participant observation, the study will gather information from school management and parents from the selected sample. Nairobi county has a total of 225 public primary schools ('Downloads & Resources | Nairobi City County', 2019). The study will take a sample size of four schools with a student population of 200 and above.

3.5.2 System Design

System data and processes will be modelled to build a prototype outlining the look and feel of the final product. The information gathered during the requirements planning phase will be reviewed and analysed at this phase to define a set of clear data objects essential for product development.

The study will employ case diagrams to help in identifying the actors in school home communication and their roles in the process. Data flow diagrams will also be used to determine the flow of information among the actors. Lastly, use case entity relational diagrams will be used to visualize the information and their relation. Each entity will be analysed in detail using database schemas. At the end of this stage, there will be database design and application mock-up. The tasks at this stage will be to first define a detailed system area model. Upon completion of the system

area model, the scope will be refined accordingly to ensure that critical functions are delivered. The second role will be to develop outline system models. The deliverables at this stage will include system functions, reusable design components, system structures and tentative layout of user interface, and reports to be supported by the application. The third deliverable will be to refine the system design. In cases where inconsistency might be involved, prototypes of screens will be developed and shown to the users for review and recommendation. Adjustments will then be made to the open issues. The other deliverable will be to prepare implementation strategies, finalize system design, and obtain approval for development.

3.5.3 Construction

This phase will involve development of the proposed software using a set of selected tools. The parent portal will be designed in a mobile application. The android studio will be used to develop the mobile application. Android applications are written in Java Programming language (Sileyew, 2019). It is a vital platform to develop applications using the software stack provided by Google. The four core features of android that makes it popular are; it is open source, applications are equal, no boundaries to application and easy application development. Figure 3.3 shows the four core features of android application.

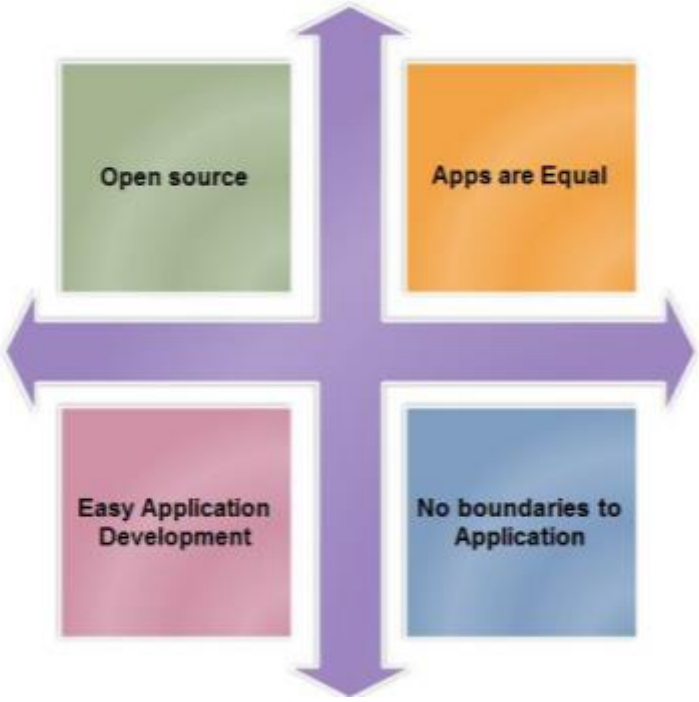

Figure 3 3: The four core features of android application

Android SDK provides an open development platform which empowers developers to build extremely rich and innovative applications, a feature that is key for success of this project (Shaheen, Asghar and Hussain, 2017). This project will use a layered approach in the development of the parent portal. The HTTP layer will be responsible for sending HTTP get and post requests to the server and receiving responses. Next to it is the API layer. This layer will be responsible for

parsing the feedback from the server, formulating the query and passing it to the HTTP layer. The API layer will also be responsible for extracting the necessary fields and passing it to the data layer. The Generic Data layer will contain components that will include designing business layers and implementing functionalities such as caching, and validation. The third layer is the platform dependent data layer. This layer will be responsible for data storage dependently, making it available for the use and managing data interaction. The last layer is the user interface. This layer will be responsible for views on the parent portal application. Figure 3.4 shows the various layers of the parent portal application.

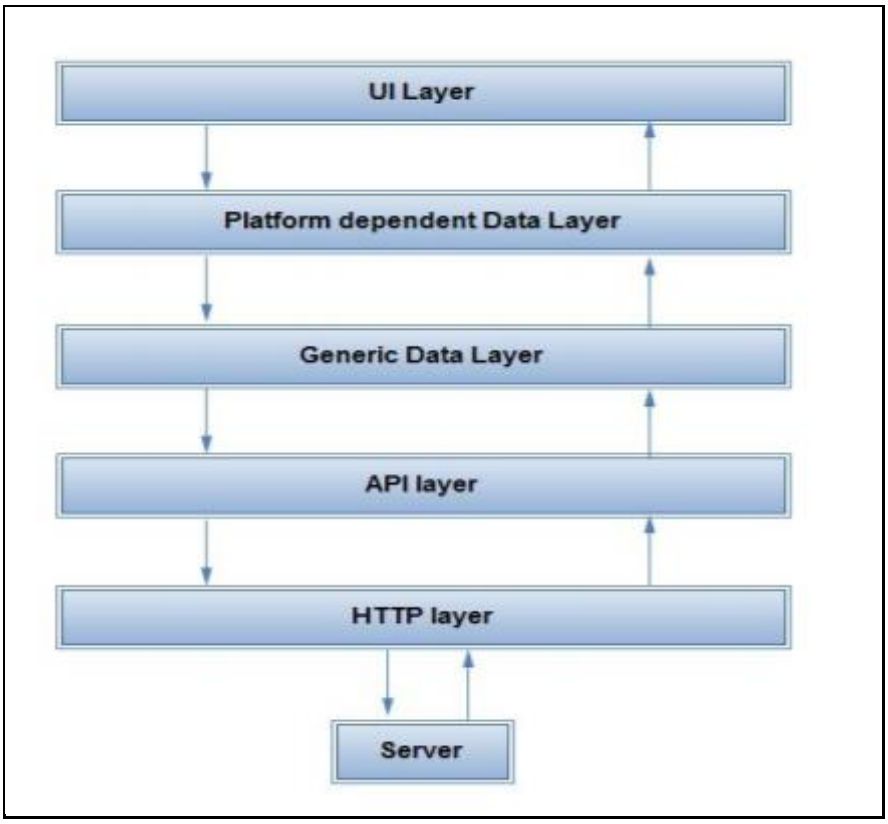

Figure 3 4: Layered Architecture

3.5.4 Implementation

This is the last stage of RAD methodology. It will involve unit testing and user testing to ensure that the product has met the requirements. Unit testing will be conducted by the product developer. On the other hand, user testing will be consulted by selected teachers and parents. Test cases and user manuals will be prepared to guide the testing process. All these shall be available to the testers in good time and they be trained before commencing the testing process. To enhance fast implementation, the modules will be implemented on a rolling basis based on the list of priority provided by the schools.

3.6 Target Population

Target population is a group of persons or participants who have specific attributes with particular attributes of interest and influence (Tuunanen & Peffers, 2018). The target population is more refined as compared to the general population in that it contains no attributes that breaches the research assumption, context or goal (Tuunanen & Peffers, 2018). Qualitative research draws their samples from the target population using a set of techniques depending on the size and complexity of the population. As mentioned earlier therefore, it is important for a researcher to specify the target population if the study population is large.

For this study, the target population will be all the public primary schools in Nairobi, teachers within the schools, and parents to students. Nairobi county has approximately 35,000 primary schools out of which 225 are public primary schools ('Downloads & Resources | Nairobi City County', 2019).

3.7 Sampling Technique and Sampling Size

Parga et al. (2018) argue that sampling is a statistical analysis in which a fixed number of models is taken from a large population. By studying the sample population, a researcher should be able to fairly generalize the results back to the larger population from which they were picked. Random sampling techniques will be used to pick schools from which the research will be conducted, the number of teachers, and the number of parents.

The formula below, as proposed by Parga et al. (2018), will be used to calculate the sample population:

$$n = \frac{z^2 \cdot N \cdot p \cdot q}{N \cdot E^2 + z^2 \cdot p \cdot q}$$

Figure 3 5: Random Sampling Formula

n is the sample size. The formula takes into account finite population (f<0.05), 95% confidence level (z), population size of 225 schools (N), maximum population variability (p=q=0.5), and 3% sampling error (E). Using the formula, the sample size for schools is 143. In each of the 143 schools, we will pick teachers and parents depending on the population of the school.

3.8 Data collection procedure

Primary Data will be collected from teachers and parents using interviews and questionnaires. According to Parga et al. (2018), questionnaire is effective in greeting systematic and properly ordered data. The questionnaires will be peer reviewed before to ensure high quality is maintained. The study will use both drop and pick an email to share the questionnaire with the respondents. Emails will be used in cases where respondents cannot be physically reached.

3.9 Data Analysis Procedure

Data analysis involves cleaning up the collected data before analysing, interpreting, and giving meaning to it (Parga et al., 2018). Content analysis will be used to analyse the research data. This will involve checking the filled in questionnaires for comprehensiveness then coded for quantitative analysis. The quantitative data will be classified into groups to enable the researcher to make general reports from the observable feedback. We'll also use excel to analyse the data.

3.10 Data Reliability

Reliability is the consistency of measure (Duke et. al., 2020). It is the extent to which a measure provides stable and consistent results. Reliability also involves repeatability. That is, a repeat measurement under the same condition should give the same result. Testing reliability is vital as it refers to the consistency across the parts of a measuring instrument. The three attributes of reliability are homogeneity, stability and equivalence (Duke et. al., 2020)

Stability is tested using test-retest reliability testing (Duke et. al., 2020). For this study, this will include issuing a questionnaire to and interviewing selected participants more than once under similar circumstances. A comparison will then be made between the participant's responses each time they complete the questionnaire and respond to the interviews. Equivalence will be tested using inter-rater reliability (Duke et. al., 2020). This test involves the process of determining the level of agreement between two or more observers. Also, the researcher will ensure reliability by conducting one-on-one interviews using standardized questions. The interviewer will undergo a brief training on how to conduct interviews and avoid bias. Inter-rater reliability will be used since it ensures consistency in results by using solid data collection instruments and procedures to gather data.

3.11 Dissemination of Results

Dissemination is a planned process that entails consideration of the target population and the settings in which a research finding is to be received, and where applicable, communicating and interacting with respondents like policy makers in ways that are to facilitate update of the research results in decision making process and practice (McBride, 2016). McBribe emphasizes the need to share research results with respondents as this helps in creating understanding and partnership in resolving research problems.

Upon completion of the research, the research results will be disseminated to the participants through emails, text messages, face to face communication and voice calls. The mode of communication will depend on the participant's preference which is to be collected during data gathering. The final products will be uploaded on Android Play-store and made available to the public for free download and usage.

3.12 Utilization of the Results

Utilization of results refers to any form of use that a research result is put to (Sudha, 2017). These utilities can include economic, commercial, political and social. Sudha argues that result utilization can also be understood as immediate (direct) or mediate (indirect)…For this

study, the research results will be used immediately for academic purposes. The results will help in developing a product for primary public schools in Nairobi County.

3.13 Ethical Consideration

Throughout the course of the study, respondents and other third parties will be informed on the purpose of the study, the procedure used to collect data and surety given that their identity will remain anonymous & confidential during and even after the study. Also, they will not be exposed to any potential cost. All previous works are to be cited aptly and acknowledgement given to the respective authors.

Chapter 4: System Analysis, Design and Architecture

4.1 Introduction

The aim of this study was to come up with a mobile portal that would be used for communication between schools and parents. Given the many applications that are already in use, this calls for a hybrid system that covers most of the key features needed by both parents and teachers. This chapter explores the various features that will be developed in a bid to come up with a simple but effective communication application.

4.2 Survey Information

3.5.4 Response Rate

A total of 220 questionnaires were sent out to the respondents out of which 178 were returned giving a response rate of 81%. The response was good enough and a true representative of the total population. A response rate of 80% conforms to the Xu et. al.'s (2029) recommendation of at least 70% percent response rate. Figure 4.1represents the response rate.

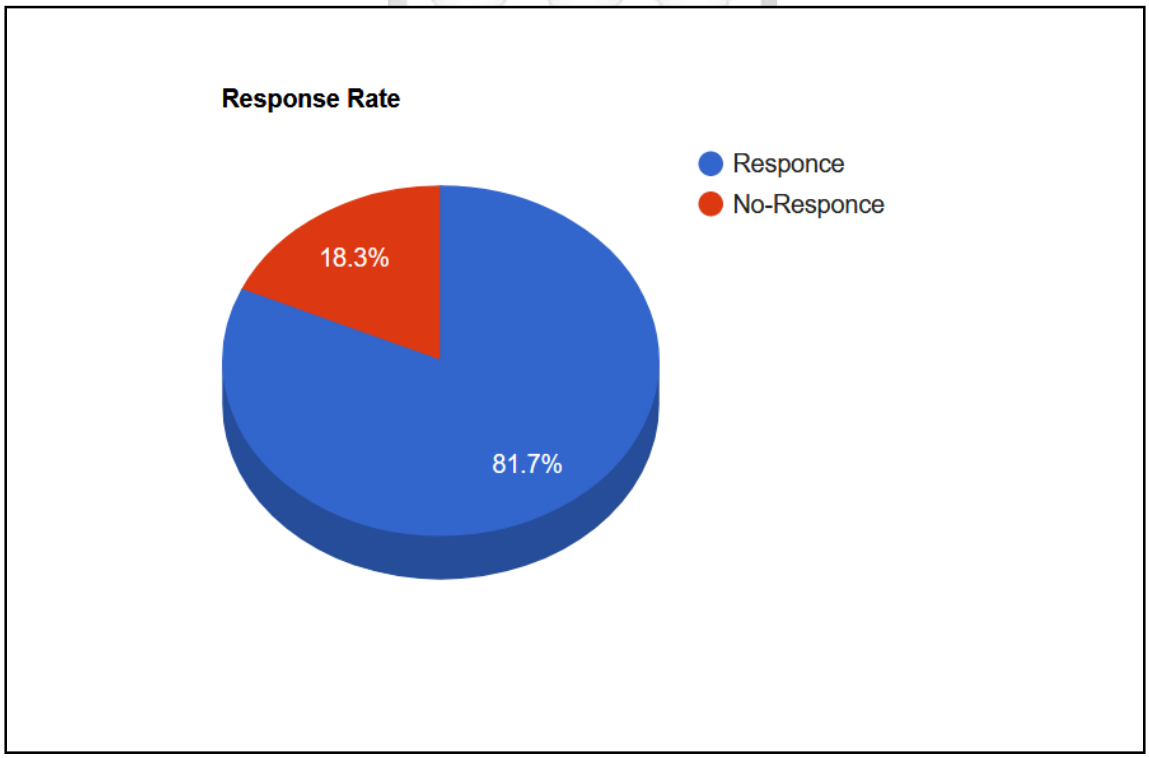

Figure 4 1: Response Rate

4.2.2 Data Analysis

The questionnaires in the form of Google Forms were distributed online to parents and teachers with children in primary schools within Nairobi County. The responses provided by the respondents have been analysed to understand their view on the parent's portal. Below are some of the survey questions that have been analysed:

1. How regularly do you go through the school's website?

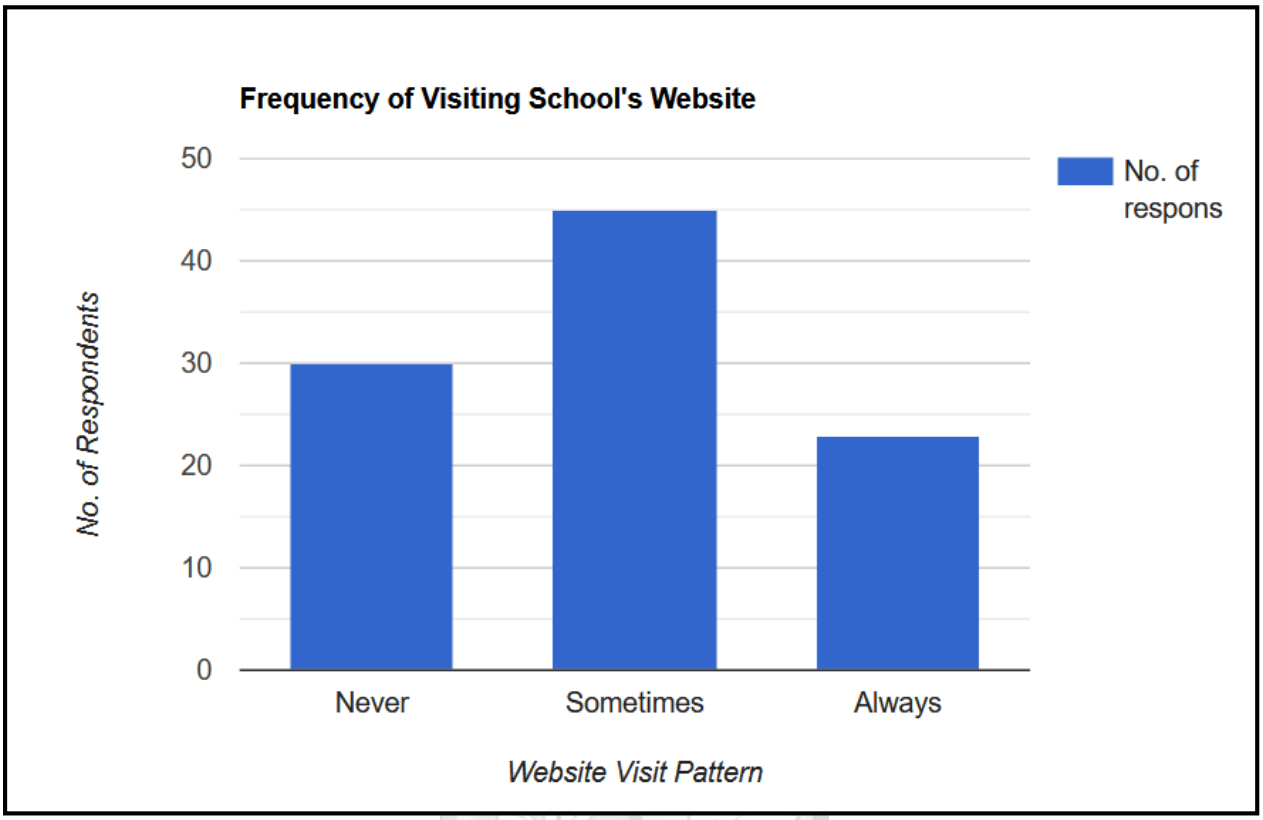

Figure 4 2: Frequency of visiting website

From Fig. 4.2, demonstrate that 30 out of the 98 respondents never visit the school's website. 45 of the respondents do visit the websites once in a while and 23 of them always visit the school's websites. With only 42.6% of the parents always checking the website, it implies 57.4% are left out, this is more than half the population making websites not a good option for parent teacher communication.

2. Our school regularly shares news about the qualifications and accomplishments of its teachers

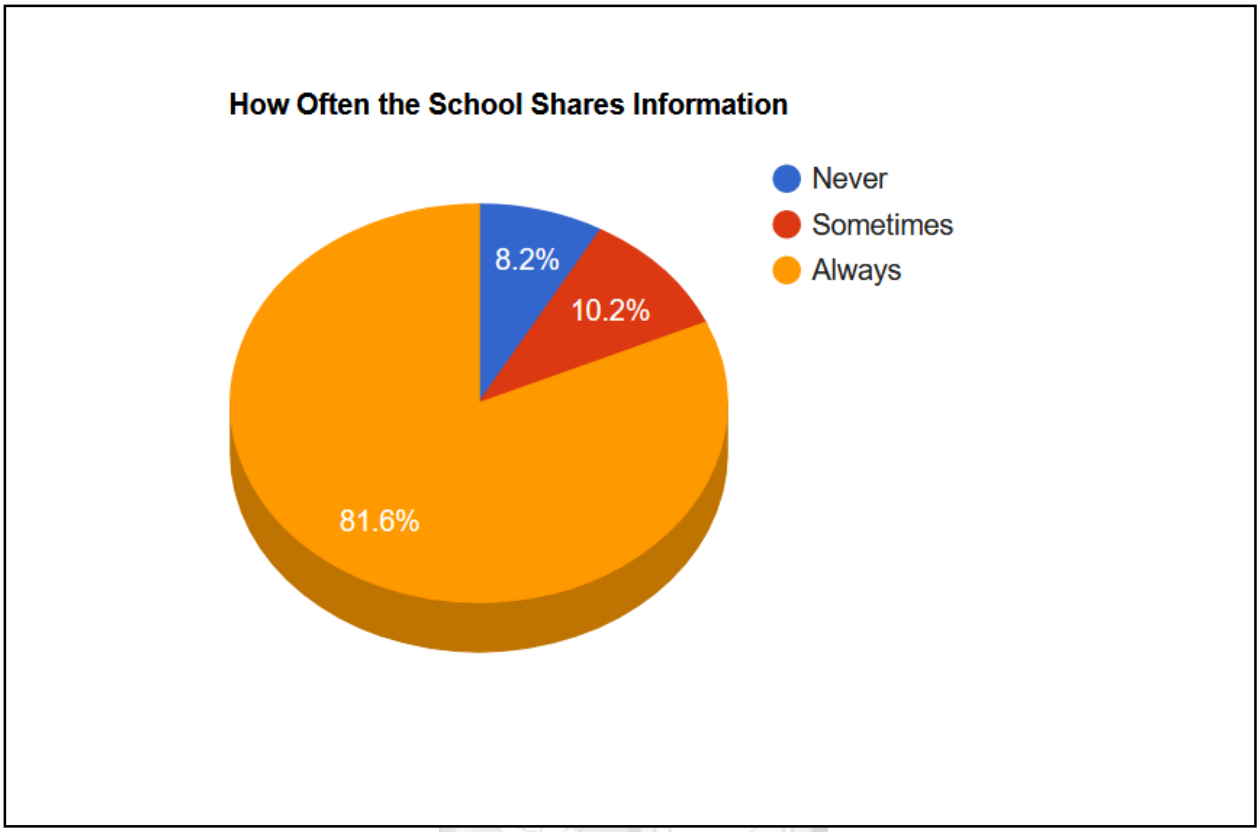

Figure 4 3: How often schools share information

From the feedback, it is clear that schools do send information with parents so often. Passing this information through the website would mean that the majority of the parents miss out on the information as they do not visit the website as much.

3. Does your school use digital applications to manage communication between school and parents?

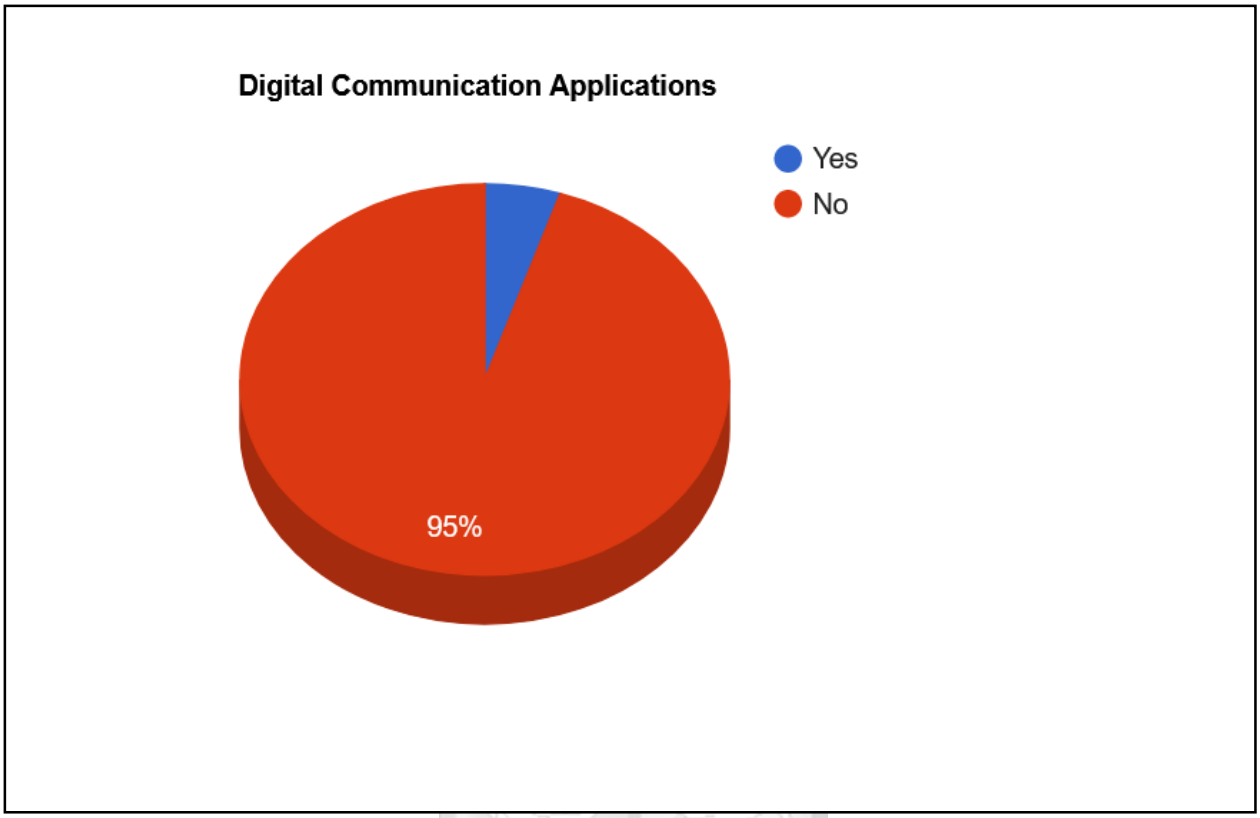

Figure 4 4: The number of schools using mobile applications

From figure 4.3, it is clear that 95%of the schools do not use mobile applications to keep student's records and to communicate with parents. From the data collected, the majority of the 95% still rely on manual systems such as letters and word of mouth to relay information.

4.3 Interpretation of the Results

From the data analysis, it is clear that public primary schools in Nairobi are having a gap in communication tools between schools and teachers. The schools are facing communication challenges as few parents receive communications from school and this is due to the poor choice of communication tools. Even though some schools have websites, most parents do not check the websites for updates from schools. Also, only 5% of the schools use modern communication tools such as WhatsApp. The rest of the schools still rely on the old communication tools to relay information between schools and parents. It is with these reasons that a modern application with crosscutting features would improve communication between schools and parents hence improved parental involvement.

4.4 System Analysis

Based on the contribution from the preliminary studies, we now define the functional specifications of the proposed platform and we will as well develop a paper prototype to check on the usability and user friendliness before developing the actual product.

Based on the contributions of the preliminary studies, the first cycle of development started, with the definition of functional specifications of the platform, which resulted in a paper prototype, subjected to a formative evaluation, with usability tests by the users, later on. Functional specifications are detailed descriptions of the functionalities that will be included in the platform, to meet the needs of the users and the objectives of the product (Garrett, 2019)

4.4.1 Functional Analysis

The system is divided into 4 areas: private area which has functionalities and content to every user, individually and privately; group area for group sharing of content with the group members; Kindergarten area, where teachers provide institutional information to the parents; Support area, where parents can contact the school and find more information about their child.

In addition, the system should have the following functional specifications:

i. The application should send notification to the user whenever there is a new message or reply. The notification should be copied to email.

ii. The message can be marked as urgent by the sender.

iii. The user accounts and credentials are generated by the system, using email address or freely defined user name.

iv. The user can search messages by keywords, date or the destination.

v. The system should give simple reports on the student's progress as per the data maintained in it.

4.4.2 Non-functional Analysis

The functional features of an application are made possible or supported by the non-functional design. Gu (2028) defines non-functional requirements as the system quality and software quality requirements. The non-functional requirements of the system include:

i. Should have efficient performance and highly scalable with increasing workload

ii. Responsiveness: the system should be responsive to the inputs keyed in by users or to external interruptions which are of higher priority.

iii. User-friendliness: users should be able to use the application without any guidance or help from experts.

iv. Availability: the application should be available in the android app-store for users to freely download and install on their phones for use.

v. Screen-adoption: the application should be able to render its layout to different screen sizes

vi. Network coverage: the application should be able to work in places with slow internet coverage.

vii. Security: the data stored in the application should be recurred and encrypted from external environments and attacks.

4.5 Use Case Diagram

Use case diagrams help in showing the functions or roles of each of the system users (Gu, 2018). The following use cases of the system have been identified: login, view student's details, view announcement, provide feedback and manage the parent portal system. The actors include a parent, system administrator and a teacher.

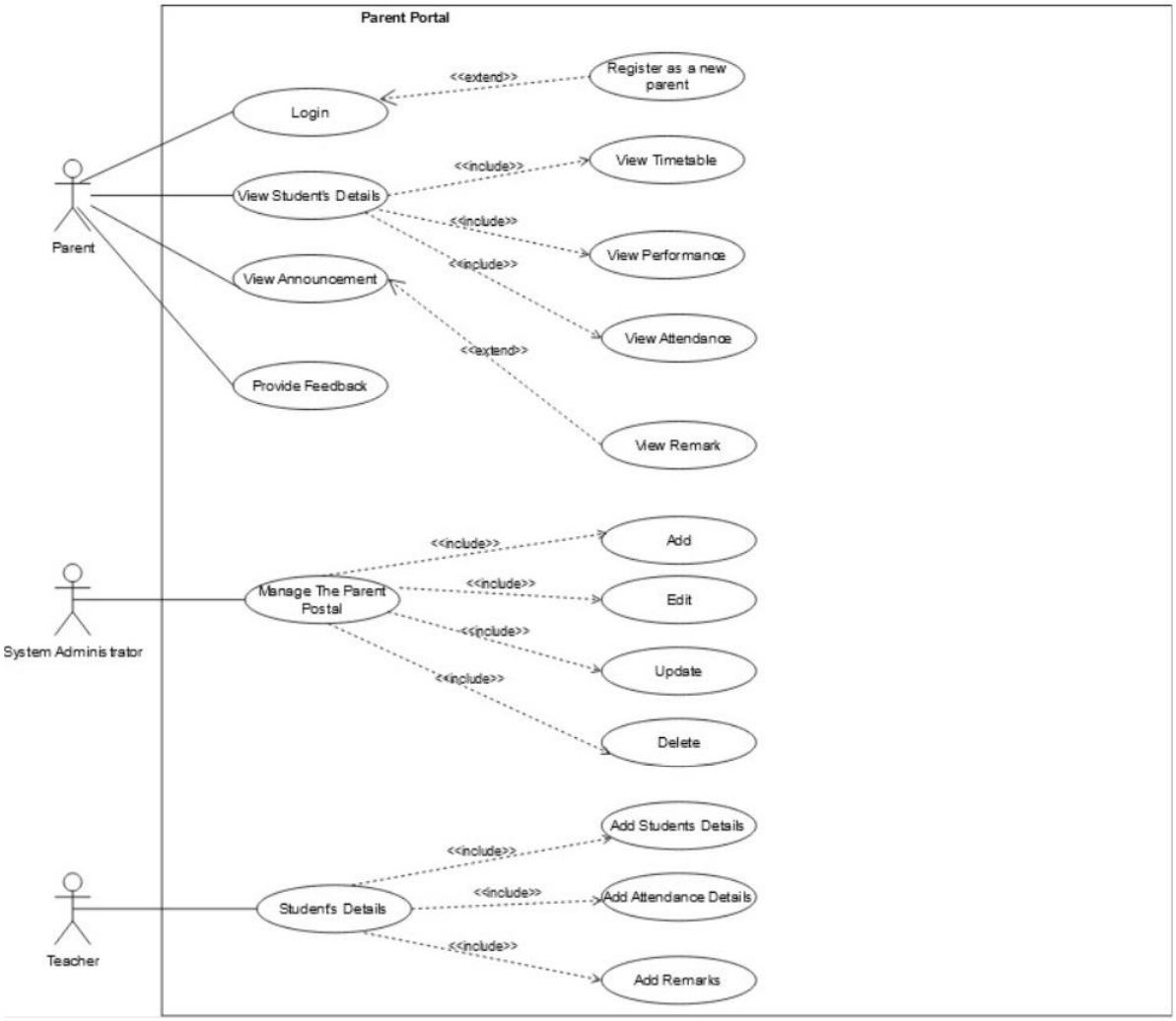

Figure 4 5: Use Case Diagram

4.6 Data Flow Diagram

Data Flow Diagram (DFG) is used to show the relationships between or among entities in an application. It demonstrated data movement throughout the system. DFD incorporates inputs, processing, storage and output. DFD is categorized into stages such as the Context Diagram, Level 0, and Level 1 diagrams.

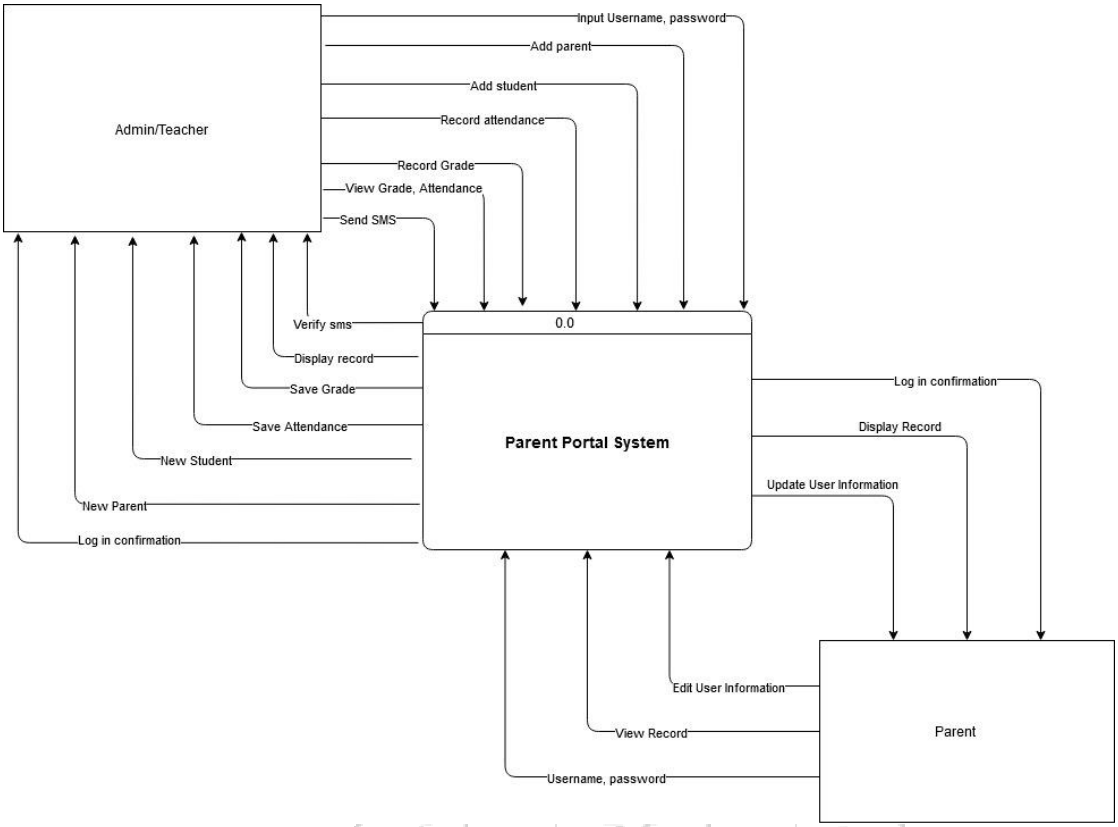

Figure 4 6: Context Diagram (level 0)

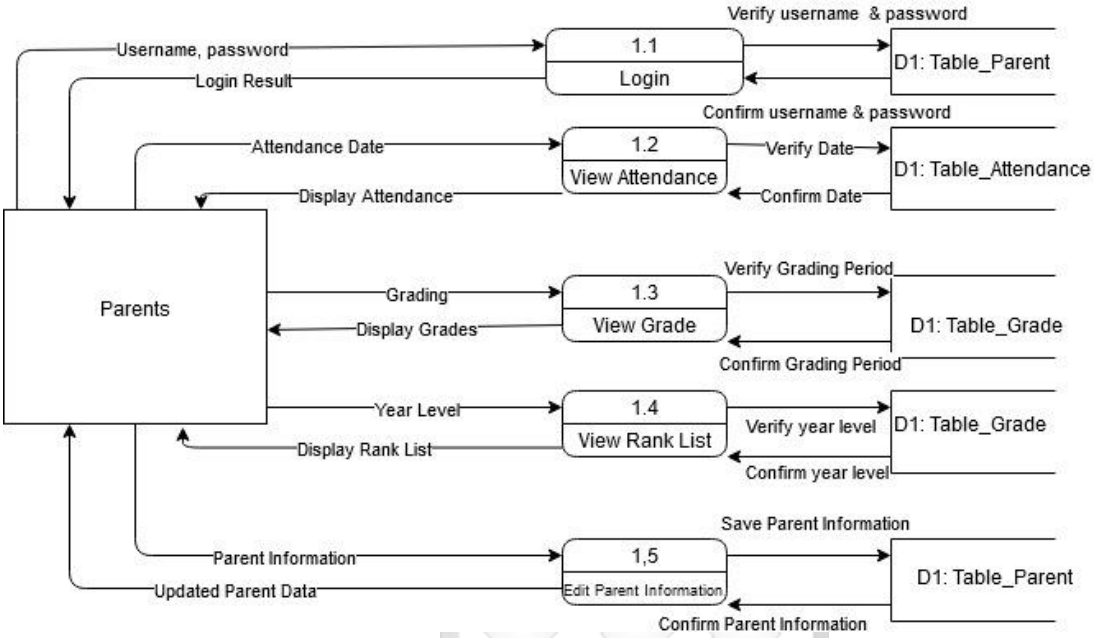

Figure 4 7: Level 1 diagram – Parents

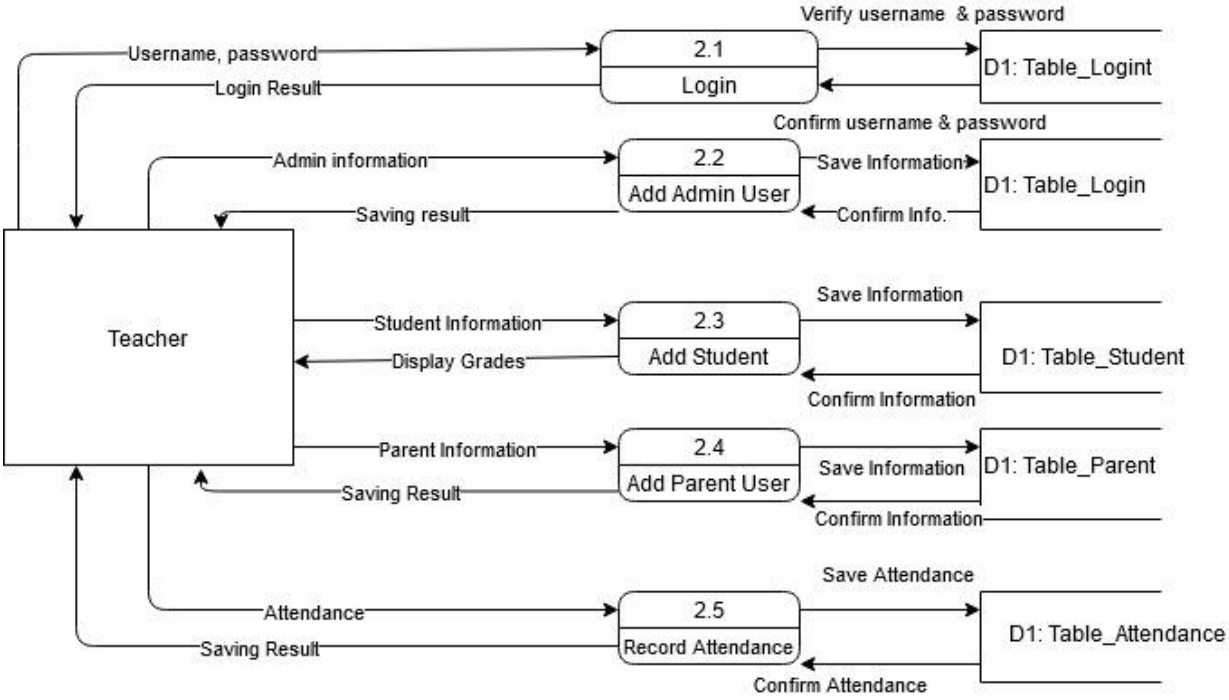

Figure 4 8: Level 1 Diagram – Teacher

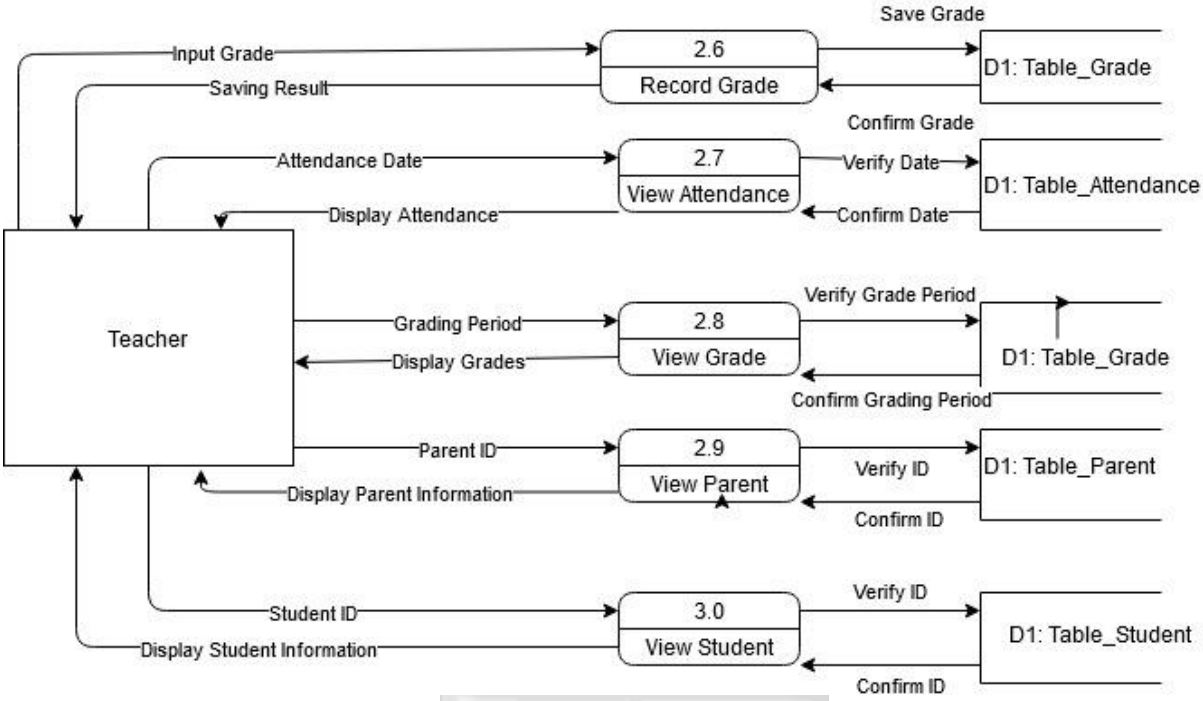

Figure 4 9: Level 1 Diagram – Teacher

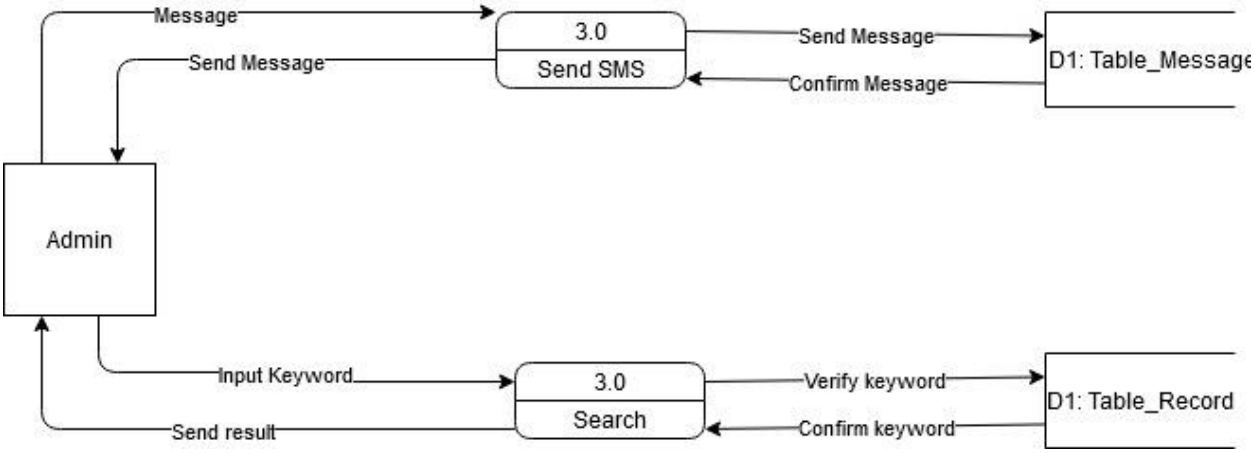

Figure 4 10: Level 2 Diagram

4.7 System Architecture

The system architecture diagram (Figure 4.10) presents the structure of the platform. The application will be cloud based. Parents and teachers request information about a student using a

text message or predefined number. Server maps the predefined number with the student name. The server then searches for the information which is requested by the parent or teacher and shares it through SMS or simple reports.

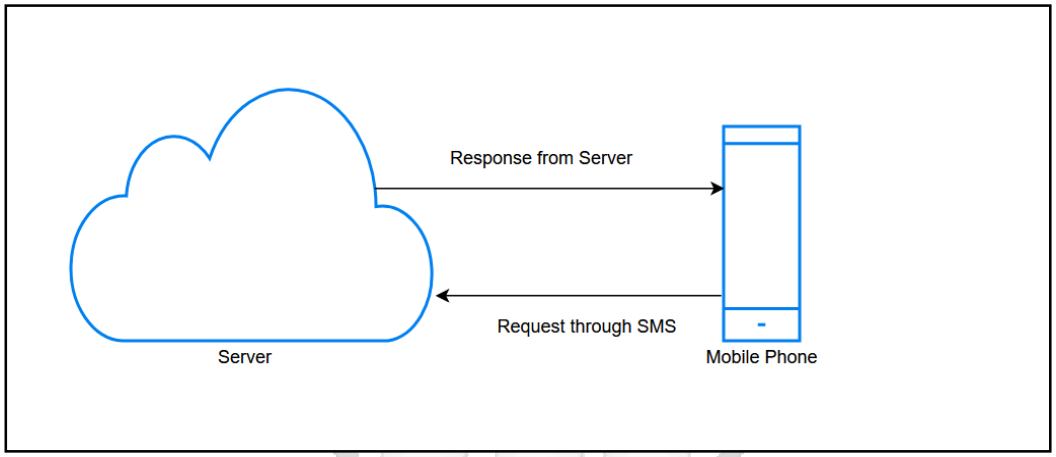

Figure 4 11: System Architecture Diagram

Chapter 5: System Implementation and Testing

5.1 System Development Environment

Table 5.1 gives the details on both the hardware and software components that have been used to develop the software.

Table 5 1: Hardware and Software Specifications

Hardware/Software	Usage
Laptop: HP Core i7, 8 GB RAM and 500GB Hard drive	Use for documentation and development of the of the mobile application
Android studio	Used to develop the proposed solution
Windows 10	The operating system running in the computer
MS word 2016	Used for documenting the dissertation document

5.2 System Implementation

Android studio has been used to develop the application. The users' details are stored using preferences. All the other features are stored in firebase which is cloud base.

5.2.1 Account Creation and Logins

When you open the application for the first time, one is given the option to create a new account or log in. The user is to choose accordingly, either a teacher or a parent. All the fields are mandatory. The figures 5.1 and 5.2 show the login screen.

Figure 5 1: Initial screen

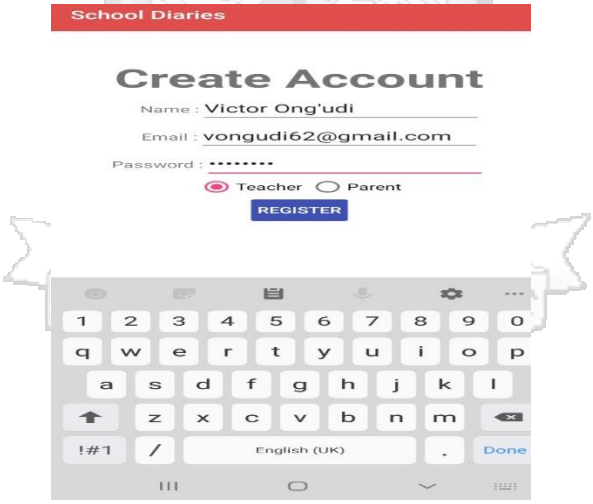

Figure 5 2: Account registration

5.2.2 Teachers Side

When you log in for the first time on the teacher's side, figure 5.3 shows what you will see. The teachers are then able to add classes to their accounts using the + sign. To add the classes, the teachers must use the account IDs provided by the system administrator.

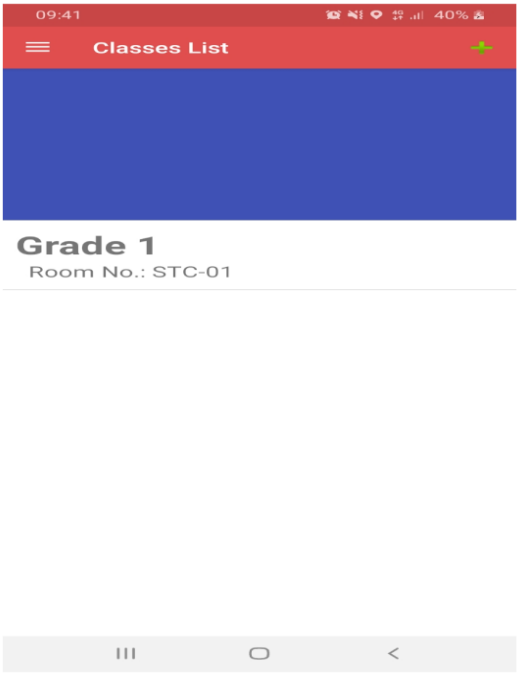

Figure 5 3: Home page

As the teacher selects one of the classes, it loads into the class fragments which have a viewer-pager with advanced viewer-pager animation that are selected randomly. The first page is the student's page. It shows all the learners that were added to this class. The page shows the student's images and their name. The images are stored in firebase storage. At the bottom of the page is the floating action button which is used to add learners to the class.

The second page is the attendance page. The page allows the teacher to mark learners as checked in when they get into the class and checked out as they get out of the class. The teacher can also mark a student absent if he/she fails to attend the class. The grid recycle-view allows multiple selection of students and mass change of the status to any of the 3 mentioned above.

The last page of the view-pager allows teachers to add different activities to students. When a teacher selects the activity to be added, the teacher is taken to the fragment where he/she tags the learner. Only kids selected here will have their feed updated with that activity. Activity feeds are like news feeds on social media. When a learner is tagged in an activity, the activity appears on the learner's feeds. When you click on a child in the children list, the screen changes to the learner's activity feed with the child's picture on the shared element.

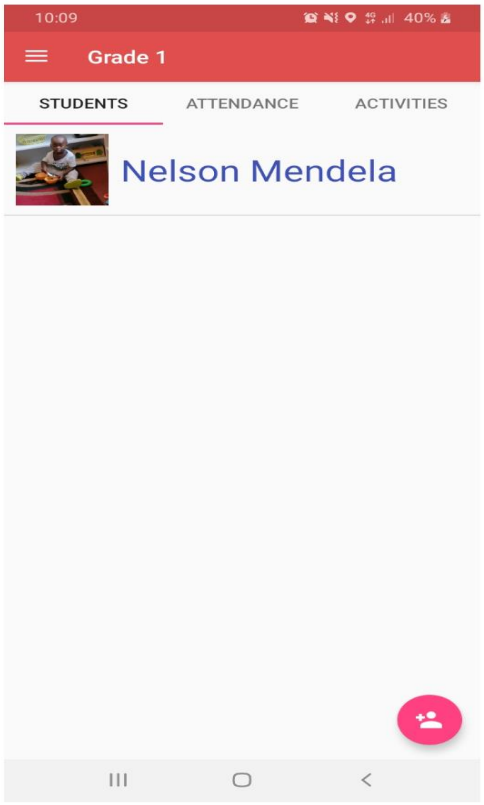

Figure 5 4: The Pages on Teachers Profile

5.2.3 Parents Side

Parents' side is mainly for viewing the activities of their children at the school. This submodule can as well be used by other stakeholders like guardians, siblings and family members to view the activities of the children.

Once a parent logs in to his/her account, a list of the children assigned to him/her are displayed. The names of kids get loaded to the recycler view, this enables the list to be automatically updated wherever a child is added or removed from the list.

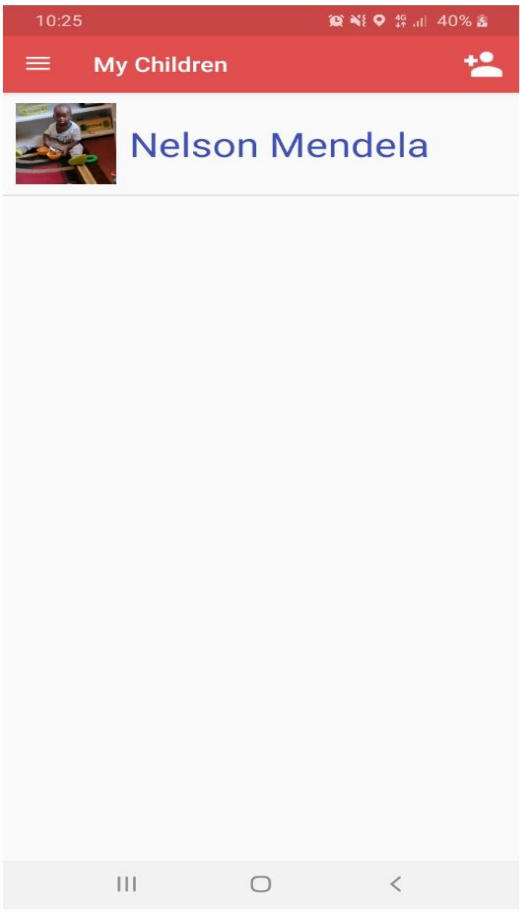

Figure 5 5: List of Children Assigned to a Parent

To add a learner to a parent's account, the user clicks on the add button in the top right of the toolbar. The user is prompted to key in a valid child code for the new addition.

The parent's side also has a navigation bar which helps the parent to logout of his/her account. The navigation bar can also be used to create shortcuts. The other features included in the navigation bar include profile picture, name and email address.

5.2.4 Common Features of the Feed

1. Coordinator Layout

The parent layout of the feeds is a coordinator layout. The layout loads the profile picture of learners and the name which are both stored in the firebase database. The feed collapses when a user scrolls down to look at the feed.

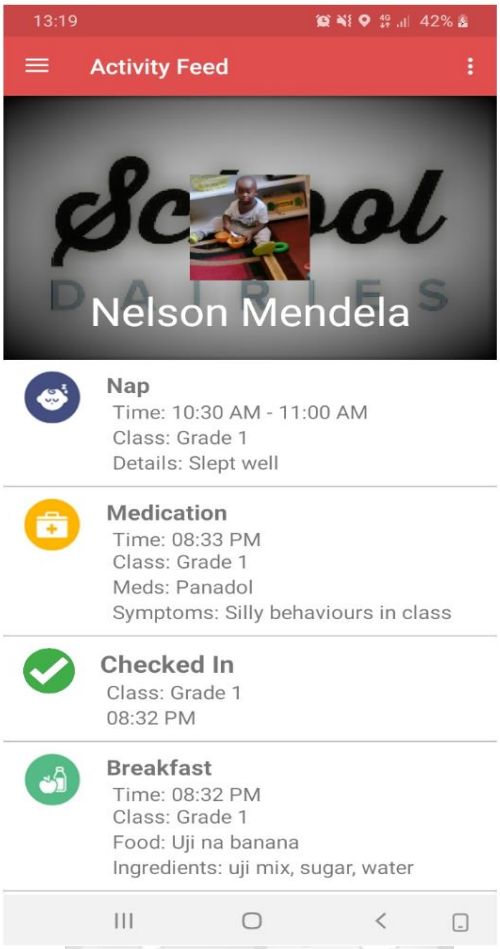

Figure 5 6: Coordinator Layout

2. Recycler View with Different Card Layouts

Activities that are published by teachers on a learner's profile are displayed on a recycler view. However, each feed can be drilled down on to see details. This is enabled using different card view layouts to display them. The feeds are updated with a bit of animation using advanced animation effects.

3. Shared Element Transition

The shared element transition is implemented on the profile picture of the learner. When a user clicks on a learner on the learners list fragment, the system shares the image from the fragment to the profile picture of the kid in this Activity feed fragment.

5.2.5 Editing Learner's Profile

The functionality enables users to edit their profile such as profile photo. When editing profile photos, the user can either upload a photo from the phone gallery or capture a photo from the camera. We use camera API to capture a photo and gallery API to upload photos. The

application also has image compression features to help in compressing images for better performance.

Figure 5 7: Editing a Learner's Profile

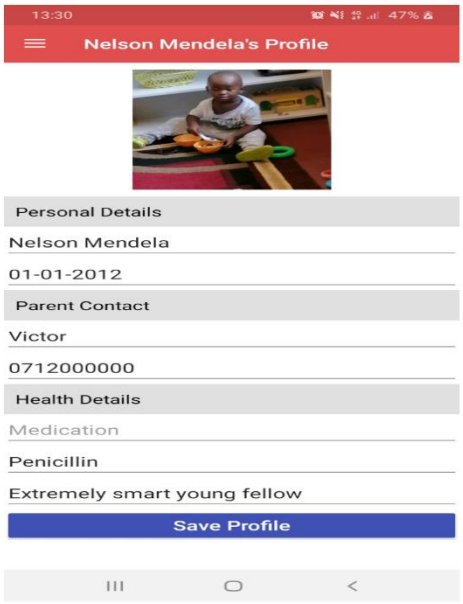

Figure 5 8: The information to be Edited

5.2.6 Create Shortcut

This feature enables users to create shortcuts to their frequent or preferred functionalities. For example, a parent can create a shortcut to the child's feed. Next time when the parent clicks on the shortcut, it takes him/her directly to the feed.

5.2.7 Share Learner's Code

The application can be used by family members to monitor the activities of their children. The application user content provider enables parents to share codes of their children to other family members via SMS and data sharing applications such as WhatsApp. The messages sent have a child's code which can be used by the recipient to add the learner to their profile.

5.2.8 Other Features

The application has other features such as multi window support and multi device support. Multi window support enables users to multi-task by opening more than one tab at a time. On the other hand, multi device support enables users to use the device from different devices with different screen sizes. Currently, the application can be used in android phones and tables.

5.3 System Testing

The application went through both unit and user testing. The unit testing was done by myself, then developed. And, the user testing was done by a selected number of parents and teachers. The aim of the tests was to confirm the functionality and capability of the application.

5.3.1 Functionality Testing

The test looks at the functional specifications of the application. The test was also done to help in fixing errors to ensure that the functional requirements are met. The following are the features that were tested:

Table 5 2: Functionality Testing

Table 5 3 a: Functionality Testing

Test Case Name: Functionality Test **Test Date: 22.04.2021** **Tester: Victor Okinyi**					
Activity Tested	**Description of the Test**	**Expected Outcome**	**Observation**	**Error**	**Verdict**
Account creation	The application creates users and register their data in the database	The users should successfully create user accounts	User accounts successfully created	None	Ok
Account login	Users to log in to the application using the created credentials	Users should be able to login successfully	users successfully logged in	None	Ok

Table 5 3 a: Functionality Testing

Test Case Name: Functionality Test **Test Date: 22.04.2021** **Tester: Victor Okinyi**					
Activity Tested	**Description of the Test**	**Expected Outcome**	**Observation**	**Error**	**Verdict**
Assigning a teacher to a class	After account creation, a teacher should be assigned to a class	The system should allow class assignment	The teacher successfully assigned to a class	None	Ok
Add a learner to a class	A learner should be added to a class accordingly.	A learner should be added to a class accordingly.	A learner has been successfully added to a class	None	Ok
Remove a learner from a class	A learner can be removed from a class accordingly	A learner can be removed from a class accordingly	A learner has been successfully removed from a class	None	Ok
Mark attendance register	The teacher should be able to mark a learner's class attendance.	The teacher should be able to mark a learner's class attendance.	The attendance register successfully marked	None	Ok
Update learner's profile	The parent or teacher should be able to update the learner's profile such as changing their profile photo.	The parent or teacher should be able to update the learner's profile such as change profile photo.	The learner's profile has been successfully updated	None	Ok
Share learner's code	Parents should be able to share codes with the	Parents should be able to share codes with the	Learner's code successfully shared	None	Ok

Table 5 3 a: Functionality Testing

Test Case Name: Functionality Test **Test Date: 22.04.2021** **Tester: Victor Okinyi**					
Activity Tested	**Description of the Test**	**Expected Outcome**	**Observation**	**Error**	**Verdict**
	relatives they wish to track the child's progress	relatives they wish to track the child's progress			
Create a shortcut	Parents should be able to share codes with the relatives they wish to track the child's progress	Parents should be able to share codes with the relatives they wish to track the child's progress	The feeds shortcut successfully created	None	Ok
Post feeds on a learner's profile	Teachers should be able to post feeds to a learner's profile. Parents should be able to reply the feeds	Teachers should be able to post feeds to a learner's profile. Parents should be able to reply the feeds	A feed has been successfully posted on the learner's profile	None	Ok
Display feeds on a learner's profile	The system should allow users to view a learner's feeds	The system should allow users to view a learner's feeds	The parents have successfully displayed the feeds	None	Ok
Edit user profile	The application should allow both the teacher and parent to edit their user information.	The application should allow both the teacher and parent to edit their user information.	User profile has been successfully edited	None	Ok
Log out	The system should allow users to logout	The system should allow users to logout	User has successfully logged out from the application	None	Ok

Table 5 3 a: Functionality Testing

Test Case Name: Functionality Test **Test Date: 22.04.2021** **Tester: Victor Okinyi**					
Activity Tested	**Description of the Test**	**Expected Outcome**	**Observation**	**Error**	**Verdict**
	when they need to	when they need to			

.

5.4 Test Conclusion

From the tests, we conclude that the application has passed all the set requirements set by the researcher and performs as anticipated hence is fit for use by the primary schools in Nairobi County.

5.5 Application Deployment

The application should be deployed on the android-based tablets/phones as an android package (APK) file. The application will be hosted on the android app store when it can easily be downloaded and installed by users.

5.6 Summary

In this chapter, we have looked at the various functionalities of the complete and functional application. The test cases are proof that the developed application has met both functional and technical requirements. Note that minor improvers can be made to the mobile application to improve its usability.

Chapter 6: Discussion

6.1 Introduction

Active engagement with mobile technology provides a great potential for delivering information to both parents and teachers hence boosting parental engagement. Developing the online portal took into account the various needs of both parents and teachers, including things like health and co-curricular activities. Coming up with an all-inclusive application calls for collaboration among experts in the field so as to meet the fast-changing IT practices and educational needs of learners.

6.2 Review of the Research Objectives: Findings and Achievement

The first objective was to investigate the tools that are currently used by schools to enhance parent's involvement in education. This objective was achieved by conductive literature review of previous works done by other scholars in the same field. Among the tools used are social media applications like Facebook, WhatsApp and twitter. Some institutions, for example in Japan, effectively use Line and it has been embedded into the education system. Some other tools are email addresses, SMS, and websites. The features of these tools have been used to come up with a more modern and all rounded application that would meet most of the communication needs between parents and teachers.

The second objective was to review the frameworks, models, and applications used in the parent portal applications for schools. It was established that most communication tools used by schools are mobile based and connected through the internet. Hence, the most suitable application was found to be an android application with a cloud based database.

The third objective was to develop a mobile based parent's portal for public schools in Nairobi County. This objective has been met by collecting requirements from both parents and teachers. The data collected was then validated and a mobile application developed to meet the requirements. The mobile application is an and android application and it uses Java as the programming language. The application is open source to allow collaboration for other IT experts who may be interested in enhancing the functionalities.

The last objective was to test the developed application. We did both unit testing, done by the developer and user testing, which was done by a selected teachers and parents. The feedback from the tests were then used to resolve errors and ensure the application is working as required. The techniques that were used during testing include functionality testing, compatibility testing, usability testing and software metrics testing.

6.3 Benefits and Limitations of the Developed Portal

The developed application presents the following benefits:

i. The application enhances communication between parents and teachers on a daily basis. The learner's records are digitally stored hence reference can be made on the records at any time and place. Digitization of communication with parents reduces the overreliance on paper work by schools to communicate with parents. This is an improvement from the research done by Tuunanen & Peffers (2018). which found that a lot of time is wasted when teachers communicate with parents through letters.
ii. Parents are able to monitor the progress of their children in a detailed manner through the uploaded photos and pictures. This will in effect improve the involvement of parents in their children's learning process hence better performance.
iii. One on one discussions help parents to know their children's teachers and vice versa. With many learners to manage, some parents may feel left out but with the application, it is easier and convenient to initiate a discussion with the teachers.

Based on the research, the mobile application has the following limitations:

i. The application is android based hence it can only run-on phones and tablets that use android. This will pose a challenge in adoption by the parents and teachers who use non-android-based applications.
ii. The application needs the internet to run. This implies that users with phones that are not internet enabled and those residing in places with no internet connectivity will be disadvantaged. Data by world bank shows that about 22.565% Kenyans have used internet by the 2019. The data shows increasing trend of internet access. The percentage is small, and it mean majority of the population will not be able to enjoy using the portal (Individuals using the internet (% of population) - Kenya. (n.d.).

Chapter 7: Conclusions and Recommendations

7.1 Conclusions

Efficient communication between parents and teachers has vital rudiments in creating beneficial and healthy relationships between parents and teachers. This study attempted to understand the tools that are used by schools to bridge the communication between schools and parents. From the analysis, the research also developed an application to redound constructive communication between teachers and parents.

According to this study, using digital communication tools between parents and teachers gave positive results. Based on the surveys conducted, the following were deduced:

i. The use of mobile applications for communication helps in developing effective relationships.
ii. Flow of information between teachers and parents becomes simpler and effective.
iii. It improves parent's involvement in the learning process.
iv. The use of photos and videos makes communication with parents clearer and more exciting.

The developed application automates the communication process between parents and teachers. It greatly reduces paperwork for schools that still rely on paper correspondences. Being paperless will have ripple effects like reducing the manpower required to communicate with the parents and effectively cut down on the office stationery costs. The accumulated evidence supports the significance of parental involvement in the children's education. The parents have the skills and ability to nurture both cognitive development and achievement motivation. The research supports that teachers and educationists are committed to involving parents into their children's education by using various tools of communication. The educational outcome of the children can be so positive with the effective parental involvement.

It is important to understand that the main goal of a parent portal is to effectively engage parents into communicating with schools. From the data collected, we saw that some parents still prefer the traditional means of communication like letters and word of mouth. Therefore, an integrated model best works for parents and they should be given the option to choose which communication model would be effective for them. This also implies that implementation of the parent portal would not lead to complete eradication of the traditional models of communication. An integrated approach would be the nest to cater for the varied needs of parents. However, using the developed parent portal will provide parents with a broader spectrum of information hence teachers are encouraged to come up with effective ways of onboarding parents into adopting the system.

The literature review provides evidence beyond dispute that when parents are involved in their children's education, their children tend to achieve more. Incorporating modern technology into communication between parents and teachers will go a long way into facilitating the development of effective parental involvement.

7.2 Recommendations

An enhancement is recommended to incorporate features such as school fees management, student's applications, program enrolment, promotion to the next class, and the assessment plan. These are core activities in the learning process and keeping parents abreast with the information will improve the value derived from the application. Eventually, this will help students improve in their performance when they get improved support from the parents.

7.3 Suggestion for Future Work

With the development in technology, there will be a need to pay more focus on technologies that support family – school alliance. Therefore, the issues of using technology to enhance parental involvement in communication should be given a collective approach by professionals from all walks of life. The effect of learning and parental involvement should ve studies further since the two are closely related. Primary schools in Nairobi County cannot afford purchasing parent portals just to meet the goal of parental involvement because parental involvement is a secondary goal. The main goal is that the learners get better learning experiences and acquire knowledge and skills that would help them succeed in life. To make the tools affordable, there is a need to adopt an open source approach to develop effective parent portal for schools in Kenya. Therefore, it is suggested that studies examining the impact of technology on students' learning should also look at how technology affects parental involvement, and vice versa.

7.4 Limitations

The study only focused on Nairobi County. Therefore, findings of the study may not be similar to other schools in the remaining counties in Kenya. There is a need to extend the study to the remaining counties in Kenya and to come up with a tool that can work for all the primary schools in the 47 counties. Most schools in Nairobi have better infrastructure such as electricity and internet connection as compared to schools in the other counties in Kenya. Also, the county is more culturally diverse. These characteristics, among others, mad it the best place to conduct the study.

Also, the study only paid attention to public primary schools. This means that the findings could not work for private primary schools. In Kenya, there is a glaring difference between public and privately owned schools. Some of the differences are in the structure and the population of the schools. Private schools are more structured and tend to offer extra learning resources and foreign curricula as compared to public schools. This dissimilarity, along with the gap in educational standards, makes it necessary to conduct a research dedicated to the private schools before developing an application for them. In terms of population, public schools are more populous as compared to private schools. There is a need to extend the study to include the private schools.

The end products will be a tool that can be used by all primary schools in Kenya, whether public or private.

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Appendix A: Sample Questionnaire

STUDY QUESTIONNAIRE

Dear Respondent,

My name is **Victor Ong'udi**, a Master of Science in Computing and Information Systems student at Strathmore University. I am conducting a study on **A Mobile-Based Parent Portal for Public Primary Schools in Nairobi County, Kenya**. This is in partial fulfilment for the award of my master's degree.

GENERAL SURVEY INSTRUCTIONS

Please respond as accurately and honestly as possible. There are no right or wrong responses. For each question, choose the response option on the scale that best corresponds to your opinion. The survey should take less than 15 minutes. The survey is confidential to ensure candid responses. No individual data will be reported back to the school. All responses will be grouped and a feedback report will be created across all participants. I will retain all completed surveys. Your responses are very important to this process. If you have any questions, feel free to contact me at:

- email: victor.ongudi@strathmore.edu
- Mobile no. 0711567027

Thank you for your help.

SPECIFIC INSTRUCTIONS AND RESPONSE SCALE

This questionnaire is designed to collect information from parents, teachers, and other interested stakeholders about their school's commutation systems

I am a……1. Parent 2. teacher 3. Other-stakeholder

Background information			
Please circle the number that best describes your own communication patterns.			
	Never	**Sometimes**	**Always**
1. I regularly go through the school's website	1	2	3
2. I use texting, instant messaging, or both to communicate with parents/teachers.	1	2	3
3. When they're available, I watch digital videos on education posted online.	1	2	3
4. I access the Internet from a mobile device—such as a cell phone, iPad, iPod touch, or gaming device.	1	2	3
5. I spend time networking with teachers/parents on social media.	1	2	3

6. I spend time interacting with parents/teachers on social media.	1		2	3
7. I spend time networking with friends and family on social media.	1		2	3
8. I spend time following the updates of school groups on social media.	1		2	3
9. I struggle to keep up with the important messages in my life.	1		2	3

School Communication Questions

Please circle the number that indicates the extent to which you agree or disagree with the following statements concerning our school's communication patterns. Then, indicate how important each expectation is to you.

Message Delivery and Engagement	**Disagree**	**Neutral**	**Agree**	**Not Important**	**Somewhat Important**	**Very Important**
1. Our school communicates important 2. information—openings, closings, and schedules—in a timely and effective manner.	1	2	3	1	2	3
3. Our school regularly communicates student successes including academic achievements, athletic results, and visual/ performing arts accomplishments.	1	2	3	1	2	3
4. Our school markets itself well by publicly sharing	1	2	3	1	2	3

interesting course offerings and after-school clubs.						
5. Our school regularly shares news about the qualifications and accomplishments of its teachers						
Message Delivery and Engagement	**Disagree**	**Neutral**	**Agree**	**Not important**	**Somewhat important**	**very important**
6. I can receive messages from our school in a variety of different ways—through my cell phone or mobile device, in print, or from my computer.	1	2	3	1	2	3
7. Our school's website is an engaging destination that I always look forward to exploring.	1	2	3	1	2	3
8. I would like to see more photos and videos of school happenings shared on our school's website.	1	2	3	1	2	3
9. I am satisfied with the way I'm currently receiving messages from our school.	1	2	3	1	2	3

10. The messages our school shares regularly catch my attention and stand out from the messages shared by the other organizations, businesses, community groups, and workplaces—in my life.	1	2	3	1	2	3
11. Our school's messages leave me confident and proud to have my child in this school	1	2	3	1	2	3

Suggest about how the school can better engage parents and students in the educational process?

What are the 5 important pieces of information you would want to be updated on from school?

Appendix B: Turnitin Report

Curiginal

Document Information

Analyzed document	Dissertation Draft V2_110036.docx (D103500743)
Submitted	5/1/2021 1:17:00 PM
Submitted by	
Submitter email	Victor.OngUdi@strathmore.edu
Similarity	3%
Analysis address	library.strath@analysis.urkund.com

Turnitin Report.pdf