CHALLENGES AND CONSTRAINTS OF THE PAPERLESS CLASSROOM: WAY FORWARD

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Abstract: *The challenges and constraints of paperless classrooms was explored in this study using the experiences of school leaders and teachers in the Ekurhuleni district. Qualitative method was adopted. Hence data was collected through semi-structured interviews from purposefully selected participants. Thematic analysis was used for analysing the collected data. The study findings showed that the practice of paperless classrooms which has various benefits brings with it a number of challenges, like a lack of technical support, problems associated with security, the slow and inconsistent roll out of the resources, and a lack of on-going teacher development through formal and on-the-job Continuous Professional Development (CPD). The study recommends the inclusion of digital resources as tools that facilitate the enhancement of teaching and learning rather than changing the face of traditional classrooms.*

Keywords: *Ekurhuleni District, Leading Learning, Paperless Classrooms*

Introduction

The term "paperless" introduced a digitised classroom where computer and other technological gadgets are considered pivotal and inevitable. For a school to be functional, it is important to have an effective and efficient environment. The paperless classroom promotes a more efficient and organised classroom (Meishar-Tal and Shonfeld, 2019). ICT provides opportunities to streamline and enhance the efficiency and effectiveness of the activities that are undertaken across the development landscape of educational settings (International Telecommunication Union, 2014). Dube, Nhamo and Magonde alluded that the introduction of ICT makes the work activities of school leaders, teachers and students faster and easier (Dube et al., 2018). Research conducted by Kganyago found that ICT empowered classrooms have shown an increase in productivity and competence for teachers and learners (Kganyago, 2018). Byrne and Furuyabu confirm that ICT, through the creation of digital materials, is capable of helping school management and teachers to swiftly share and update information as well as easily make corrections and/or changes when needed (Byrne and Furuyabu, 2019). However, regardless of the importance and relevance of the paperless classroom, its effectiveness is hampered due to various challenges. Hence, the reason for this study which explores the challenges of the paperless classrooms using the case of Ekurhuleni district of South Africa. The study was guided by the research questions: What are the challenges experienced by leaders and teachers in implementing the paperless initiative in the classrooms of Ekurhuleni? What is the possible way forward?

Methodology

Qualitative approach was employed for the study. This is in accordance with Kumar and Creswell who hold the view that qualitative method aids the collection of in-depth information (Kumar, 2019), (Creswell, 2014). The schools and participants were purposively selected. For instance, the schools and participants were respectively selected based on location and their experiences. Data was collected by means of semi-structured interviews. This allowed for follow-up questions where necessary. The collected data was coded, categorised, thereafter, themes were generated. This is in alignment with Saldaña who supports the coding and categorising of data before the generation of themes for analysis (Saldaña, 2016).

Additionally, the researchers ensured that ethical practices were upheld. For instance, ethical clearance was obtained from the relevant higher institution, while permissions were sought from the department of education as well as participating schools and participants. Consent forms were completed by participants prior to data collection exercises.

The biographic data of participants are as presented in Table 1.

Participants	Gender	Age	Highest qualification	ICT proficiency	Teaching experience	Responsibility	Research Site
Principal D	Male	60	B. Ed.	None	31 years	Principal	Site A
Deputy M	Female	52	Honours	Good	28 years	Deputy Principal-Curriculum	Site B
Deputy G	Male	55	B. Ed.	Good	24 years	Deputy Principal – Disciplinary LTSM Coordinator	Site B
HOD M	Female	50	Masters	Excellent	26 years	Head of Department – English ICT Coordinator	Site A
HOD B	Male	48	B. Ed.	Good	21 years	Head of Department – Humanities	Site B
Teacher T	Female	32	Honours	Excellent	5 years	Post Level 1 teacher	Site B
Teacher R	Female	32	PGCE	Excellent	9 years	Post Level 1 teacher	Site A
Teacher S	Female	26	B. Ed.	Excellent	4 years	Post Level 1 teacher	Site B
Teacher C	Male	42	Masters	Excellent	9 years	Post Level 1 teacher	Site A
Teacher SN	Male	36	B. Ed.	Excellent	5 years	Post Level 1 teacher ICT Coordinator	Site B

Participants	Gender	Age	Highest qualification	ICT proficiency	Teaching experience	Responsibility	Research Site
Teacher M	Female	37	Honours	Excellent	9 years	Post Level 1 teacher	Site A
Teacher K	Female	33	Honours	Excellent	5 years	Post Level 1 teacher ICT committee member	Site B

Table 1: Biographical details of the participants

Findings and discussion

The findings of the study are presented in themes and sub-themes. Table 1 below presents the themes and sub-themes generated from the analysed data.

Themes	Sub-theme	% Response
1. Challenges and constraints of the paperless classroom Initiative	1. Environmental distractions	37%
	2. Limited in-service training	32%
	3. Insufficient resources	26%
	4. Partial implementation and contradiction of policy	26%
	5. Resistance to change	21%
	6. The inability to lead learning	11%
	7. Lack of consultation and involvement	-
	8. Abuse of ICT resources and the lack of classroom monitoring	16%
	9. Lack of adoption	10%
2. Way forward	1. Availability of ICT resources	16%
	2. Outsourcing to qualified ICT technicians	11%

Table 2: Themes and sub-themes derived from and analysis of the data

Theme 1: Challenges and constraints of the paperless classroom initiative
Sub-theme 1: Environmental Distractions

The data reveals that 37% of the respondents are of the firm view that power outages as a result of load shedding are an impediment to the proper implementation of the paperless classroom. Participants in the interviews provided elaborate details of this challenge by stating:

> *Electricity affects the smooth running of ICT classes. Our townships are plagues with cable thefts and illegal connections and therefore electricity is a problem. To add on these issues is the national crisis South Africa is facing with load shedding, even if the schedule*

has been given for us to know if our area will be affected it is not followed. Hence, no one can predict when electricity will be switched off and on.

So the issue with ICT classroom they are completely dependent electricity, there are some days we would arrive at school and there's no electricity and the unfortunate part is that I took hours making sure I'm ready for my lesson. So now my laptop is flat and the Smartboard is off and I don't have a backup. Though creating e-lessons is enjoyable it has disadvantages when there is load shedding.

Moreover, an excerpt from the interview depicts: *"It is a huge problem when there is no electricity… affects network and internet access. The issue of no internet in the classroom therefore prevents us from browsing the web for sources to boost content"*. Another teacher added: *"The unfortunate disadvantage is the fact that we experiencing load shedding, which disorganizes our teaching with ICT"*. Example from a participant: *"…two weeks ago I had prepared an e-learning lesson but due to load shedding I could not conduct my lesson as planned, had to create something else, but again I couldn't even make copies it was impossible, hence I literally had to change your lesson"*.

The analysed data showed that 16% of the respondents were of the view that theft and vandalism were contributing factors and constraints to the implementation of the paperless classroom. Views from the interview process with one of the deputies show:

The problem of theft, is a serious one. Because in the event where a teacher is absent and we cannot find a substitute for, then the very learners find an opportunity to vandalize and steal the hardware that were installed in the Smartboards. When they use their USB the device gets infected with a virus and refuses to function.

Another participant expressed: *"In this school, the biggest challenge is theft. Most of the times the Smartboards are not working because the hard drives have been stolen or the device has been vandalized"*. Corroborating this claim, a teacher added: *"The learners are very careless at times with the Smartboards and they end up breaking or stealing the hardware such as hard drives, power cables and HDMI"*. A principal in the study recognised:

…the constant burglaries that we have in our communities where electronic equipment is stolen, like nobody's business. And we report to this matters to the police, they come and take fingerprints and all those types of things. You must just know that, if you will report the case, your school like others just becomes a numbered added onto the statistics and no criminals are brought to justice.

A deputy in the interview remarked on the additional security measures that had to be implemented to ensure ICT equipment is kept safe:

…in order to curb the problem of theft and burglaries we had to outsource people who would build steal cages for the Smartboards, so when the teachers need to use it they need to unlock the cage to access the Smartboard and lock it after use.

The data corroborates with assertions made by Makwela and Mthintso (Makwela, 2019), (Mthintso, 2018) that electrical power outages have a negative impact on the teaching and learning environment as paperless classrooms require reliable electricity for the use of ICT resources and a strong internet connection. Such challenges provide room for schools to revert to traditional methods of instruction.

Sub-theme 2: Limited in-service training

The essence of professional development varies as it relies on the way and speed with which teachers learn. As a result, the structures of in-service programmes necessitate different foci which refer to the content of the programme (De Clercq and Shalem, 2014). Moreover, Mthintso (Mthintso, 2018) attests that ICT training should not be on teaching about technology but rather teaching with the use of technology. From the data, it is evident that 32% of the respondents were of the notion that the in-service training provided by the Department of Education which was executed through the Matthew Goniwe School of Leadership and Management was insufficient.

Participants verified this claim:

…when the new ICT program started we received in-service training, which was conducted by the department. The training was an introduction to the use of Smartboards, the use of laptops and how to interact with learners with the use tablets, for a short period.... The trainings mostly took place after work…. To put it blatantly those training was not properly planned, and were not capacitating, they were inadequate to say the least. I and others are still struggling even today….

Similarly, another teacher noted the limitation of the training and asserted:

…my sense was that we all were being oriented, because this was new. What we learnt from those orientation sessions was to know how to switch the device on and off, how to go to that Smart Note application where I can write…for instance, we've been using this device for a while, but we have never been taught on how to connect it to the internet.

Furthermore, a participant expressed dissatisfaction pertaining to the time awarded for training and remarked:

…Having it once a week was a problem. As much as I had a background of technology there were new features that I didn't know. And they required me to constantly practice …because you would go to class without the confident of using them.

To further support this claim, another teacher was of a similar view and stated: *"…I think it was three months…It always took place on a Tuesday and a Thursday after school. It was for about 2 hours from 14h30 till 16h30"*. A respondent from the survey confirmed, *"It was inadequate, because not enough time was allocated for the training."* Other participants in the interview process were of a similar view as it relates to the hurried nature of the training and perceived the trainings as an information overload for individuals who were not techno-savvy and opined:

…for those who have been teaching for years without a background of technology I could tell it was an information overload. I think the biggest challenge was the inability to apply or practice what was demonstrated during the workshop, so what would happen the following week, we needed to recap intensely before moving forward so I felt there was no continuity because of the huge time lapse between training days.

Furthermore, another participant highlighted that: *"…the training was mostly diffracted towards lesson preparation and not specific to any subject"*. Correspondingly, one of the interviewees further emphasised: *"the training in my view was based on how to create and deliver a lesson, how to save a lesson and how to access content like e-books.*

But there was nothing about how to go on YouTube, how to Google this, or how to download, nothing like that…". Corroborating this claim, others reported:

> *The training was more on the technical side rather than pedagogical not related to my subject. It included how to use Microsoft applications, moving the curser and creating speech, bubbles, and all of that…. And what I did notice with the training is we weren't taught how to integrate the content that we have into an ICT lesson. So the training was focused on navigating through the applications and how to write on the actual smart board.*

> *They took place after working hours and this was very inconvenient for teachers has they had afternoon classes or had to collect their children from school etc. The one-on-one trainings were based on the needs of the educator and didn't have any milestones or curriculum to align them which ended up making them unstructured. I think the most significant challenge to the ICT trainings was that it was not a training which awarded any certificate of completion and like any employee in any field, incentive are the greatest motivators for full commitment.*

Moreover, another teacher insisted on the lack of professional regard the facilitators exhibited. She added: *…they would arrive unannounced and not book available times with teachers for oneon-one trainings… As a grade 12 teacher life at work is very stressful and chaotic*. Participants established their views on the outcomes of the trainings received. A deputy principal highlighted:

> *The most prominent cause of the lack of use of the devices is the fact that we were not properly trained and therefore lack the confidence to use the smart gadgets. The younger educators are obviously more computer-literate than us the older generation. It's an out of this world conversation when you hear them talking about HDMI cables and how it functions….*

In addition, a teacher stated *"another thing is that these kids are actually becoming a little more advanced than us teachers…some of the functions of the Smartboard they themselves will provide assistances to the teacher"*. An interviewee also attested: *"…teachers that attended the training until they were abruptly ended and she still is intimidated and lacks confidence…, which perhaps talks to the intensity and relevance of the training for different people at different levels of exposure to technology"*.

Furthermore, a teacher who is an ICT coordinator expressed their frustrations and testified:

> *It's so disappointing that such a great initiative such as this was not given the space and time to grow. The trainings… left some teacher with incomplete or insufficient training…teachers ended up depending on me to assist as an ICT coordinator as they were struggling to use the devices in the class. And the challenge was that I also am a teacher in the school so having to divide myself into two has been extremely difficult. The trend I see, whatever government put in place, they themselves fail to see it through and never not stick to the plan.*

The view of a school leader regarding the training that was conducted mainly for principals as the leaders in the paperless schools was expressed as follows:

> *a brush wash (quick) very shallow and informal training which was conducted by Mathew Goniwe…this workshop was not a formal training where you get a certificate or you are given something to prove that you went through that training. It was mostly…hand over some documents for reference purposes. In my view it was more of an information sharing*

session than a real workshop that could actually produce a qualified ICT individual… We were expected to spearhead the implementation and monitoring of the programme and as managers we manage any problem that may arises and solve those problems. But with the minimal training…was insufficient in making one as a leader to understand the fundamentals of the ICT programme.

The principal further emphasised the inadequacies of the teacher focused training and maintained:

Educators…were not equipped enough to understand the technical challenges of these devices. And therefore, when these board gets frozen, the educator will be rushing to the principal's office, asking for assistances and the problem could not be resolved in-house, besides informing the supplier and the supplier takes a long time to address this matter.

The assertions of the research participants support the view of Muslem (Muslem et al., 2018), who state that the lack of teacher confidence in the use ICT devices within the teaching and learning situation could be associated with insufficient training which is a major impediment to the implementation of ICT. Furthermore, Singhavi and Basargekar (Singhavi and Basargekar, 2019) and Khan et al. opine that deficient training facilities for the teachers as well as the lack of specialised subject-specific training programmes are among the major causes of limited use of ICT at schools (Khan et al., 2012).

Sub-theme 3: Insufficient resources

A. Unavailability of learner devices

The analysed data showed that 26% of the respondents in the qualitative survey construed that the lack of tablet devices for the learners posed a challenge and apparent constraint in the furtherance of the introduction and implementation of the paperless education system in Ekurhuleni schools. Congruently, one of the teachers in the interview stated: *"In my school the only electronic thing that you find in a smart classroom is the Smartboard…learners do not have no electronic gadgets at all, unless they have their personal smartphones"*. To corroborate this claim, another participant claimed:

"…As a result they are still using their notebooks, they are still using textbooks, which I believe shouldn't be if we are honestly, in a paperless class. So in nutshell our paperless classrooms may be lacking the necessary resources".

Another teacher reflected on the issuing and subsequent retrieval of the learner devices at the initial stages of the paperless classroom project:

…in 2015, learners were given tablets… but there was an issue with shortages. A substantial number of learners were not given tablets and they were expected to finish the year without tablets…. there was a huge uproar from the learners and their parents because it seemed as if they were treated differently than the first group…the remaining tablets was taking time and learners refusing to go to class therefore the district, school management team (SMT) together with the school governing body decided to retrieve all tablets until there they were enough for all learners…that was the last time we ever had tablets for our learners till today.

Furthermore, an HOD reported on the retrieval rate of the devices:

…we retrieved 80%, the rest of the tablets parents and learners claimed they were broken or stolen or that learners were mugged while walking home from school. The…

> *retrieval procedure required evidence from the learner such as a police issue affidavit and case number proof that the gadget was truly stolen…this didn't deter our learners and parents from reporting theft cases as a result the district collected 80% of the gadgets that were initially delivered to the school.*

A teacher verified the above-mentioned claim of the failure to retrieve all issued devices and remarked:

> *The department informed and assured us that they were fully secure and installed with tracing devices and therefore in the event they get stolen, they would be able to trace and find out their whereabouts We were later informed that it was proving almost impossible to track the stolen devices. The reports we received from learners was not that they were careless with the devices but rather they were mugged with guns and knives for the tablets, they handed them over because their lives were in danger.*

One of the interviewees mounted a strong argument as it relates to the sensitivity of these smart devices and their recommended life span by elaborating: *"…a tablet is just like smartphones which is unlike a textbook that can be passed over from learner to learner for years, these are devices, that are very sensitive and have a shorter lifespan…"*. A deputy principal explained that the biggest obstacle faced by the paperless initiative was the availability of financial resources and sustainability. She expressed:

> *…the biggest problem that faced the paperless initiative especially the learner tablets were related to resources. The school have thousands of learners and as opposed to the Smartboard once it is installed it is mounted and damages maybe be minimal unlike learner devices where every learner has to have their own personal device and the possibilities of damages and loss are more.*

Moreover, a principal asserted on the abrupt retrieval of the learner devices and depicted the looming challenge of reverting back to the previous methods of teaching by reporting:

> *…returning the tablets to the service provider through the department of education rendered too many of our learners in the grade…left without these gadgets and this posed a challenge for teachers and learners to continue with the ICT initiative…they had no option but to revert back to that textbook method.*

An interviewee articulated on the negative effect the unsuccessful retrieval of gadgets from the learners has had on the functions of the paperless classroom. He asserted: *"subsequent groups …were taught with Smartboards and textbooks. Meaning traditional methods and modern methods had to coexist in one class"*. Another teacher further emphasised:

> *"basically the paperless classroom is mostly beneficial to the teacher and the learners will only benefit through the use of the Smartboard". "…now we are in lockdown and are our schools are opening and closing due to Covid-19 it would have been ideal to be able to interact with the learners…". Basically "…the electronic part of the paperless classroom ends at school. Once they get home learner cannot access anything electronic if they don't have maybe their personal smartphone".*

B. Exposing Learner Socio-economic Backgrounds

26% of the respondents in the qualitative survey were vocal about the new challenge that ICT enhanced classroom environments have brought to light as it relates to

the exposure of learners' socio-economic backgrounds. A quote from one of the respondents in the survey concurred with data: *"ICT exposes the less privileged"* (Respondent 5). An excerpt from the interview with one of the HODs revealed the current state of the paperless classroom after the retrieval of learner devices by stating: *"Now we have resorted to using learners' smartphones to share information but this method just exposes the learners whose parents cannot afford to buy those phones"*. One of the interviewees elaborated:

> *And in the case of textbooks learner who come from extremely disadvantaged backgrounds we place a high priority in ensuring that they get first preference in getting a physical textbook unlike those with smartphones. It's a tough decision to make as a teacher. …so at our schools it is the ones who have smartphones are now used as a solution to alleviate the problem of shortages of textbooks.*

Another teacher provided an elaborate depiction of the socio-economic challenges learners revealed during the national lockdown as a result of rising Covid-19 infections in the country:

> *For example, during the national lockdown… WhatsApp groups were created… only 60% of the learners are part of the group as they have smartphones therefore almost 40%, they cannot access it because they don't have the means. If the learners have the smartphone the other challenge would be data to access the internet. So even though we are depending on technology but it exposes critical social economy issue within our communities.*

A different participant in the interview process shared the hurdles the paperless classroom exerted on the teachers and the learners and further emphasised the abovementioned statement:

> *We created a WhatsApp group intending to continue with school work but the unfortunate part was that our learners come from really poor families and have no access to smartphones, so we couldn't continue with those groups because it was unfair and seemed that we favoured learners who come from better families that the poorer learners.*

Furthermore, another teacher advanced this claim by stating:

> *…The reality is, even if the learners have a smartphone the likelihood is data maybe a challenge for them. And these were the challenges we encountered even during the National Lockdown…, it was basically impossible to access our learners... due to these blunt contextual factors.*

C. Limited access to internet connection

Evidence from the data shows 21% of the respondents in the survey viewed the restricted access to the internet in the school environment as an obstruction to the functionality of a paperless classroom. An extract taken from one of the respondents describes the tremendous role that the internet plays in the process of teaching and learning: *"Internet connection is the heart of ICT but is inaccessible to many who need it"* (Respondent 5). Furthermore, from the interview process a participant agreed that: *"another challenge related to the paperless policy was the issue of internet access in the school. Which I feel is a very basic element of the paperless class"*. Another respondent stated:

The internet that exists is only by the offices of the principal and the staffroom but not to the entire school. …the leadership and management of the school… look at anything ICT related like access to internet… as something foreign or a luxury that we cannot all have as it costs a lot of money. When we desperately need internet to download we need to beg for the password and convince him on valid reasons why you need access. Which I feel is short-sightedness.

A deputy principal further emphasised:

…Wi-Fi is available it is limited to the admin block… only available for staff members and learners do not have access, it requires a password. The limitation of internet does affect our functioning as teachers and learner because in class we cannot search for content that would enhance our teaching and learning experience.

Another participant highlighted on the fact that the ICT empowered classroom suffers due to the inaccessibility of the internet and she postulated: *"…none of the class have internet. Which is a problem because sometimes in the classroom there is need for me to demonstrate something to my learners and I end up using my own mobile hotspot… to access the internet which"*.

Similarly, one of the teacher echoed on the inconvenience of accessing the internet in the school:

The Wi-Fi does not reach the classes meaning as soon as you move away from the admin block you lose the internet connection. This issue is very disheartening because when we prepare our ICT lessons we want to download video clips or add a link so not having internet does affect my class and limits the things I can do in class. In the case where I need to prepare a lesson or want to play something for my learners I generally just use my own data because I can't always be going to the designated areas for Wi-Fi it's very far and inconvenient.

Moreover, another deputy principal confirmed the claim:

…educators have to leave their classrooms and come down to the office to research. More than anything it is all about budget constraints, it is upon the school to extend the Wi-Fi connection to all areas of the school. And the fear is when this internet is extended the learners will further abusive the use of the internet...

To conclude, another teacher felt that internet connection is a crucial necessity in the paperless classroom and also offered: *"Wi-Fi is something that is very important to me as a teacher who willingly uses ICT in my class"*.

The data reflects the views of Nirmala (Nirmala et al., 2013) and Omotayo (Omotayo, 2011) who state that inadequate financial resource allocation to install technological infrastructure and internet connectivity impedes the effective implementation of any educational change.

D. Teacher use of personal resources

Based on the data, one participant revealed the challenges encountered on a personal level when one had to use one's own personal internet connection:

…lack of internet connectivity in our classes affects us as teachers on a personal level, even though I do acknowledge that downloading videos of plays for the learners does make my teaching a bit easier. But, the use of my internet is a cost that I'm incurring that the

school doesn't recognize…. unfortunately, if I want my lesson to run smoothly… then I have to incur the expense.

One of the teachers expressed in despair the need to address the needs of the learners during the teaching and learning process: *"…because we do not what to disappoint our learners, we end up using our own data to search for content"*. Additionally, another participant maintained that the use of their personal resources to keep the project functional is financially strenuous: *"Most of the time I use my personal router if I needed something online… which is very costly on my end, but I do it for my learners"*.

E. School financial resources

In terms of school financial resources 16% of the responses highlighted that this was one of the factors causing insufficient resources provision required for the process of teaching and learning.

Expanding on the preceding data, a respondent in the survey offered: *"Technology in schools poses a challenge of increased expenditure on electricity especially in our school which is a nofee school"* (Respondent 15). Moreover, excerpts from the interview process exhibited a similar view:

> *We noticed that the electricity bill has increase significantly due to the fact that the Smartboards cannot be switched off throughout the day and night, for security reasons, so that the tracking device will be able to signal once the devices have been stolen. …the electricity bill affects the school financial allocation, because as a section 21 school we receive a budget from the government to meet the needs of the school… since the installation of these device our budget does not cover our electricity expense.*

Furthermore, one participant commented on the limited financial resources schools have at their disposal as it relates to internet coverage: *"the department gave us access to internet and then it is the school responsibility to expand that internet to the entire school. …So, it's a challenge*.

> *Especially in lower quintile schools which are no fee schools"*.

A principal in the interview process attested to the above assertion in terms of the re-introduction of conventional learning materials in the paperless classroom:

> *…re-introduction of the use of textbooks re-surfaced another challenge of shortages of textbooks… when the tablets were introduced to institution the assumption was that the budget would not be used to procure textbooks for that grade but rather… reallocated the funds for other grades that were not part of the paperless classroom project. Now we are forced by circumstances in the middle of the year to ensure that we make provisions to buy textbooks for learners who had lost or damaged their tablets.*

The data corroborates the views of Nirmala et al. who construe that factors influencing against the effective implementation of ICT are scarcity of electricity, inferior technological infrastructure, the expensive internet connectivity, deficient software licences updates and poor maintenance (Nirmala et al., 2013). Similarly, Singhavi and Basargekar (Singhavi and Basargekar, 2019) postulate that high-speed WIFI connection is essential for the integration of ICT into the teaching and learning environments.

F. Lack of quality ICT equipment

The effective integration of ICT requires the availability of quality ICT hardware, infrastructure and other technological accessories (Mthintso, 2018). The challenges and constraints in the introduction and implementation of the paperless classroom initiative and the lack of quality ICT equipment have been highlighted as e factors affecting the implementation of this project; 11% of the respondents of the survey support this claim. In light of the data, one of the respondents arrived at this conclusion: *"It is hard to implement the paperless classroom initiative if all you're provided with is not of good quality. Devices that die in a first week of arrival"* (Respondent 16). During the interview process, a participant expressed frustration on the quality of ICT equipment that was delivered to schools. She articulated:

> *…the unreliable lifespan of the laptop delivered to schools! The laptops were delivered to our schools and later… distributed to teachers, brand new from the box. We as teachers had to sign documents proving that we were the recipients of these laptop and to our disappointment some of the laptops didn't not even switch on, we were told to charge them but days later they still had never switch on. Other educators complained about the battery life of the laptops, they said for the laptop to function they had to be constantly be plugged in to the power sources which was shocking.*

Similarly, another participant commented on the nature and condition of the devices teachers were expected to use in ICT classrooms:

> *…the truth is most teachers still do not have laptops. My personal experience as an ICT coordinator in the school is that the laptops were of a very low quality they did not last at all and were not in a good state. Some arrived but when we were issuing them to teacher you would find that the laptop didn't not switch on or the battery life was non-existents, meaning for one to use this so-called new laptop it would have to be constantly plugged into the power source to work.*

In addition, another teacher commented comparing the quality of devices learners had received prior to the comprehensive retrieval process against the laptop devices teacher were provided with and states: *"…at times the device would not be broken by the learners, but they would suddenly malfunction just like the laptops teachers had, within a space of three months after receiving them…"*. Furthermore, an extract from an interview with another teacher revealed: *"…the department also provided Wi-Fi routers so a teacher can carry it to class but unfortunately their routers struggle to catch connectivity in my view I think they were provided with a used up life span already, so they did not function from the onset"*.

Moreover, a participant added another view on quality ICT equipment and explained:

> *…the office has a photocopying machine which are also part of ICT and we mostly use them to make copies for learners. But the challenge with them is that at times they are not working then we are sometime faced with a challenge of the machines not working, learners not having smart devices… we face a lot of challenge in township school but we do our best to overcome.*

Sub-theme 4: Partial Implementation and contradiction of policy

The analysed data showed that 26% of respondents were of the view that challenges and constraints in the implementation of the paperless classroom initiative were based on contradictions to the policy and partial implementation processes. From the interviews a participant postulated: *"In my view I feel there (is) a great contradiction in what the department has called the paperless class and what I as a teacher am experiencing at first hand in my school"*. Correspondingly, a deputy principal speculated on the level of implementation: *"…we are partially in alignment with policy…, I think what is causing the contradiction is when the department fails to deliver the ICT devices as prescribed by the policy"*. Similarly, an excerpt from the interview with another participant who is a principal raised an additional issue:

> *The documents providing the information about the project truly promised us 'heaven and earth' that those devices would not be touched by any force or element that is…anti-progress, but unfortunately, most of the tablets which were given to learners did not last long. At the end of 2016*

> *…we were instructed to be retrieve all the tablets….*

Concurring with the previous claim, another teacher stated: *"…after those first ones were taken by the government no other group received tablets"*. In a desperate attempt to salvage the partially implement the paperless classroom project a teacher advocated: *"…since we have Smartboards in our classes and prepare our electronic lessons we requested that learners who have phones in Grade 12 should bring them to make sharing easier since they don't have government issued tablets"*. Furthermore, one of the teachers expanded on the notion of partial and contradictory policy implementation by stating that:

> *The difficulties right now in my school is having to switch between the grade 12 classes where I prepare e-lessons and going to the lower grades where I revert to using the chalk board, issuing out notes… to conduct my lesson. If the school was completely converted into a paperless school, I think …it would force everyone to be on board with the programme….*

Participants noted that:

> *The programme seemed to be still struggling to find its feet because we do have the Smartboards but do not have the necessary gadgets and access to the internet as we should. So at this point the little ICT improvement become useless and ineffective. So personally I feel it's pointless just to have those Smartboards, because anyway, in the case of theft or lack of electricity we still need the Whiteboard which is just a sophisticated version of a chalkboard. So you see now instead of moving forward we are moving backwards.*

> *I don't feel at this point the initial implementation has been successful. In my view I think once again the department has abandoned it. Because all the gadgets I and you are speaking about in most of the institution… are not functioning.*

In support of this view Kganyago notes that an ambiguous policy and unclear implementation guidelines obstruct the application of ICT in school settings (Kganyago, 2018). Furthermore, the integration of ICT in teaching and learning commences with how well the policy is formulated, understood and absorbed by all major stakeholders. Makwela

(Makwela, 2019) asserts that non-adherence to the integration procedures and principles could culminate in unsuccessful ICT integration.

Sub-theme 5: Resistance to change

Data showed that 21% of the respondents in the qualitative survey expressed that one of the challenges that is perceived to be an impediment to the full implementation of the paperless classroom initiative relates to resistance to change. One of the participants in the interview process highlighted their personal reluctance to embrace the paperless classroom as a systemic change process to conventional teaching and declared: *"…senior educators such as myself… are reluctant to use Smartboards and are teaching grades that have the devices installed. The most prominent cause of the lack of use of the devices… is lack the confidence to use the smart gadgets…"*. Similarly, a teacher remarked: *"…the older generation do not see the importance of ICT or are de-motivated… people are afraid of change and therefore perceive ICT as a threat to their way of life or comfort zones"*. Furthermore, another participant attested that the refusal to adapt to technological education reform is a prevailing issue in school organisations by stating:

> *…a lot of teachers that don't use ICT… In my opinion, it is actually the fear of the unknown, the truth is people don't want to learn new stuff. They're okay with what they know, the method of teaching they know is comfortable for them. And, I think some are honestly intimidated by using technology. Like I said, I don't think there's any teacher that would want to look like a fool in front of their learners because of technology. They'd rather stick to what they know and converting those people would be very difficult....*

Moreover, one of the interviewees further emphasised the above-mentioned claim: *"…there are people who don't actually use ICT gadgets. They feel like they don't need the gadgets because Whiteboard are installed. So it's easier for them to revert back to the traditional way of doing things. Basically the Whiteboard is a better version of the traditional chalkboard"*. One of the teachers put forward an assertion regarding the resistance to change due to the introduction of the whiteboard in paperless classrooms by stating:

> *As it stands we have LED Whiteboards in class that were installed to assist teachers who lacked the confidence to work with the smart devices. But the installation of these Whiteboards led most teachers to ignore the use of the Smartboards and never improve their skills in ICT, which I feel is very problematic. Because in all honesty this Whiteboard is the same thing as the chalkboard, it plays the very same role.*

The data in this research study verifies the claim that teachers limit the use of technology within classrooms (Chambers, 2019). The extent that technology is utilised within an ICT classroom hinges on the teachers' mind-set on the role of technology in the classroom and is justified by what they feel technology can do in the teaching-learning process (Taiwo, 2009). Furthermore, Kganyago shows that there are teachers who are terrified to use technology for the purposes of teaching and insist that they are too old to understand new technology software (Kganyago, 2018). Lim (Lim et al., 2018) established that the unenthusiastic attitude the teacher demonstrates, such as the reluctance to learn and the unwillingness to participate hinders knowledge sharing from taking place. Changing individuals' negative attitudes is essential for increasing ICT skills. Therefore, for

ICT to be successfully implemented in education, it is necessary for teachers to have high levels of self-efficacy and to possess positive attitudes to the use of technology (Khan et al., 2012), (Singhavi and Basargekar, 2019).

Sub-theme 6: The inability to lead learning

The data adapted from the interview process reveals that the partial implementation of the paperless policy negatively impacted the ability of leaders to lead learning. One of the participants who is a school leader mounted a powerful argument that in the implementation process leaders were side-lined and seemed as an afterthought:

> *"We found ourselves as leaders of institutions watching from a distance. Even though we perhaps had our own rudimentary knowledge of the basic functions of the Smartboard we were never taken through any training but we were urged to support, monitor, manage and ensure that the security of these smart devices".*

Furthermore, a deputy principal expressed in dismay the frustration of leading organisational change without being adequately equipped and stated: *"honestly as a leader and senior teacher in the school it's difficult to lead people in something that is foreign to me too".* Another participant added: *"…in terms of what is going on inside the paperless class such as eBooks, e-materials as well as other material that are utilised by the teacher, we as school leaders become learners watching….* To further emphasise this claim of leaders being incapacitated to lead leading in paperless environments, a participant stated:

> *So to a certain extent, principals are faced with the responsibility and must take the initiative in ensuring that those gadgets are well looked after they are monitored all the time, they are supervised and access is controlled. The reality is, the department is putting us there, but are not realizing that we no longer have a vested interest, because we lack the knowledge of how those things are actually being utilized….*

Another participant attested:

> *The state of the project in my view is that it is losing its meaning and intended purpose because most of the teachers resorted back to the textbook method. This was as a result, the chalkboards that were replaced by the Smartboards happened to be returned back to the classes and placed in a particular corner because the Smartboards were not working, and the teacher must teach. So, chalk and talk. Still becomes the order of the day….*

The depictions of teachers and school leaders in the data concur with Morrison and Kedian (Morrison and Kedian, 2017) who state that leading learning depends first and foremost upon confident and conversant school leaders being able to expressively articulate a compelling vision, well-versed in the research of ICT integration and change processes, and prepared to invest in human capital. Leading learning could be described as a processing of school leaders seeking surety that will enhance the nature and quality of a student learning a new concept in a manner that mitigates against the old way of teaching and learning (Morrison and Kedian, 2017). Leading learning at any level in a school involves the act of influencing and working with others in a highly collaborative, collegial and supportive environment that encourages risk and innovation and which places learning at the centre of all activities (Fitzgerald and Gunter, 2006).

Sub-theme 7: Lack of Consultation and Involvement

Regarding the lack of consultation as it relates to the challenges and limitations in the induction and implementation of the paperless classroom initiative, the response of one of the teachers in the interview indicates: *"…when these gadgets were introduced, I think a lot of teachers were saying this was done prematurely without consultation at a very sensitive grade and as a result learners were distracted by this new technology in the classroom setting"*. Additionally, one of the participant verified this view from the point of view of a school leader:

> *Most… principals who are leaders of the institution we're not consulted in terms of our own input and…how we're going to actively participate. We were only informed to come and fetch the devices …you can imagine… fetching things we ourselves have never seen before. Furthermore …the drafting of the policy, I cannot emphasize on what are the content of that particular policy. How was it drafted? How it passed and what were the steps to be followed in order to make sure that it has been fully implemented? I can't tell you because I was never taken through that particular policy.*

One of the participants further emphasised the detrimental impact and results of the failure to consult major key role players in the implementation of the paperless classroom and insisted: *"…it was introduced at an exits grade. In my view, you can't introduce a child to a tablet in the final year of their school career, when they're about to leave the system"*.

Sub-theme 8: Abuse of ICT resources and the lack of classroom monitoring

Concerning the abuse and misuse of ICT resources, 16% of the respondents who took part in the survey highlighted the aforementioned as challenges in the implementation of the ICT initiative in schools. The responses from the interviews showed that participants were of the same view, as an HOD posited: *"Learners… misuse and abuse the Smartboards by playing music, movies and loading games of the devices which… damages them and causes them…. They are not password protected…as a result the Smartboard… have viruses"*.

Another participant indicated that *"Learners do not view the Smartboards as learning tool but rather toys to play with and use them for entertainment"*. Furthermore, another teacher opined on the misuse of the learner devices that were previously issue to learners and stated: *"The problem was that learners saw the tablet or e-reader as a toy, instead of something that aids they're learning, and therefore these devices had a negative impact instead of a positive one"*.

To further corroborate this claim a teacher stated:

> *At our school, it is the teachers that rotate and therefore there is no home rooming. …during these rotation learners are left unattended and have sufficient time to fidget …the problems we have with Smartboards are increased by learner's misuses….*

Moreover, an excerpt from a principal in the interview process illuminated on another way in which learners abuse resources and reported: *"internet connection in the school is tantamount to be abused by those who need it the most. Uses such as social media, pornographic material, movies, games and music…l"*. The participants were of a

similar view with Azike (Azike, 2013) who warns that an educational reform lacking studious supervision will fail, while Omotayo (Omotayo, 2011: p. 8) articulates that ineffective monitoring and evaluation of the education initiatives open opportunities for the obstruction of effective implementation of the objectives.

Sub-theme 9: Lack of adoption

The lack of adoption of the project was viewed as a challenge that detrimentally impacts the introduction and implementation of the paperless classroom. Deductions from the interview with two of the teachers highlighted:

> *From the point of view of the school administration and management, there is clearly no adoption of ICT, because if they had fully embraced it I believe we would be having many teachers on-board and confidently using it… The leadership of the school is not actually quite clear of power of ICT. Maybe they are limited in knowledge about ICT but there seems to be no willingness to learn and embrace it.*

> *The learners themselves are disadvantaged by schools who do not view ICT as important. They will be go to universities and are going to be using ICT. I think it would be better if we expose them to ICT while they are in high school. So, we're not doing justice to our learners. The world is moved into technology and we must move too.*

A principal in the interviews concurred with the claim of lack of adoption and provided details:

> *…from the onset to when this project was piloted, we, mostly called it the MEC's project, because the majority role players were not consultant were not informed, it was a decision that was taken at a higher level… of the MEC in Gauteng. From a distance I could detect what main intention was to ensure that learners in under privileged areas are exposed to technology for teaching and learning before they reach institutions of higher learning. That is why the department instructed us after the installation and issuing of the devices that we must draft our own policies. … even though when you draft a policy without knowing how the devices actually working, the amount of input you can make is limited and due to lack of insight…*

To corroborate the lack of adoption and embrace of the paperless classroom another participant postulated:

> *"If the devices need to be fixed we inform the district because this project is "Not Our Baby". So no responsibility lies with the school. The attitude we receive from our leadership at times just makes us feel like they are the "Middle Man", the district gave us these Smartboards so that you teachers can work with them, therefore work with what you're given".*

Theme 2: Way forward

School leaders and teachers leading learning in paperless classrooms identified factors that need to be addressed in order to ensure the complete introduction and implementation of this ICT initiative in Ekurhuleni schools.

Sub-theme 1: Availability of ICT resources

Reponses from the qualitative survey depict 5% of the respondents viewed the improvement in the accessibility of the internet in paperless classrooms as the key factor in addressing the challenges opposing the smooth implementation of the project. An HOD articulated: *"…ensuring that the internet connection is spread through the whole school, requires sufficient finances to facilitate that Wi-Fi project"*. Equally, another participant concurred: *"…the extension of the internet to the entire school would ensure that the project succeeds and also makes our job much easier"*.

As it relates to quality ICT equipment, 11% of the respondents recommended the procurement of quality devices. One of the participants advocated: *"The purchasing of quality equipment, because the laptop I received which was a brand new laptop, has never worked, without be constantly plugged in to electricity"*. Additionally, a teacher further emphasised: *"it is extremely crucial in my view that quality equipment from reputable brands are procure, this will alleviate a lot of problem. The investment into quality equipment involves the leaders, such the ministers and the MEC to ensure the tender is granted to good companies"*.

16% of the respondents established that solutions to address the issue of power outages must be provided. A deputy in the interview process opined: *"The installation of generator will address the current pandemic of load shedding, they will assist when the electricity trips then the generator immediately kicks in just like it happens at shopping malls in this way there is no disruption of lessons"*.

Furthermore, a teacher expressed the need to acquire updated textbooks and learner devices to address the difficulty of electricity affecting paperless classrooms, and put forward:

> *…to overcome the issue of power outages is to ensure that the teacher has a backup such as a textbook that is relevant such as the one the teacher would have used on the Smartboard. If school would ensure the Learning and Teaching Support Material (LTSM) is procured for all learners and is updated, we could overcome and move on with our lessons. We would have something to fall back on in the case of load shedding. If the learners had the tablets, even if the was no electricity and the Smartboards shut down the learners would still be able to use their devices and the lesson will still be empowered by ICT….*

Another participant provided: *"…there's no other solution …such as generators or solar batteries in order to ensure that teaching and learning is not interrupted"*. The principal mounted a power argument, saying in order to address the current issue plaguing the paperless classrooms:

> *The only way to come to resolve them, let the schools take full responsibility, let the department handover the budget, the responsibility, and also the technical training of teachers to the schools…I don't think we will encounter problems of having to wait, for the service provider to come and repair or wait, somebody to come in and unlock the blocked devices or replace the stolen gadgets. You will automatically do what needs to be done on the spot. That is what we are actually doing, for instance I don't have wait for someone to deliver chalk when we run out of chalk, or I don't have to call the department when the*

school has no printing paper, I as a leader attend to the matter myself because I've got the budget for that….

Concurring with the views of the principal, another teacher summarised: "Because everything revolves around the finances. So just look at the procurement and maintenance of laptops for teachers, access to the internet, to address the issue of electricity like the buying of a generator and for learners to have tablets everything begins and ends with the availability of finances".

Sub-theme 2: Outsourcing to qualified ICT technicians

11% of the respondents highlighted the outsourcing to qualified ICT technicians. A deputy principal in the study raised a crucial solution to the challenges experienced on the availability of competent onsite technicians and asserted:

…it is very important to have a person solely designated to deal with ICT challenges… I think schools should be provided with a technologically advanced personnel or technicians whose work will be to assist the educators where they have problems… So if schools can be provided with a stationed technological assistance I think that can be progressive and functional.

This assertion is further corroborated:

I think they must hire an IT specialists or administrators who is going to be based at school. So that the maintenance of the Smartboards is done continuously and deal with these technical problems that we might be having.

Additionally, a teacher expanded on this suggestion:

The hiring of technicians must be purposeful, their presence must serve a purpose such as attending to technical issues and malfunctions of the Smartboards. Technicians should be able to repair the devices onsite and ensure that the necessary updates of software is done timeously. The proper upkeep of the ICT equipment ascertains the smooth running of the paperless classroom project in schools. The laptop that were issued to educator have never been updated and we teachers do not have the skills to update these devices, this should be done technicians.

In order to address the efficiency of maintenance another participant expressed the view:

I think the department must partner with a reputable company with an intensive graduate program so that when technicians are sent to sites they are more than equipped to deal with the job specifications. Furthermore, I think the maintenance of the Smartboard should be done onsite perhaps by the very technicians in that case the school will not waste and lose precious time waiting for assistance to come.

To conclude another teacher provided strategies to address the issue of irregular maintenance and asserted: *'A strategy to address the issue of maintenance is that just like it work for our cars where after 15 000 kilometres the car is due, so should maintenance be where after a certain amount of hours of usage which may translate to months maybe three then the devices are due foe software upgrades and maintenance".*

Conclusion

Paperless classrooms in the teaching and learning environments from the perspectives of teachers and school leaders of learning provides valuable insights. While many embrace the prospects of a digitally driven teaching and learning environment, there are a myriad of challenges and constraints related to successful implementation of a paperless classroom that need consideration. A sustainable approach requires trained teachers as leaders of learning who embrace technological advancement, who are willing to experiment with technologies and develop life-long learning both for themselves and their learners. Based on the findings, in addition to the theme on way forward, the following recommendations are made:

- More efforts should be made to enhance school infrastructure so as to limit the impact of environmental disruptions like power outages. Also, provision of sufficient resources and the availability of ICT devices for individual learners is recommended. These can be done through support from the government and partnership with relevant organisations.

- The employment of qualified, competent ICT assistants and onsite technological maintenance is advocated.

- Improving policy must be done through better consultation and involvement of all stakeholders including parents and the larger community.

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Translation of abstract and keywords into Bulgarian

Резюме: *Предизвикателствата и ограниченията на безхартиените класни стаи са изследвани в това проучване с помощта на опита на училищни ръководители и учители в квартал Ekurhuleni. Приет е качествен метод. Поради това данните са събрани чрез полуструктурирани интервюта от целенасочено подбрани участници. За анализ на събраните данни е използван тематичен метод. Резултатите от проучването показват, че практиката на безхартиени класни стаи, която има различни предимства, носи със себе си редица предизвикателства като липса на техническа поддръжка, проблеми, свързани със сигурността, бавно и непоследователно внедряване на ресурсите и липса на онлайн продължаващо развитие на учителите чрез официално непрекъснато професионално развитие и на работното място (Continuous Professional Development, CPD). Проучването препоръчва включването на цифрови ресурси като инструменти, които улесняват подобряването на преподаването и ученето, вместо да променят облика на традиционните класни стаи.*

Ключови думи: *квартал Ekurhuleni; водещо обучение; безхартиени класни стаи*

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