Current Journal of Applied Science and Technology

23(6): 1-13, 2017; Article no.CJAST.36184
Previously known as British Journal of Applied Science & Technology
ISSN: 2231-0843, NLM ID: 101664541

The Integration of Technology in Teaching and Learning of Mathematics: ----- The Missing Link

Farai Chinangure[1*] and Lawrence Mapaire[1]

[1] Young Academic Mathematics and Sciences Initiative , South Africa.

Authors' contributions

This work was carried out in collaboration between both authors. Author FC designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Author LM managed the analyses of the study. Both authors read and approved the final manuscript.

Article Information

DOI: 10.9734/CJAST/2017/36184
Editor(s):
(1) Wei Wu, Applied Mathematics Department, Dalian University of Technology, China.
Reviewers:
(1) Stamatis Papadakis, University of Crete, Greece.
(2) Dimitris Chassapis, National and Kapodistrian University of Athens, Greece.
(3) Ch. Krisnandari Ekowati, Nusa Cendana University, Indonesia.
Complete Peer review History: http://www.sciencedomain.org/review-history/21225

Original Research Article

Received 17th August 2017
Accepted 29th August 2017
Published 3rd October 2017

ABSTRACT

This article was motivated by observations made by the researchers that most mathematics educators were shying away from using technology to teach mathematics even in well-resourced schools while learners were embracing technology and using it as a source of inquiry in their everyday lives. The paper further explores how various strategies can be put in place to motivate educators to use technology in teaching and learning of mathematics. The researchers feel that very little is being done to bolster educators' confidence in grabbing this opportunity and help learners to benefit from availability of technology. The study adopted a mixed method research design and was informed by the social constructivist and critical theories. Data was elicited through ten focus group discussions held in districts in provinces where the researchers worked as mathematics facilitators. Data from educators were analyzed thematically The study established that educators were reluctant to embrace technology to teach mathematics; while in the contrary learners were fast catching up with changes in technology in such a way that lessons were boring to most learners. Technology (internet and digital media) was supposed to inform instruction to make lessons learner-centered, more interesting and relevant to the current needs of learners. It was observed that most male mathematics educators were more interested in attempting to use

**Corresponding author: E-mail: flchinangure@gmail.com;*

technology than their female counter parts who used it for social networking. To restore the dignity of mathematics teaching and learning, a comprehensive strategy to motivate educators not to shy away from technology was to be adopted. Among other things the study recommended training, provision of free WIFI to schools, allowing learners to bring and use their smart phones at schools and introducing incentives such as additional remuneration to motivate educators.

Keywords: Technology; integration; collaboration; social networking; mediation; scaffolding; zone of proximal development.

1. INTRODUCTION

There is a general outcry that today's child has lost interest in learning and spends more time glued to video games, social network and internet. The attention being paid by learners should be seen as an advantage that has rejuvenated the learner's quest for new information and skills. What is shocking in this regard is the pace at which educators are catching up with learner knowledge and use of technology. In most classes the educators are boring to learners because they seem to be failing to cope with the demands of the internet and digital technology. Yet, if technology is integrated into mathematics lessons, quality of teaching and learning is guaranteed through learner-centered approaches that promote collaboration, critical thinking, creativity and effective communication.

1.1 Back Ground to the Study

The advent of technology as a tool for learning defies the notion that educators are the main sources of information [1]. If used effectively technology makes learning more learner-centered and redefines the role of the educator to that of a facilitator. With the correct instructions and guidance, the learners can learn any topic in a very interesting way with very little assistance from educators. Learners have access to information on how to learn any concept on internet at their own time, at their own pace in an interesting way if educators' attitude and support is fully given. Technology enhances the development of collaboration, creativity, critical thinking and communication skills [2]. Current studies show that 93% of the world uses technology to employ their workers and if educators do not use technology in teaching and learning, they are only preparing 7% of their learners for the world of work [3]. Educators treat the use of smart phones with suspicion and learners are not allowed to bring and use phones in mathematics lessons. Researchers agree that if learners are forced to leave their smart phones at home so much learning is lost [1]. Technology takes learners to the point of instruction and information. The use of technology in whatever form makes teaching and learning more functional and relevant because learners use technology in everything they do. Technology is the future and what defines learning today and beyond the 21st century. However, from observations, the majority of the educators have become square pegs on round holes [1]. There is enough justification in channeling a lot of resources and investment in technology if educators had the same zeal and motivation in the use of technology as the learners. Scholars agree that learners take pride in what they do if educators show and make them aware that they can achieve the best results [3]. Through persistent failure in mathematics over the years, most learners have lost self-confidence and its incumbent upon the educators to rekindle the lost confidence and hope through exposing their learners to a variety of technology based learner-centered activities. Twitting to other learners and social network groups make collaboration and sharing of ideas possible. Educators can work together and set realistic goals with their learners that can be unraveled through the various computer games and each learner working at their own pace can solve problems and provide feedback on line to their educators, seek for clarity and move on to more challenging tasks. The presence of live lessons and demonstrations on YouTube do not require the teachers *to know concepts better than their learners* but will create opportunities for teachers to become partners who share realistic experiences with their learners. Thus, such diversity caters for different teaching and learning styles and enables learners to use technology responsibly. True and effective teaching then lies in not only guiding learners to achieve success but giving learners the opportunity to explain how they solve problems. Are our mathematics educators having the capacity to do that if they still give their smart phones to their children or even the learners they teach to set up WhatsApp for them? Can our teachers manage to move at the pace of

technology if they still cannot have an email address which they can use for communication?

It is the responsibility of educators to encourage connectivity and make the learners believe that they can solve any mathematical problem if they goggle around for information and get the necessary feedback to move to zone of proximal development. There is apparently a general apathy reflected by educators who are lagging behind in the use of technology without a twitter account or even an email address. What this study seeks to address is the missing link that makes educators fail to run with their kids to the extent that learners say lessons are boring and ignore the educators, hence watch video games during a mathematics lessons.

Availability of defunct computer laboratories in the schools is likened to a situation where car keys and a car are dumped into the hands of a person who cannot drive. While technology is changing, the educators are not, how then can educators manage to effectively engage learners who have the zeal and excitement to learn new things through technology if they are reluctant to move with the pace of change?

1.2 Statement of Problem

The above scenario makes it apparent that the new role of the educator is to prepare learners for the future that is technology driven when they leave schools. Performance in mathematics can be improved if the educators are engaging, responsive and dynamic as the world around them. Lack of adequate knowledge on how to use technology adds on to other challenges such as lack of pedagogical content knowledge, methodology and failure to use appropriate teaching and learning media [4]. It is against this background that this study attempts to investigate the missing link that make educators hesitant to confidently use technology to teach mathematics.

1.3 Research Questions

1. What factors are affecting the educators' attitudes towards the use of technology in teaching mathematics in primary schools?
2. How can educators' competence in the use of technology in teaching mathematics be improved?
3. How can the use of technology restore the dignity of mathematics through quality teaching and learning leading to improved learner performance in mathematics?

1.4 Objectives of the Study

1. Identify challenges faced by mathematics educators in using technology to teach mathematics.
2. Examine the strategies that can enhance educator competency in the use of technology to teach mathematics.
3. Explore how the use of technology can restore the dignity of mathematics through quality teaching and learning.

1.5 Rationale

The main purpose of the study was to explore what the missing link; in promoting the use of technology, in the teaching of mathematics in an attempt to make teaching methods more appropriate to learners who are more technologically literate than their educators.

2. CONCEPTUAL AND THEORETICAL FRAMEWORK

Technology is part of social change, comprised of forms of interaction, relationships and social order of the day that define new realities and meaning to human life. By definition, social change is whatever may happen in the course of time to change the roles the institutions, their social structure, their emergence, growth and decline [5]. According to [6] social change means modifications of the way people work, rear families, educate their children, govern them, and seek ultimate meaning in life. The conceptualization of technology as a social change means human beings have to change their ways of thinking in order to adapt to new realities that define the current society that is continuously changing as well. Advent of technology can be considered one of the changes that man has no control over [6] and resisting its usage and existence is as good as refusing to acknowledge that death is inevitable. From a sociological perspective, the use of digital technology took the form of planned change and therefore its use and application must also take a planned form for it to be accepted by educators who understand things in orderly fashion due to the nature of their training. Related to this point is the notion that the pace at which technology is taking over the functions of human beings in society is creating conflict and resistance among

educators who question its relevance and value compared to their previous way of teaching. The biggest question is where and how would educators fit in the new world order and at what pace? The very pace of appreciation of technology has engulfed the young generation faster than the old guard who should define values and norms that govern socialization of the young in preparation for the future. Technology is an essential component of everyday life, and both the old and modern generation must function within its horizons. Seen in this light, educators must tailor their ways of teaching to the diversity required by technological needs of today learners if they are to remain relevant and less boring to young people whom they should teach the necessary skills. The above views and ideas are informed by the critical theory.

The current study is also informed by the fundamental principles of the social cognitive theory [7]. The key principles that inform this study include interaction, scaffolding, mediation, feedback and apprenticeship learning. The social constructivists not only suggest that individuals construct knowledge through interaction in social contexts [8,9] but also emphasize that technology helps to place acquisitions of new concepts into the learner's zone of proximal development (ZPD). The ZPD is the distance or gap between what the child can do alone and what they can accomplish with the aid of more capable adult or peer [7]. This assumption places technology at the apex of effective teaching because it takes the learners into the zone of proximal development without the educator but through discovery. Therefore, by providing technology driven tasks the educator would be facilitating understanding of concepts to the learners. Technological programmes provide scaffolding [10]. Scaffolding is the assistance given to a learner to better understand concepts. Illustrations and comments given to learner's work would be some form of scaffolding and technology can ensure that learners get immediate feedback. From technology, learners can check their answers and responses. Hence, any form of feedback helps learners to grasp ideas better. [6] adds that feedback helps to move the learners from a level of low mental functioning to a level of higher mental functioning. The theory that informs this study asserts that as learners interact they create and acquire knowledge. The interaction is between the child and the video or YouTube presenter or between the learner and other learners through WHATSAPP or Face Book. This is very relevant to meta-cognition. YouTube videos on calculations provide learners with enough mediation and feedback. Explaining, modeling responses, dialogue and discussion are all forms of mediation. There is room for repetition as the learner would play the video over and over until the concept has been mastered [7,6]. [8] purport that technology also creates opportunities for apprenticeship learning [11,12] as learners practically carry out the tasks. When learners collaborate and interact on social networks, they share ideas and less skilled learners are helped by more knowledgeable learners to follow calculation strategies and eradicate misconceptions [13].

3. LITERATURE REVIEW

3.1 Factors Affecting the Teachers' Attitudes towards the Use of Technology in Teaching Mathematics

Technology refers to computers, satellite and various forms of the electronic and social media [6]. Technology in the context of mathematics refers to smart phones, tablets and calculators of all sorts [14,15], computers including internet [14] and social media and other devices that are associated with these devices [16]. Through the Internet, Twitter, Facebook, YouTube, Viber, LinkedIn and the short message service (SMS) and many of the ever-changing technological media, teaching and learning can be language rich and interactive [14,6,17].

The technology can be referred to as a tool for teaching mathematics in its different forms. However, most people view the use of technology with suspicion because they know very little about the way technology works. Educators in particular who lack the knowledge and skills about the use of technology feel that technology is an extra burden].On the contrary, research studies established that technology can enlarge the scope of the content learners can learn and broaden the range of problems learners are able to tackle. The purpose of this study is to explore the views and comments of educators so as to come up with strategies to integrate technology in the teaching and learning of mathematics from an informed position.

Studies have shown that there is a level of resistance to this new technology from the old guard [6] and this resistance is impacting negatively not only in the teaching and learning

of mathematics, but also in the learners' social lives. Learners have virtually pointed out that their teachers are boring while the teachers blame technology for destructing learners' attention resulting in poor competence in mathematics [15]. [15] again points out that educators feared that learners would be over dependent on technology (calculators and mathematics software) before they mastered the basics especially at the foundations phase. It may be in light of the above view that educators dismiss technology as a nonentity. However, studies carried out established that if technology is used thoughtfully and appropriately it can improve performance and restore the dignity of mathematics [15].

Educator attitudes were investigated by The study established that there was no consistence in integrating technology in teaching because educators did not trust technology. The educators did not use technology for fear that it might damage computational skills of children [15]. This study seeks to find out if educators are resisting the use of technology because they do also not trust it. By collecting views and comments from educators in the survey a position regarding technology can be reached.

Some people resist the use of technology due to cultural or moral reasons. In his study on the influence of celebrities on learner behaviour, [18] raised concerns that technology adversely influenced learners' behavior as learners used it to exploit sexual and pornographic material and imitating their celebrities. For this very reason some individuals give justification to resist the use of IPads and smart phones for fear of eroding the cultural values of learners.

Teaching of too many subject areas robbed educators' time to try using new technologies. The work load is too much and educators tend to use the traditional ways of teaching. This study therefore seeks to find out if the educators are failing to use the computer technology due to lack of knowledge and skills or because of too much work load.

Environmental factors have also been found to be causing educators not to use computers. The fact that the most computer laboratories are always offline might have caused the educators to lose interest. Some of the local environmental factors include load shading, learners transport home might take them early, theft of smart phones and IPads, school break ins in computer labs, cost of bundles and WIFI. The host of these factors can militate against the use of technology. Educators might feel the use of computers is a waste of time and resort to their traditional methods of teaching.

3.2 How to Improve Educator Competency in the Use of Technology in Teaching Mathematics

Normally, when individuals fail to keep up with social change and when a need is realized, individuals take initiatives to bridge the gap [6]. Thus, this study seeks to stimulate the move that would help educators to see the gap and then motivate them to bridge it. Collection of educators' views and comments will initiate action that will enable them to the bridge the technological gap.

Use of computers play a pivotal role in promoting meta-cognition. This is so because there is a lot of integration that takes place when educators use technology in teaching mathematics. Computers can be used to perform complex operations. Learners are able to see connections because there is visualization when they observe patterns on the computer. [15] identified several computer programmes on which learners can draw shapes on geoboards, reflect or rotate them. There are a lot of activities that can develop meta-cognition in geometry which educators can use and integrate in their teaching. This implies that using technology and social media in the teaching helps in the provision of feedback which is a critical component of critical thinking and it aids reflection.

3.3 How the Use of Technology Can Restore the Dignity of Mathematics and Improve Learner Performance

Studies show that learners are getting the experience to use technology largely as a result of their outside-of-school experiences and are no longer satisfied with an education system that is based on traditional approaches [19]. Technology supports the notion of child-centered and interactive approaches which educators are not kin to use. This view is in line with s observation that today's learners are made up of a generation raised on the expectation of interactive, skill-based, experimental teaching and learning methods. Of note, most educators reject use of collaborative learning on the belief that it is too hard to implement.

Longitudinal studies carried out in America investigated the use of not only the calculator but computer applications and found that Grade 4-6 learners who used technology improved their conceptual understanding of mathematics [15].

Van [15] explains that learners might be split into groups, one group might do mental calculations while the other is using computer applications to check on the answers. This task would create an opportunity for learners to take turns to practice their mental work using both mental calculations and even calculators in form of interesting games while reinforcing their skills. This study therefore seeks to find out if the educators are failing to use the computer technology due to lack of creativity and knowledge of its benefits.

Van [15] posits that there is computer software that can be downloaded and used as manipulatives. Some programmes also teach and tutor learners while the teacher is busy planning the next lesson. This would reduce his work load while at the same time learners are using their time constructively. Research established that power point projectors can help to provide vivid illustrations that may keep learners more attentive instead of the chalk and talk [15].

From the previous studies, principles of constructivism show that learners construct their own meaning from new information, as they interact with reality or others with different viewpoints from exposure to technology [20]. This gives the educator a new role defined by facilitating and guiding students to construct their own knowledge [20]. Based on these views teachers need to have knowledge on how they can activate the previous experiences of learners to be in synch with the concepts being taught [16] through a well-structured learning environment. Thus, knowledge of technology in this regard becomes a pre-requisite to enable the educator to provide the mediation.

Using technology in teaching mathematics acts as a source of motivation for learners through the development communication networks and social network groups where they assist and interact with each other online. To learners, this kind of teaching and learning style is what they can appreciate because they are bound to inquire, investigate and collaborate with their peers to check the correctness of their answers. It promotes self-efficacy and the zeal to discover new knowledge through their own efforts and rewarded through peer feedback where they can assimilate new knowledge and possibly correct their own mis- conceptions. The educator needs not know all the content knowledge but through learners' discoveries and inquiries, learners and educators can be partners. The educators would no longer be inundated with a lot of marking as learners will edit, check their answers and correct their way of thinking. It means less work for the educator. This stance if compared to traditional chalk and talk approaches is less taxing because the educator is not expected to know everything and do all the work for their learners [4,21,6].

Research evidence emanating from the USA on internet usage show that learners spend most of their time on social media network [22,32,31]. Seen in this light, the educator can take advantage and assign learners more group tasks to encourage them to collaborate and share information. By so doing, more opportunities are also created for the educator to provide scaffolding through various forms of interaction such as WHATSAPP and Face Book communication among their learners. In addition, the educators can even go on Skype and facilitate video conferencing when learners are not in the classrooms but where they are connected by WIFI to receive educator comments on their work.

Owing to the above exposition on merits of using technology in teaching mathematics, there is a need to come up with policies that are imbedded in current technological practices to improve teaching pedagogy [13,25]. In this regard, it should be understood that the availability of technology does not make the theories that inform teaching methodology and learning styles less important. The current approaches should simultaneously re-skill educators while re-thinking about the place of connectivity and technology in educational practice. Limiting educator's space in technology during teaching training programmes is but just a process of incapacitating them and making them vulnerable to learner criticism.

3.4 Ethical Clearance

The researchers had to first obtain the necessary ethical clearance and permission to conduct the study from authorities and where they are affiliated.

4. DATA MANAGEMENT FINDINGS AND ANALYSIS

The following section presents the biographical data of respondents.

Table 1 shows that among the respondents 58 percent were males while 42 percent were females. There were more male mathematics educators in the intermediate phase than females. There were 52 percent educators who were above 41 years and 48 percent below 40 years. The majority (60 percent) of the educators teaching mathematics had not specialized in the subject while only 40 percent had specialized. The following section summarizes the findings of the study according to the sub-research questions.

4.1 Research Question 1

4.1.1 What factors are affecting the teachers' attitudes towards the use of technology in teaching mathematics in primary schools?

Drawing from the biographical data on the Table 1 there were more males teaching mathematics from the sample drawn and out of those majority have not specialized in mathematics. The fact that some of the educators had not specialized in the subject had implications for confidence to try out new approaches with technology. As such lack of adequate skills and training in the subject may have been some of the factors that militated against the use of technology in the teaching of mathematics by some educators. This assumption is in concurrence with the claim that educators in particular who lack the knowledge and skills about the use of technology feel that technology is an extra burden. In addition, work overload can accord for failure to try out the use of technology in subjects they did not specialize in. The teaching of too many subject areas, robbed educators' time to try using new technologies hence they resorted to traditional methods. In contrast, however literature implies that the use of technology in teaching mathematics can reduce the educator's work load if planned well the learner can work alone at their own pace while the educator is busy doing other work. Compared to traditional chalk and talk approaches use of technology is less taxing because the educator is not expected to know everything and do all the work for their learners

Table 1. Biographical Data of Respondents

Respondents	Biographical variable	Variable description	Frequency	Percent
Educators	Gender	Males	29	58.0
		Females	21	42.0
		Total	50	100.0
	Age	25-30	8	16.0
		31-35	7	14.0
		36-40	9	18.0
		41>	26	52.0
		Total	50	100.0
	Qualifications	Diploma	4	8.0
		Bachelor of Education	39	78.0
		Master of Education	5	10.0
		PHD	1	2.0
		Missing	1	2.0
		Total	50	100
	Specialization in mathematics	Yes	20	40.0
		No	30	60.0
		Total	50	100.0

Table 2. Ownership of gargets that use technology and how it influenced use of technology in teaching mathematics

Variable		Laptop ownership	Smart phone ownership	IPad ownership
Response%	Yes	40	84.0	34.0
	No	80	16.0	66.0
	Total	100	100	100
Rate of usage%	Yes	10	80	10
	No	90	20	90
	Total	100	100	100

but learners will work on their own and receive immediate feedback and correct themselves [22, 23,24]. The next section examines the other factor.

Table 2 shows that the majority of educators owned the smart phones. Very few owned a laptop (40%) and an IPad (34%). The implication was that most educators were confident in using the smart phone in social network such as Face Book and WHATSAPP with their friends that had nothing to do with the teaching of mathematics. If this is considered in light of the findings from literature, social networks can accord learners opportunities for collaboration and sharing of ideas. Research evidence emanating from the USA internet usage show that learners spend most of their time on social media network [22]; [23,24]. Seen in this light, the educator can take advantage and assign learners more group tasks to encourage them to collaborate and share information. This in tandem with social cognitive principles that emphasize scaffolding and interaction as methods by which learners generate knowledge. The next section examined confidence level as one of the factors.

The next section analyzed the level of confidence.

Table 3 shows that the level of confidence with use of technology was very low (2%).The educators did not use technology because they had no confidence in it. This finding concurs with what was established in earlier studies that educators did not use technology for fear that it might damage computational skills of learners [15]. On the basis of this, it can be concluded that teachers are resisting the use of technology because they do also not trust it and they deliberately avoid practicing its usage. The next section considers how often educators use some of the technological packages as a factor.

Table 3. Level of confidence

Variable	Frequency	Percent
Very Confident	4	8.0
Confident	2	4.0
Poor	44	88.0
Total	50	100.0

Table 4 shows that only 6% of the educators were aware of the software that can be used to teach mathematics. Some of the educators did not have an email and those who had, rarely used them. Studies have also shown this trend among university lecturers as established that in institutions of higher learning there is a level of resistance to this new technology from the old guard [6]. The best bet is to avail enough training and support to educators. Next section examined personal reasons why educators did not use technology as a factor.

Table 5 above shows that most educators did not use technology for fear of cost of bundles, lack of resources, general mistrust and lack of training. The above findings concur with the claim that environmental factors have also been found to be causing educators not to use technology such as being offline, load shading, learners transport home might take them early, theft of smart phones and IPads, school break ins in computer labs, cost of bundles and WIFI.

4.2 Research Question 2

How can educators' competency in the use of technology in teaching mathematics be improved?

Table 4. Use of technology by educators

Variable		Do you have an email	Do you use the email regularly	Are you aware of any mathematics programmes you can use
Response%	Yes	42.0	40.0	6.0
	No	58.0	60.0	94.0
	Total	100	100	100

Table 5. The main reasons why educators did not use technology

Variable		Lack of training	Cost of bundles	Lack of resources	General mistrust
Response%	Yes	46.0	40.0	30.0	86.0
	No	54.0	60.0	70.0	14.0
	Total	100.0	100	100.0	100.0

Table 6 above shows that the majority of educators believed training, free WIFI, provision of resources and use of software that work offline could enhance the use of technology. However, the educators did not support that learners bring and use smart phones as source of information. They generally believed that smart phones destructed learner attention and focus.

Responses from focus group discussions on how the use of technology can be improved among educators show that the cost of bundles was prohibitive and the educators had not been trained adequately on how to use technology. Some pointed out that unless their salaries were increased, use of technology to them meant more work and therefore they needed to be paid more. The following verbal quotes illustrate the above views:

> *The training is piece meal it does not give us enough skills and confidence to try new things* ***(Female participant 1).***
>
> *The schools cannot afford to support us because the bundles are too expensive all our computer labs are closed due to lack of connectivity* ***(Male participant 10).***

4.3 Research Question 3

How can the use of technology restore the dignity of mathematics leading to improved learner performance in mathematics?

Table 7 reveals that all (100%) of the educators agreed that technology was creating enough opportunities for collaboration, immediate feedback, learner centeredness, and learners to move at their own pace and addressing different learning styles. The majority (70%) were skeptical about bringing of smart phones and access to mathematical games.

4.3.1 Responses from focus group discussions on how the use of technology can promote the dignity mathematics teaching and learning

During focus group discussions most of the educators reiterated that technology was creating enough opportunities for collaboration, immediate feedback, learner centeredness, and learners to move at their own pace and addressing different learning styles. The following verbal quotes illustrate the above:

> *The learners can share information and correct each other on WHATSAPP* ***(Male participant 1).***
>
> *The learners can google for new information and can learn at their own pace.* ***(Male participant 11).***
>
> *There is reinforcement and immediate feedback. There is room for repetition.* ***(Female participant 3).***

Like the responses to questionnaires, focus group discussions held with educators also showed that educators were skeptical about learners being allowed to bring smart phones to school and access mathematical games. The verbal quotes that follow reflect on the views given by educators:

> *Learners would access unsuitable content that will influence them negatively* ***(Female participant 31).***
>
> *Unless there is enough monitoring most learners may end up playing soccer games and watching pornography* ***(Male participant 17).*** The next section discuses statistical inference from quantitative data in a nutshell.

5. DISCUSSION OF FINDINGS OF THE STUDY

On factors that affected the use of technology in teaching and learning of mathematics, this study identified lack of adequate training, mistrust, fear of extra work, cost of bundles and lack of confidence among educators. These findings concur with what was established in earlier studies.

On how to promote usage of technology, the study found the need for adequate training, monitoring learners and provision of free WIFI to schools. Most computer labs were not working and learners were not using them due to expensive bundles. Using technology in teaching mathematics acts as a source of motivation for learners through the development of communication networks and social network groups where they assist and interact with each other online. These findings then make it imperative for educators to change their mindset and allow learners to participant in social networks through the use of their smart phones. The forbidden fruit mentality will only increase the desire among learners to explore what is unsuitable. Where teachers assign tasks and set targets, learners develop the motivation to be the source of information and sharing it with peers to enable scaffolding and interaction leading to assimilation and accommodation of concepts.

Table 6. How use of technology can be improved among educators

Variable		Training	Free WIFI	Provision of resources	Allowing learners controlled use of smart phones	Monitoring and enforcing	Using so line. eg s
Response%	Yes	16.0	80.0	70.0	76	76.0	80
	No	84.0	40.0	30.0	24	24.0	20
	Total	100.0	100	100.0	100	100.0	100

Table 7. How the use of technology can restore dignity of mathematics

How technology restores dignity of mathematics	Strongly Agree%	Agree%	Not Sure%	Disagree%
1 Its child centered	60	20	10	10
2 Motivational	70	20	0	10
3 Caters for different learning styles	80	20	0	0
4 There is learner collaboration	100	0	0	0
5 Expect demonstration lessons on line	50	0	40	10
7 Learners can move at own pace	70	20	30	0
8 There is immediate feedback	90	10	0	0
9 Allow learners to bring smart phones to school	10	20	30	40
10 Allow learners to goggle for answers and share with their classmates	80	10	10	0
11 Allow access to mathematical games	40	10	30	20

The study found that the most common social network educators' use is Whatsapp and their emails do not work regularly. However earlier studies carried out in the USA [22,23,24] show that such social networks can enhance collaboration and further teaching if educators shared the same social networks with their learners and create platforms for sharing ideas. In addition, the study found that educators do not know any software programmes to use and they rarely used technology for teaching mathematics. The findings are in line with what was established earlier [20] when learners leave smart phones at home they leave knowledge and go school empty handed without any source to refer.

The findings from the current study show that educators feel that the use of technology in teaching mathematics increases their work load is disputed by research findings done in other parts of the world. If compared to traditional chalk and talk approaches, use of technology is less taxing because the educator is not expected to know everything and do all the work for their learners [22,23,24]. Learners are endowed with the responsibility to uncover and goggle for information and compare their responses to prescribed answers online. Thus, immediate feedback is provided unlike in chalk and talk where books are not marked for weeks while learners guess as to how they performed in a task.

The training educators have been validated as a prior need in this study. In fact, the value of training component in any sector be it education or what should be ongoing. Exposing educators to adequate knowledge will enable educators to have skills to turn learners into responsible users of technology. [18] observed that the social technological media space has been invaded by celebrities whose personalities might be imitated and influence learners to behave irresponsibly. Seen in this light, failure by educators to be active users of internet and other forms of media technology limits the educator's ability to provide guidance and counseling to learners who may take celebrities of adverse personalities as role models. Self-efficacy and regulation among learners can be promoted by educators who are full participants in the use of technological packages.

6. CONCLUSION

1. The study established that cost of bundles, lack of resources, general mistrust and lack of training were among some of the key impediments that hindered educators from interest to integrate technology in the teaching and learning process of the subject.
2. Improved use of technology by educators could be achieved through training and linking pedagogical theories to connectivity
3. From the findings of the study it was concluded that technology was creating enough opportunities for collaboration, immediate feedback, learner centeredness, and learners could move at their own pace and there was room to cater for different learning styles.

7. RECOMMENDATIONS

1. The researchers recommended that institutions training educators should train educators in the use of technology for teaching mathematics. There should be emphasis on both theoretical and practical knowledge on use of technology.
2. The government should provide free WIFI to schools in order to enable learners to have access to programmes on internet at no cost.
3. On the basis of the findings of the study, the researchers recommended that most mathematics educators should be involved in ongoing in-service training in order to equip them with skills to use technology competently to teach mathematics
4. As has been established in the study, technology not only makes work easier for educators but also benefits learners more than traditional methods. Consequently, the researchers recommended that more technological resources should be given to schools.
5. Technology should be used in mathematics teaching in order to make the subject more interesting to learners who are now techno-literate. The theories of teaching and learning should be imbedded in connectivity so that their relevance can be understood in current trends of teaching and learning.
6. The researchers recommended that since the CAPS (Curriculum Assessment Policy Statement) document does not mention the use of technology in the content clarification section, planned and deliberate effort should be made to realign the CAPS(Curriculum Assessment Policy Statement) document in line with technological needs of learners

7. The researchers strongly recommended the creation of Technology Centres where educators could be staff developed in every district.

8. LIMITATIONS AND CONCLUSION

The findings of this study cannot be generalized to the whole of South Africa. They were based on needs analysis by a mathematics service provider in underperforming **sc**hools in mathematics. However, the findings cannot be completely dismissed because they shade light on areas that need attention and to be developed to restore dignity of mathematics and improve on the quality of teaching and learning of the subject through the use of technology.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Delzer K. Reimagining classrooms: teachers as learners and students as Leaders. Kayla Delzer, TEDxFargo; 2015. Available:https://www.ted.com/topics/education
2. Vankus J. Active methods of mathematics education: Faculty of natural sciences; 2015.
3. Pirard P. The 5 principles of highly effective teachers: At TEDxGhent; 2013. Published on 25 Sep 2013.
4. Chikodzi I, Nyota S. The interplay of culture and mathematics: The rural shona classroom. The Journal of Pan African Studies. 2010;3(10).
5. Hans G, Mills CW. Character and social structure. New York: Harcourt; 1953.
6. Mutekwe E. Higher education and the social media technology: A dilemma unfolding in institutions of higher learning. Journal of Education and Human Development. 2015;4(3):119-133.
7. Vygotsky LS. Mind and society: the development of higher psychological processes. Harvard: Harvard University Press; 1978.
8. Eggan, Kauchaki. Introduction to teaching: Becoming a professional. 4th Edition, Pearson, Florida; 2011.
9. Mutekwe E, Machingambi S, Maphosa C, Ndofirepi A, Wadesango N. A SWOT analysis of the rise and pedagogical implications of the social constructivist epistemology in educational practice. The anthropology. International Journal of Contemporary Studies of Man. 2013;15(1):53-6.
10. Kozulin A. Psychological tools. A socio cultural approach to Education. Cambridge: Harvard University Press; 2002.
11. Collins M. Do celebrities have a positive or negative effect on society?; 2010. Available:http://www.helium/comdebates/151608 page1-4.
12. Meter P, Stevens RJ. The role of theory in the study of peer collaboration. The Journal of Experimental Education. Learning with Peers: Multiple Perspectives on Collaboration (Fall). 2013;69(1):113-127.
13. Dame J. More professors using social media to teach USA Today College; 2013.
14. Papadakis S. Creativity and innovation in European education. Ten years eTwinning. Past, present and the future. International Journal of Technology Enhanced Learning. 2016;8(3-4):279-296.
15. Van de Walle JA. Elementary and middle school mathematics teaching development. Addison-Wesley. Longman; 2008.
16. Jonassen DH. Learning with technology: A constructivist perspective. Columbus, OH: Merrill and Prentice-Hall; 2009.
17. Gwagwa A. His story, her story. London: The Lion Press; 2014.
18. Chinangure F. The influence of celebrities on the behavior of high school students in Zimbabwean secondary schools. UNISA. South Africa; 2017.
19. Prensky M. Digital natives, digital immigrants. On the Horizon, MCB University Press. 2001;9(5):1-8
20. Donald D, Lazarus S, Lolwana P. Educational psychology in social context: Oxford. Oxford University Press; 2007.
21. Hart J. Top 100 social media tools for learning. Journal of Information and Communication Technology. 2014;13(1): 19-28.
22. Amory A. Use of information and communication technology in teaching, Learning and Administration in the Gauteng Department of Education, South Africa, 39–46. In Proceedings of World Conference on Educational Multimedia,

Hypermedia and Telecommunications; 2010.
23. Bernoff J. Groundswell: Winning in a World transformed by social technologies. Journal of Information and Technology in Teaching, Learning and Administration in the Technology. 2008;12(2):130-137.
24. O'Brien D, Torres AM. Social networking and online privacy: Facebook users' perceptions. Irish Journal of Management. 2012;31(2):63-97.
25. Abe P, Nickolas JA. Integrating social media into the classroom curriculum About Campus. 2013;18(1).

Peer-review history:
The peer review history for this paper can be accessed here:
http://sciencedomain.org/review-history/21225