PERCEPTIONS OF PARENTS AND TEACHERS OF THE USE OF MOBILE APPS FOR MATHSEMATICAL EDUCATION

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ABSTRACT–Educational experts believe that primary school learners can benefit from mobile mathematical (maths) applications. The successful use of these applications by primary school learners will depend on their access to mobile devices and on the perceptions of parents and teachers toward the use of these applications. Very little scientific research is currently available that can shed light on the above-mentioned access and perceptions. The aim of this paper was to fill this gap and to investigate the access to mobile devices of grade 1 to 3 learners in the Free State Province in South Africa. In addition, the perceptions of the teachers and parents of the use of mobile applications for maths education of these grade 1 to 3 learners were investigated. Quantitative data was collected by using a survey targeting 11 maths teachers and 450 parents of grade 1 to 3 learners in nine different schools. The results indicated that 63% of the grade 1 to 3 learners had access to a mobile device at home and that parents and teachers were very positive towards the usage of mobile maths applications in home and school settings. The results of this study imply that the Free State province could be a conductive environment for the development and testing of mobile applications for the maths education of grade 1 to 3 learners.

Keywords: Mathematical education, mobile apps, perceptions, parent perceptions, school learners

1. INTRODUCTION

"Mobile is full of exciting technologies, and approaches that can help us transform how we teach, work and learn" (Stead, 2014). This statement aptly points to the current global trends where many teachers and parents are turning to and experiencing the transformational opportunities that mobile technologies bring to learning (Thiruchelvam, 2014; Grunwald Associates LLC, 2013). Furthermore, mobile educational apps include some of the most useful learning tools that have ever been developed (Prensky, 2012). For example, according to a study commissioned by Encyclopedia Britannica, parents who have downloaded educational apps have observed an improvement in the academic performance of their primary school children as a consequence of using these educational apps on smart-phones and tablets (Daily Mail, 2011). More specifically, educational apps are proving to be particularly useful in maths education. One most recent and comprehensive study involving 800 teachers revealed that 71% of these teachers who use digital educational apps reported improved maths performance amongst their learners (Takeuchi & Vaala, 2014).

Despite the opportunities and advantages of mobile educational apps for maths education, the adoption rate in primary schools in the Free State province is extremely low. In order to increase the exposure of teachers and learners to maths educational games, the Information Technology (IT) department at the Central University of Technology (CUT) in SA initiated a project at the start of 2015 where senior post-graduate students were involved in a socio-constructivist project to design and develop appropriate mobile maths applications (apps) for grade 1 to 3 learners in their immediate community. During the first phase of this project each group of post-graduate students were expected to gather data from the parents of the learners and the teacher they collaborated with before they commenced with the second phase of the project which is the design and development of their maths apps. Firstly, they had to determine whether learners have access to mobile devices (in order to pilot the developed apps) and secondly they had to determine what the perceptions of parents and teachers

are towards the use of mobile educational maths apps at school and at home which would give an indication of the willingness of parents and teachers to pilot the developed maths apps.

The research questions in this study are:
1) To what extent do grade 1 to 3 learners have access to mobile devices?
2) What are the perceptions of teachers and parents towards the use of mobile educational maths apps?
3) Which factors influence the perceptions of parents towards mobile educational maths apps?

2. CONCEPTUAL FRAMEWORK

This section provides the context of the study and will include a discussion of the following: 1) maths performance; 2) advantages of mobile applications for learning; 3) perceptions of parents and teachers towards mobile applications.

Internationally there is mounting concern about the participation levels and success rates of learners in maths in developed countries (Noyes & Sealey, 2012). The state of maths education in developing countries warrant even more concern, but the situation in SA is particularly disturbing where the performance of learners in maths is the worst of all middle- income countries in the world, and even worse than many low-income African countries according to international studies (McCarthy & Oliphant, 2013). In addition, according to a report published by The World Economic Forum in 2014, SA also has the worst quality of maths and science education of all 148 countries surveyed (Writer, 2014).

It is the view of the authors that all stakeholders must give priority to investigating innovative methods that could improve maths performance of school learners in their communities. Educational experts believe that supporting learners with information and communication technology (ICT) solutions could be one way to improve maths performance (National Science and Technology Forum, 2014). As far as the use of ICT solutions in maths teaching is concerned, several researchers are in agreement regarding the benefits that it offers. The conclusion drawn by Baya'a & Daher (2013) is that ICT integration in maths education provides maths teachers with integrative teaching methods that support learners' independent learning.

Despite the advantages of ICT solutions for maths teaching, it must be noted that a large percentage of SA children have not enjoyed access to it in the past due to low computer penetration in schools and households. For example only 10% of SA schools have access to one or more computers (Mdlongwa, 2012) and only 3.95% of SA households owns a computer (Arthur, 2012). However, newly developed maths apps and games are available on less expensive mobile devices that now offer access to many who do not have personal computers and consequently dramatically increase the percentage of the population that can access educational games and apps (Mdlongwa 2012). Prensky (2012) argues that mobile educational apps include some of the most useful learning tools that have ever been available and are preferable to books and laptops as learning tools. More specifically, Subramanya & Farahani (2012) have identified several key benefits of mobile apps for learning concepts in maths including: self-paced learning; reinforcement of abstract concepts; supplemental learning aids; anytime/anywhere use; enhanced retention; being entertaining and engaging; encourage the use of multiple (rich) media; immersion in interaction; self-assessment; provisions for exploration and experimentation; providing positive feedback; cost-effective; customizable; and time-effective. Another very important potential learning benefit of mobile apps, as identified by Bos & Lee (2013), is the repetitious use of content that will enable weaker learners to use an app repeatedly to learn or practice difficult concepts.

In addition to the various benefits that mobile maths apps (MMAs) have for learning, several studies now confirm. that the use of MMAs by primary learners lead to improved performance (Riconscente, 2013, Pope, Boaler, & Mangram, 2015). For example, a study centered on a mobile maths app, Motion

Maths, has revealed that fifth graders who regularly played the game for 20 minutes per day over a five-day period increased their maths test scores by 15% on average (Riconscente, 2013). Likewise, a Stanford College study where a pre- and post- assessment was used to measure numeracy of two groups of third grade learners, who had the same maths teacher, showed that the experimental group that played the mobile maths app, Wuzzit Trouble, showed a 20.5% increase in numeracy between the pre- and post- assessment, compared to the control group who did not play Wuzzit Trouble (Pope et al., 2015).

Despite the potential benefits offered by MMAs for mathematics teaching, the use of mobile apps in SA classrooms is still in its infancy, with only a small number of schools adopting the use of mobile apps for teaching purposes. However, this situation could change in the foreseeable future due to the fact that the Gauteng Department of Education is rolling out a project where every school child in Gauteng between grades four to nine will have their own tablet within the next two years (Oxford, 2014). Various factors will influence the successful implementation and usage of mobile technologies for maths learning in SA (in the classroom and at home). However, this paper will only focus on the perceptions of teachers and parents towards its adoption. Educational experts believe that parents play a crucial role when it comes to using mobile devices for learning (Obrien Ann, 2013), and that the perceptions of parents and teachers of primary school learners towards mobile apps are crucial for the successful implementation thereof (Grunwald Associates LLC, 2013).

Analysing literature regarding the perceptions of parents and teachers toward mobile technologies for learning reveals that perceptions change over time. For example, a study carried out by Cooney Center in collaboration with Common Sense Media in 2008 found that parents and teachers were negative about the educational value of mobile technologies and perceived cell phones as distractions that should not be allowed in schools (Druin, 2009). Another early study in 2010 found that many parents did not view mobile apps as potential learning tools and thus restricted their children to use them. Only 1% of parents polled believed that playing games on a mobile device or phone had educational value for their child (Chiong & Shuler, 2010).

On the other hand, recent studies in 2015 reveal a notable improvement in perceptions towards the educational value of mobile apps. For instance, a study conducted in 2015 by Lieberman Research Worldwide found that parents approve of the growing use of mobile technology in education, and most think it is improving the quality of education for their children. Parents also thought that mobile technologies can be especially effective for subjects like maths and science (Hill, 2015). In addition, 76% of teachers that were surveyed in the UK in 2014 believe that tablet devices bring new opportunities to learning that current teaching methods/tools cannot bring. Furthermore, 68% of parents recognized that children are more engaged when educational activities are carried out on tablet devices, while 84.2% believed that tablet devices provide educational benefits (Thiruchelvam, 2014). When turning to the situation in Africa, the UNESCO working paper series on mobile learning in Africa and the Middle East report that most teachers do not consider the mobile phone's potential for education, and many teachers are not aware of the educational potential of mobile phones (Isaacs, 2012). The aim of this paper is to shed light on the perceptions of parents and teachers towards the use of mobile apps for maths education in the Free State province of SA using the following methodology.

3. METHODOLOGY

3.1 Research paradigm

The research paradigm used in this study is the interpretivist/constructivist paradigm. Interpretivist/constructivist approaches to research have the intention to understand the world of human experience and propose that reality is socially constructed and (Mackenzie & Knipe, 2006). The interpretivist/constructivist researcher tends to rely upon the "participants' views of the situation being studied" (Creswell, 2003) and recognises the impact on the research of their own background and experiences. Constructivists do not generally begin with a theory (as with postpositivists) rather they

"generate or inductively develop a theory or pattern of meanings" (Creswell, 2003) throughout the research process. Therefore, in this study the researchers did not make use of a theoretical framework but instead focused on the views of teachers and parents towards the use of MMAs.

3.2 Sampling

A cross-sectional design was used where quantitative data was collected using survey questionnaires as the data collection instrument. Cross-sectional designs are used when a cross section of a population is sampled and studied at a single point in time using one questionnaire, one survey, or one observation. The reason for using a cross-sectional design was due to the fact that it is a relatively inexpensive method enabling the researcher to gather similar data from a large number of respondents (Benjamin, 2014). A cluster sampling strategy was followed where a cluster or group of population elements constitutes the sampling unit (Teddlie & Yu, 2007). The reason why this research strategy was followed is due to the fact that learners in schools are already grouped together in classes, and only one teacher can be contacted to distribute the surveys to all the learners in the class. The advantage of cluster sampling is that the generation of the sampling frame for clusters is economical, and the sampling frame is often readily available at cluster level. A disadvantage of cluster sampling is that the sample may not reflect the diversity of the community (Saifuddin, 2009).

The only variable that was used to select clusters was whether the group represented the previously disadvantaged (PD) population of SA or not. The number of class groups that contained PD learners and the number of class groups containing no PD learners were based on the representative percentage of the overall population of SA. According to the 2012 census of SA (Statistics South Africa, 2012), 9.6% of the population is not PD while the percentages of PD members include 79.2% for black, 8.9% for colored and 2.49% for Indian or Asian descent . The sampling strategy was based on 1 non-PD class group and 10 PD class groups, resulting in a sample containing 8.8% of non-PD learners and 91.2% of PD learners from nine primary schools (parents and teachers of grade 1 to 3 learners being the target population) in the Free State province in SA.

3.3 Data collection and analysis

Senior post-graduate students of the IT department at CUT were divided into 11 groups with a maximum of four students per group. Each group were required to collaborate with a grade 1 to 3 maths teacher in their community. Each group of students distributed a questionnaire to the teachers they collaborated with, and the teachers distributed the parent questionnaires to their learners. The ethical clearance procedures of the Central University of Technology were adhered to and participation consent forms were attached to each questionnaire. The questions in the survey were derived from various studies that investigated the adoption and usage of mobile devices and apps by young learners for educational purposes (Chiong & Shuler, 2010, Grunwald Associates LLC, 2013, Pearson, 2013). The questionnaires consisted of open and close ended questions, but this paper only report on a subset of the quantitative data that was collected. A five point Likert scale namely: 1) Strongly Disagree 2) Disagree 3) Neutral 4) Agree 5) Strongly Agree were used to gather data regarding the perceptions of teachers and parents towards the use of mobile educational maths apps. A total of 534 questionnaires were distributed and 450 were received back resulting in a response rate of 84%. Some of the respondents did not answer all the questions resulting in the total number of responses being less than 450 in some of the tables presented in the results and discussion section. The quantitative data was analyzed with the help of SPSS version 19, and reliability tests using Cronbach Alpha and comparative analysis using t-tests were conducted.

3.4 Reliability of instrument

Alpha was developed by Lee Cronbach in 1951 to provide a measure of the internal consistency of a test or scale and is expressed as a number between 0 and 1 with the acceptable values of alpha ranging from 0.70 to 0.95 (Tavakol & Dennick, 2011). Cronbach's alpha was calculated for the three Likert scale items that measured the perceptions of teachers and parents. The alpha coefficient for the three items is 0.893, indicating that the measurement scales of the items were stable and consistent.

4. RESULTS AND DISCUSSION

Table 1 provides insight as to what extent grade 1 to 3 learners have access to mobile devices in response to the first research objective of the study.

Table 1: Access of learners to mobile devices (smartphones and tablets) (n = 437)

Mobile Device Access	n	%
Learner not allowed access to mobile devices	120	27
No smart mobile device in home	42	10
Access to one mobile device	159	36
Access to two mobile devices	109	25
Access to three mobile devices or more	7	2
Total	437	100

A total of 37% (27% plus 10%) of learners have no access to mobile devices (either not allowed to have access or possessing no devices). This is equitable to 29% of pre-school to grade 2 learners, and 16% of grade 3-5 learners in America that don't use any family-owned mobile devices (Grunwald Associates LLC, 2013). As can be seen from Table 1, some learners have access to only one mobile device (36%) while other have access to two (25%) or more mobile devices (2%). If these percentages are combined, it results in a total of 63% of all learners that have access to at least one mobile device (smartphones and tablets). These results align with international results reported by Common Sense Media (2013) that 72% of learners under the age of eight in America have used a smart mobile device, which included smartphones and a tablets. Figure 1 displays the amount of time per week learners have access to a mobile device. A total of 58% of the parents spend less than two hours per week (17 minutes per day) on their mobile devices. The remaining 42% (29%+13%) of learners are allowed to use their mobile device for more than two hours per week. This can be compared to access levels of 15 minutes per day for children eight years and younger in America (Common Sense Media, 2013).

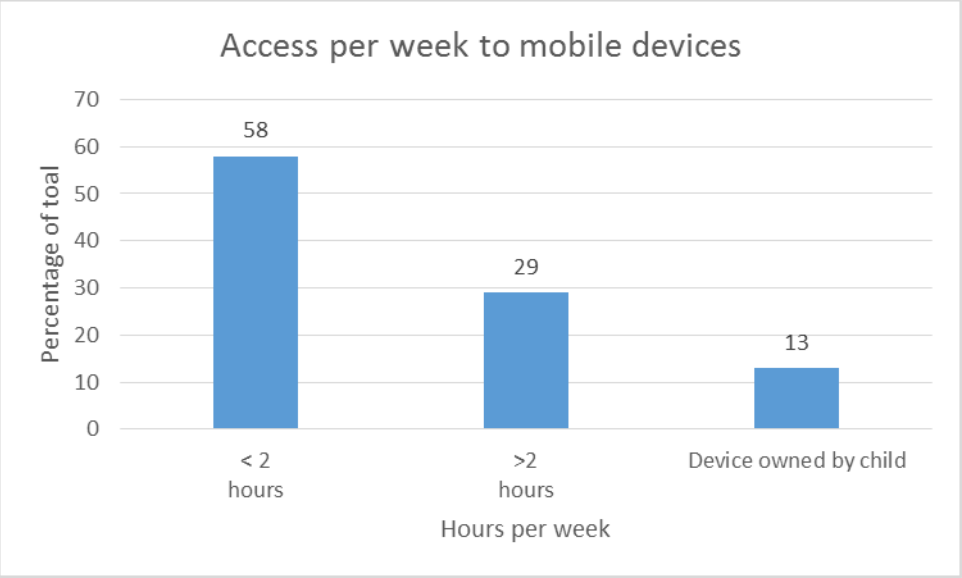

Figure 1: Access of grade 1 to 3 learners to mobile devices per week

The second research objective of the study was to determine what the perceptions of teachers and parents are towards the use of mobile educational maths apps. In order to investigate this objective, parents and teachers were presented with the following three statements:

- I believe that mobile educational maths apps can increase the maths skill level of my child (parent questionnaire) / my learners (teacher questionnaire).
- I am in favour of the use of mobile educational maths apps to teach children maths skills at home.
- I am in favour of the use of mobile educational maths apps to teach children maths skills at school.

A summary of the responses to the three statements is shown in tables 2 through 4.

Table 2: I believe that mobile educational maths apps can increase the maths skill level of my child/learners

	Parents		Teachers	
Option	**n**	**%**	**n**	**%**
Strongly Disagree	13	3	1	9.1
Disagree	12	2.5	0	0
Neutral	94	21	1	9.1
Agree	187	41.5	5	45.4
Strongly agree	144	32	4	36.4
Mean	3.97			
Std. Deviation	0.947			
Total	**450**	**100**	**11**	**100**

From Table 2 it can be seen that the total percentage of parents that believe that mobile educational maths apps can increase the maths skill level of their children is 73.5% (the sum of 41.5% that agreed and 32% that strongly agreed). In comparison, 75% of American parents with children in grade R-2, and 72% of American parents with children in grade 3-5 reported that mobile apps help teach children maths content and skills (Grunwald Associates LLC, 2013). In addition, the APM Marketplace report revealed that parents think that mobile technology can be especially effective for subjects like maths and science, with 62% of parents interviewed in this study reporting that mobile technology has increased the maths skill level of their children (Lieberman Research Worldwide, 2015). Table 2 further revealed that 9 (5 plus 4) teachers believe that mobile apps can increase the maths skill level of their learners. Table 3 demonstrates that the total percentage of parents that are in favour of the use of mobile educational maths apps at school is 73.8% (39.9% plus 33.9%). It also indicates that 10 (6 plus 4) teachers are in favour of the use of mobile educational maths apps at school.

Table 3: Parents and teachers in favour of the use of mobile educational maths apps at school

	Parents		Teachers	
Option	**n**	**%**	**n**	**%**
Strongly Disagree	11	2.4	0	0
Disagree	19	4.2	0	0
Neutral	88	19.6	1	9
Agree	179	39.9	6	55
Strongly agree	152	33.9	4	36
Mean	3.98			

Std. Deviation	0.96			
Total	**449**	**100**	**11**	**100**

Table 4 indicates that the total percentage of parents that are in favour of the use of mobile educational maths apps at home, is 72.6% (38.2% plus 34.4%). It also indicates that 8 teachers are in favour of the use of mobile educational maths apps at home (4 plus 4).

Table 4: Parents and teachers in favour of the use of mobile educational maths apps at home

	Parents		Teachers	
Option	**n**	**%**	**n**	**%**
Strongly Disagree	11	2.4	1	9.1
Disagree	20	4.5	0	0
Neutral	92	20.5	2	18.1
Agree	171	38.2	4	36.4
Strongly agree	154	34.4	4	36.4
Mean	3.96			
Std. Deviation	1.008			
Total	**448**	**100**	**11**	**100**

The third objective of the study was to determine which factors influence the perceptions of parents towards mobile educational maths apps. The following factors were investigated: age of child, gender of parents, access that the child has to a mobile device and exposure of parents to maths apps. Each of these factors was divided into two mutually exclusive groups, represented in Table 5. This criteria was selected due to the fact that several international studies on the perceptions of parents toward the use of mobile technology highlighted the effect of these factors on the perceptions of parents (Grunwald Associates LLC, 2013, Adiat, Ahmad, & Ghazali, 2013, Chiong & Shuler, 2010).

The results of the t-tests are provided in Tables 6 through 8 where the two groups in Table 5 were compared according to the mean scores that parents provided for Tables 2 through 4. The first factor group, namely the age of the child, reveals no significant difference between the mean scores of parents that have children 7 years and younger and parents that have children older than 7 years in terms of their perceptions about the learning potential of maths apps (Table 6: $t = -1.005$, $p = 0.315$) and the use of maths apps at school (Table 7: $t = -0.613$, $p = 0.54$) and at home (Table 8: $t = -1.056$, $p = 0.292$). This result is in stark contrast to a nationally representative study done in the USA that determined that parents of younger learners are more positive regarding the use of mobile apps for the teaching of maths academic content (Grunwald Associates LLC, 2013).

Table 5: Mutually exclusive groups for t-tests

Factor	**Group 1**	**Group 2**
Age of child	7 years and younger	Older than 7 years
Gender of parents	Male	Female
Access of child to mobile device	Child has no access per week to mobile device	Child has access per week to a mobile device
Experience with maths apps	Parents have previously downloaded maths apps	Parents have not previously downloaded maths apps

Table 6: t-test Results comparing factor groups on parents' belief that mobile educational maths apps can increase maths skill level

Factor Groups	n	Mean	SD	df	t	p
Child 7 years and younger	135	3.91	0.95	427	-1.005	0.315
Child older than 7 years	294	4.01	0.947			
Male	174	3.93	1.075	450	-0.25	0.802
Female	278	3.95	0.96			
Child has no access per week to a mobile device	159	3.69	1.068	263	-4.694	0.000
Child has access per week to a mobile device	284	4.14	0.822			
Parents have previously downloaded math apps	198	4.24	0.762	448	5.699	0.000
Parents have not previously downloaded math apps	252	3.74	1.046			

Table 7: t-test Results comparing factor groups on whether parents are in favour of the use of mobile educational maths apps at school

Factor Groups	n	Mean	SD	df	t	p
Child 7 years and younger	135	3.94	0.968	427	-0.613	0.54
Child older than 7 years	294	4.00	0.99			
Male	171	4.05	0.978	446	1.247	0.213
Female	277	3.94	0.965			
Child has no access per week to a mobile device	159	3.70	1.107	269	-4.239	0.000
Child has access per week to a mobile device	284	4.13	0.874			
Parents have previously downloaded math apps	198	4.16	0.931	448	3.728	0.000
Parents have not previously downloaded math apps	252	3.81				

When considering the second factor group, namely the gender of parents, it is clear from Tables 6 through 8, that there is no significant difference between male and female parents in terms of their perceptions about the learning potential of maths apps (Table 6: $t = -0.25$, $p = 0.802$) and the use of maths apps at school (Table 7: $t = 1.247$, $p = 0.213$) and at home (Table 8: $t = 1.021$, $p = 0.308$). This finding is in line with research that was conducted in Malaysia that revealed that there was no significant difference between male and female parents in terms of their attitude towards the use of instructional technology in teaching numeracy to children (Adiat et al., 2013).

The third factor group, namely the level of access that learners have to mobile devices per week, revealed that there is a difference in the mean scores of parents regarding their perceptions about the learning potential and the use of maths apps at school and at home between the two groups. Parents with children who have no access to any mobile devices have much lower mean scores (mean=3.70) than parents with children that do have access to mobile devices (mean=4.13). Moreover, there is a significant difference at the 99% level of confidence between the two groups' perceptions about the learning potential of mobile educational maths apps (Table 6: $t = -4.694$, $p < .001$) and the use of them at school (Table 7: $t = -4.239$, $p < .001$) and at home (Table 8: $t = -5.402$, $p < .001$). These results indicate that parents of learners who have no access to mobile devices have more negative perceptions towards the use and benefits of mobile educational maths apps. These results are similar to a study conducted in America that indicated that parents of learners that are not using mobile devices are less positive about the learning possibilities that mobile devices provide. They are also less likely to agree that mobile devices are a great way to engage learners in the classroom than parents whose children do have access to mobile devices (Grunwald Associates LLC, 2013).

Table 8: t-test Results comparing factor groups on whether parents are in favour of the use of mobile educational maths apps at home

Factor Groups	n	Mean	SD	df	t	p
Child 7 years and younger	135	3.89	1.005	427	-1.056	0.292
Child older than 7 years	294	4.00	1.015			
Male	171	4.02	0.97	446	1.021	0.308
Female	277	3.92	1.017			
Child has no access per week to a mobile device	159	3.6	1.153	257	-5.402	0.000
Child has access per week to a mobile device	284	4.17	0.857			
Parents have previously downloaded math apps	198	4.32	1.111	438	5.155	0.000
Parents have not previously downloaded math apps	252	3.75	1.225			

The last factor to be discussed is the previous exposure of parents to mobile educational maths apps. Tables 6 through 8 reveal that the mean scores of parents who have not downloaded maths apps (mean=3.75) is slightly lower than parents who have downloaded maths apps previously (mean=4.32). Additionally, there is a significant difference at a 99% level of confidence between the two groups' perceptions about the learning potential of maths apps (Table 6: t = 5.699, p = 0.000) and their use at school (Table 7: t = 3.728, p = 0.000) and at home (Table 8: t = 5.155, p = 0.000). These results indicate that parents of learners that have previously downloaded mobile educational maths apps have a more positive perception towards the use and benefits of MMAs. These results are similar to the findings of research conducted by the Cooney Center that indicated that parents' perceptions are more positive regarding the advantages of educational apps for learning after being exposed to good educational apps (Chiong & Shuler, 2010).

5. CONCLUSIONS

The main purpose of this paper was to investigate the perspectives of parents and teachers of the use of mobile apps for maths education of grade 1 to 3 learners. Many international studies on the use of educational technologies in education include formal school settings. However, in SA, a limited number of studies have focused on the use of mobile apps for maths education in formal school settings. The successful and widespread adoption of mobile applications for educational purposes are influenced, to a large extent, by the perceptions of parents and teachers towards it (Grunwald Associates LLC, 2013). The main contribution of this study is that it sheds light on the perceptions of teachers and parents towards the usage of mobile educational maths apps of primary school learners in the Free State province of SA. At times, there is a tendency to focus only on secondary school learners who are to enter higher education. However, several research studies indicate that the best way to improve maths performance is to focus on primary school learners (McCarthy & Oliphant, 2013). It is therefore important for Higher Education Institutions, in particular faculties offering STEM programmes (science, technology, engineering and maths), to conduct research into methods that may be used to improve the maths skills of primary school learners in order to enlarge the potential pool of learners who would eventually be able to gain entry into higher education.

A total of 63% of learners have access to mobile devices. 42% of these learners are allowed to use their mobile devices for more than two hours per week. This suggests that the majority of the parents of grade 1 - 3 learners from the nine schools in the Free State province of SA allow their children to regularly access mobile devices (see Tables 1 and 2 and figure 1).

Table 2 revealed that 73.5% of parents believe that mobile educational maths apps can increase the maths skill level of their children, while 9 of the polled teachers had the same viewpoint. Table 3 indicated that 73.8% of parents and 10 teachers are in favour of the use of mobile educational maths apps at school. Table 4 showed that 72.6% of parents and 8 teachers are in favour of the use of mobile educational maths apps at home. This suggests that the majority of parents and teachers have a very positive perception of using mobile educational maths apps at home and school to improve the maths skill level of their children/learners. These results are in line with several international studies on the

usage of mobile technology and educational games for maths education of primary school children (Grunwald Associates LLC, 2013, Lieberman Research Worldwide, 2015, Takeuchi & Vaala, 2014).

Results from Tables 5 through 7 indicated that the two most important factors that influence parents' perceptions towards the use of mobile educational apps include access to a mobile device and whether the parents have previously been exposed to MMAs. Parents of children that have no access to a mobile device expressed less positive perceptions towards its usage for learning maths. On the other hand, parents who have downloaded maths apps before and who have thus been exposed to these apps had a more positive perception towards its usage for learning maths. These findings indicate that a higher level of exposure to mobile technology is required if parents are to express a positive perception towards its usage in maths education.

A limitation of this study is the fact that the sample size was limited to school learners in one province of SA, as well as the small sample size of teachers. Furthermore, the only variable that was used to select clusters was whether the group represented the previously disadvantaged (PD) population of SA or not. However, the major findings of this study points to the fact that the majority of grade 1 - 3 learners in nine schools in the Free State province of SA are being exposed to mobile technology, with many of their parents perceiving mobile educational maths apps to be important to their children's maths skill level. It is imperative then that local developers of such apps take into consideration the cultural background of these children, many who have come from PD communities, in order to develop appropriate and relevant maths apps that they will understand and benefit from. This may well result in newer more dynamic mobile educational maths apps that are even more exciting than the current ones, thereby helping teachers to transform how they teach maths, and assisting parents to play an active role in the maths development of their children.

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