**Use of Manual and Electronic Records of Learners in Assessment**

Banji Milumbe

Examinations Council of Zambia

bmshakubanza@exams-council.org.zm

**Abstract**

The concept of 'big data' though has been with developed countries for sometime now is still a new phenomenon especially in developing countries like Zambia. As a country this is when we are beginning to develop National Data centre to store various data including data about learners. Probably this is what will help keep all the data for learners in one place and ensure that stakeholders access the data that best suits them. The question to ask is, 'Is big data segregative to a developing country like mine? A critical look at the definition of' big data' by various scholars tell us that it is not as some argue that it is not all about the volume like Kryder's law states the continuous evolving of the definition of big data. With this assurance, this paper investigated both the manual records and electronic records of learners in different forms to see how this data can add value in the assessment and education system in Zambia. It further investigated how the Zambia National Data Centre (ZNDC) will be of benefit in the storage and retrieval of this 'big data' by various stakeholders.

***Keywords****: Big Data, electronic records, manual records, assessment, data centre*

## Introduction

In Zambia, every year data about candidates sitting examinations is collected. Since 1997 when Examinations Council of Zambia (ECZ) started processing results in-house, there has been an increase in the number of candidates at primary school level alone from 168,304 in 1998 (Examinations Council of Zambia, 1998) to 443,000 in 2018, which means that even the data that is collected about the candidates has been increasing over the years. This calls for better and ingenuous ways of collecting and storing this data. Other than the data that ECZ collects as learners sit for national examination, the Ministry of General Education also collects data about the same learners as they learn complete tests in their respective schools which is not in any way linked to the data collected for national examination purposes. All this data is kept in separate databases some of which is in manual records which are not linked to each other but when combined together would be massive. Up until 2017 when online candidate registration started, the candidate registration data was mostly in manual records or separate databases which were not linked. Retrieving this data in its current state is a big challenge for Zambia.

In schools, learners are given assessments from the time the start school in pre -grade up to the time they sit the primary school leaving examination called the Grade 7 Composite Examination which is a national examination. At this point the examination administered by the assessment body, ECZ, does not take cognisance of the performance of the learner for the past seven years or so from pre-grade up to Grade 7. The concern by the examining body is only that one national examination that is administered after seven (7) years of primary schooling which is used to make a decision about a candidate's progression to the next level. What the learner had achieved in all these years' assessments and learning at school level is disregarded except for the one national examination. Similarly learners who sit the Junior Secondary school leaving examination are also assessed in the course of their two year study at junior secondary school and a national examination administered to them. At senior secondary school level, a similar arrangement exists and at the end of it all a national examination is administered without taking into account the performance during their course of study. There is no link between the assessments done by the candidate in the past seven years except for this one time examination that they take at the end of their primary schooling or junior secondary or senior secondary school.

The challenge that is faced as we consider the issue of big data is that most of these records are sitting in the learner's respective schools in manual form and hence linking their performance in school assessments with the national examination becomes a big challenge. One of the challenges of big data is variety, the many different and unstructured formats makes it difficult. To keep this data is a big challenge.

This paper investigated how the records of learner's performance in assessments that are assessed in their learning institutions can be integrated with the national examinations conducted at the end of each level that is at primary school, junior secondary school and senior secondary school. A review of the format or structure of these records was undertaken in order to appreciate the variety of formats. How the current big data analytic tools can be employed to make this data available to all stakeholders. The main reason for undertaking this investigation was to know how much data are kept in schools and how opportunities created by big data can be exploited to make these data useful to various stakeholders. Like Leonida Mutuku said 'It is difficult to solve problems you cannot quantify'. It was therefore important to quantify the information on learner's performance in assessments administered in schools.

## Literature Review

### What is big data?

Many scholars have defined big data by its characteristic using 3vs that is volume, variety and velocity. (Laney, 2001), (Khan, et al., 2014), (Jafar, Asma, Ramzan, & Muneeb, 2014) The National Academy for Education puts big data in the education context, to refer to the "numbers of student observations, the frequency of observations, and the number of types of observations, respectively." It continues to say that, "Educational big data typically take the form of administrative data and learning process data" as illustrated in figure 1. (National Academy for Education, 2017)

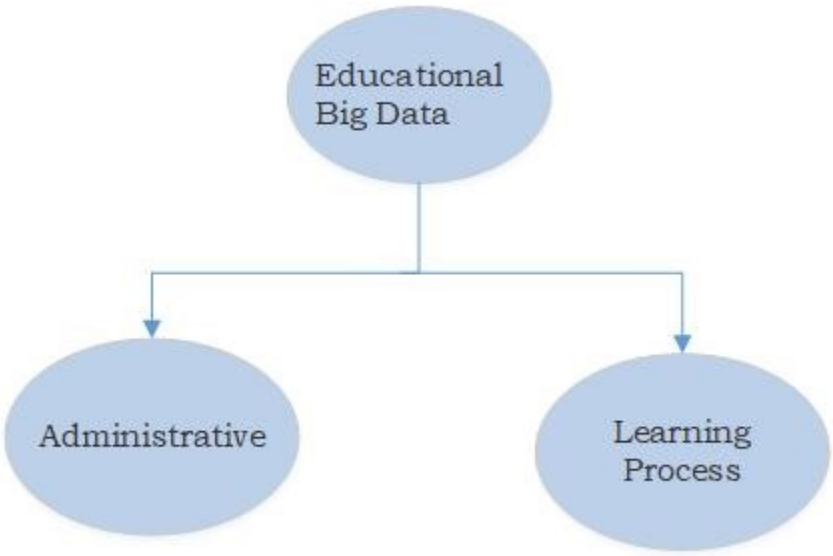



Figure 1: Educational context of Big Data (National Academy of Education, 2017)

According to Zan Mo and Yanfei Li 2015, Volume, velocity and variety all aim to realize the value of big data. Data collection, storage, analysis, is to prepare for digging out the value of data. Big data emphasizes complexity in data analysis, and it pays more attention to data processing efficiency and the data value. (Zan & Yanfei, 2015)

Kalota 2015, discussed different technologies that are utilised for big data and analytics and indicated that in terms of storage, the massive amount of data requires better methods of data storage as opposed to the traditional storage methods as the data must be stored in a distributed environment and must be mirrored as well. Doing this would be expensive and thus stresses the importance of cloud storage. Kalota 2015 further alluded that these data can be used to analyse the relationship among various variable to predict student success or dropout. Analytics can also be used to 'prevent dropouts by predicting factors that may lead to student dropout.' (Kalota, 2015)

Cope and Kalantis, 2016 concluded in their article" Big Data Comes to School: Implications for Learning, Assessment, Research" that 'in unfolding developments in the field of technology-mediated writing and writing assessment, big data and education data sciences may in time offer learners, teachers, and researchers new windows into the dynamics and outcomes of learning, finely grained in their detail, varied in their sources and forms, and massive in their scope.' (Cope & Kalantis, 2016)

In a report West, 2012 examined how big data make it possible to mine learning information for insights regarding student performance and learning approaches. It further indicates that

monitoring performance of learners by schools is made easier by use of the available statistical information compiled from various digital systems by developing dashboards. (West, 2012)

**Linking students data**

Linking learner's data from different perspectives would help in better decision making. The National Academy for Education 2017, indicates that the 'benefits of big data for educational research often arise when data sets are combined and merged'. Merging different data sets for learners would give a deeper understanding of how the learner's 'prior experiences interact with learning'.

The benefits of big data for educational research often arise when data sets are combined and merged. For example, learning process data, combined with administrative data such as demographics and test scores, can provide insights into how to address educational inequities in faster feedback cycles. (National Academy of Education, 2017) (Dede, 2016)

**Methodology**

Visits to the schools were undertaken to have a full understanding of how the learner's assessment records were generated and kept. Six schools were visited representing schools in these categories rural, urban, and semi-urban. A desk review of the learner's school assessment records was undertaken from the time a learner started attending school at that particular school.

Using the National Academy of Education, 2017, illustration we can also describe big data in the context of assessment to be in the form of school assessments and national examinations. The two types of data are not linked.

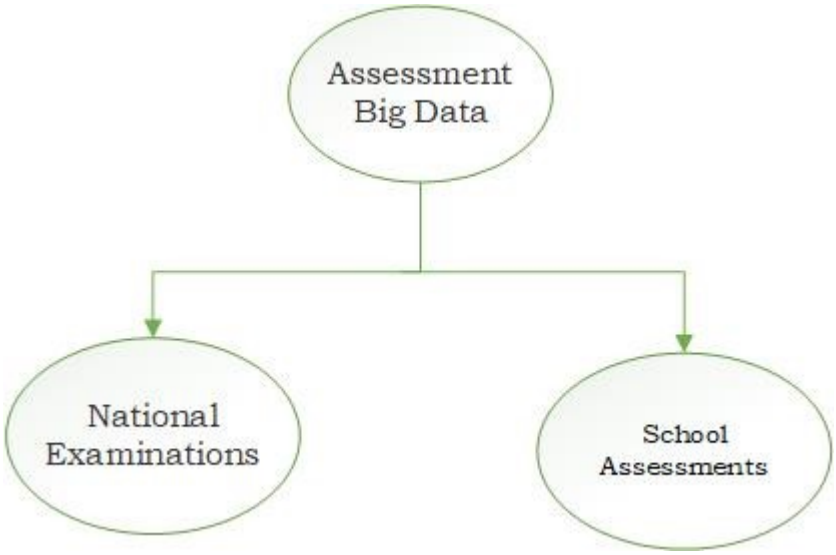



*Figure 2: Assessment Context of Big Data (Adapted from National Academy of Education, 2017)*

**Findings**

**Number of School Assessments**

A review of the number of assessments given to learners at different levels of their education was undertaken. This was to help understand the volume of the assessment data that was kept by the schools for each learner and also how it was kept and used in the course of their study. It was revealed that learners were given monthly and termly assessments/ tests as well as daily and weekly assignments. The study was concerned about the monthly and termly assessments as this was more standardised in all the schools that were visited.

In the Zambian education system, there are three terms in a year and three months in a school term. It was discovered that before the termly assessment was administered, monthly assessments were prepared and administered to the candidates. Having understood the number of assessments given in schools we came up with the following formula to help us calculate the assessments per subject that a learner at each level of their learning would have taken.

$$TA = \big(N(Ma + Ta)\big) * G$$

where

*TA = Total Assessments administered*

*N = number of school terms in a year*

$Ma$ = *Monthly assessments administered*

$Ta$ = *Termly Assessments*

**Primary School**

Using the above formula, for a candidate who has completed seven (7) years of primary school, they will have a total of *(N(Ma+Ta))*G* assessments in their primary school level.

$$TA = \big(N(Ma + Ta)\big) * G$$

$$= (3(3+1))*7$$

$$= 84 \text{ Assessments per subject}$$

This means that a learner would have taken 84 assessments per subject at the time they are sitting the national examination at the end of their primary school education. At this level learners take eight (8) subjects meaning that they would have taken 672 assessments against the 8 subjects at Grade 7 national examination. Meanwhile, a decision for learner progression from primary school to junior secondary school is based on the 8 assessments given against 672 assessments which are disregarded for decision making. Is this a fair way of determining a learner's progression?

**Junior Secondary School**

A candidate at Junior Secondary School level will have completed 9 years of their school life. Applying the same formula we have

$$TA = \big(N(Ma + Ta)\big) * G$$

$$= (3(3+1))*9$$

$$= 108 \text{ Assessments per subject}$$

This means that for a candidate to progress to senior secondary level they would have assessed 108 times from primary school to junior secondary school against 2 assessments at national level to make a decision for progression to Senior Secondary level. The total number of assessment records per subject that a candidate would have accumulated at this level is using an average of 8 subjects is 864 assessment records.

**Senior Secondary School**

Similarly, a candidate at Senior Secondary School level will have completed 12 years of their school life. Applying the same formula we have

$$TA = \big(N(Ma + Ta)\big) * G$$

$$= (3(3+1))*12$$

$$= 144 \text{ Assessments per subject}$$

This means that for a candidate to complete senior secondary school they would have been assessed 144 times from primary school to senior secondary school against 3 assessments at national level used to make a decision for progression to Tertiary education. The total number of assessment records per subject that a candidate would have accumulated up to senior secondary level is using an average of 8 subjects is 1,152 assessment records. All these records are stored in schools in various formats and is not in any way integrated to the national examinations in order to make a better decision about a learner.

The question that may be asked is, who is the best decision maker? Is it the one who uses a single assessment tool or the one who uses several assessments? The challenge that we have already alluded to is how to collect and collate these data so that they are also used to inform or feed into the national examinations.

**Format of the Records**

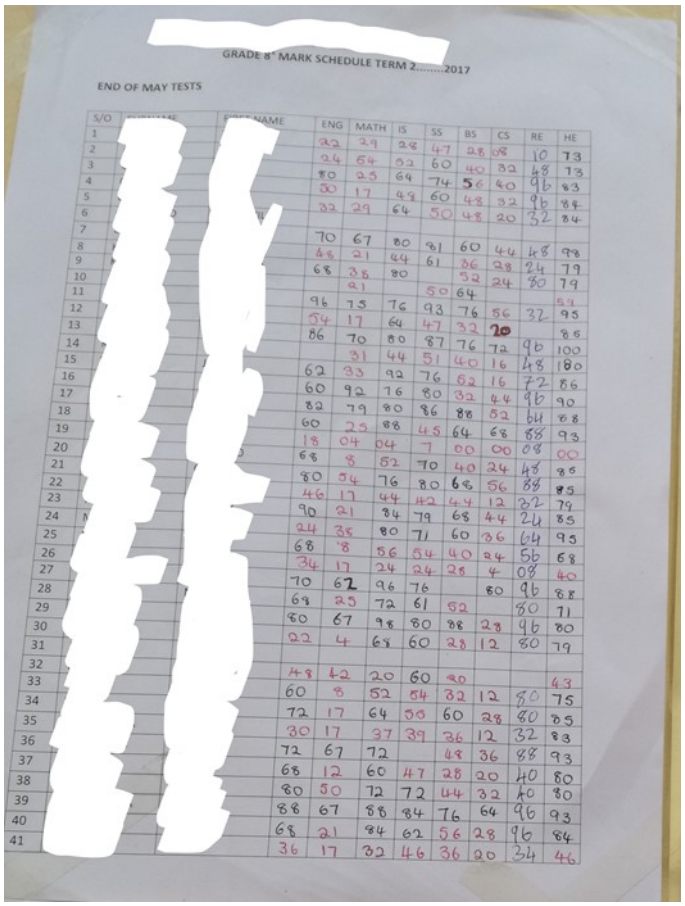
The review found out that for urban schools the records were in both manual and electronic record. The electronic records were kept in a standalone computer containing information of the learner and the assessments that were administered during the course of their study. Below are the samples of the records that were found. Names of learners and schools have been hidden for security reasons.

**Manual Records**

Manual records were kept in hard cover books where learner's assessment results were entered. Each grade or level had its own book such that it made it difficult to track a learner's performance as they moved from one grade to the next. It meant getting all the books and then start checking for each learner. For example if the learner was in grade 7 then all the seven books had to be checked to track their performance from grade 1 up to 7.

In most of the rural centres, there was one book for each group of learners where their record was kept from grade 1 up to grade 7, end of their primary school education. Centres that also

had secondary school level and maintained their learners continued with the same book which made it easier to track their performance.



GRADE 8 MARK SCHEDULE TERM 2.....2017

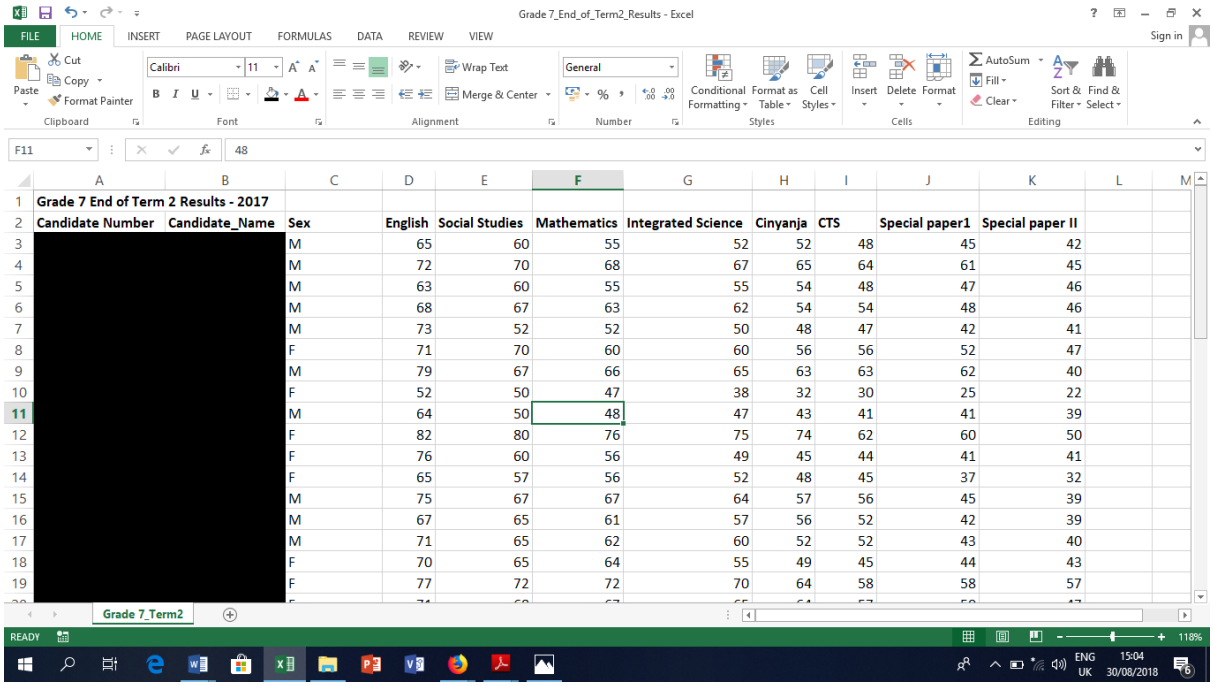
END OF MAY TESTS

| S/O | [redacted] | ENG | MATH | IS | SS | BS | CS | RE | HE |
|---|---|---|---|---|---|---|---|---|---|
| 1 | | 32 | 29 | 28 | 47 | 28 | 08 | 10 | 73 |
| 2 | | 24 | 64 | 32 | 60 | 40 | 32 | 48 | 73 |
| 3 | | 80 | 25 | 64 | 74 | 56 | 40 | 96 | 83 |
| 4 | | 30 | 17 | 48 | 60 | 48 | 32 | 96 | 84 |
| 5 | | 32 | 29 | 64 | 50 | 48 | 20 | 32 | 84 |
| 6 | | | | | | | | | |
| 7 | | 70 | 67 | 80 | 81 | 60 | 44 | 48 | 98 |
| 8 | | 48 | 21 | 44 | 61 | 36 | 28 | 24 | 79 |
| 9 | | 68 | 35 | 80 | | 52 | 24 | 80 | 79 |
| 10 | | | 21 | | 50 | 64 | | | 54 |
| 11 | | 96 | 75 | 76 | 93 | 76 | 56 | 32 | 95 |
| 12 | | 54 | 17 | 64 | 47 | 32 | 20 | | 85 |
| 13 | | 86 | 70 | 80 | 87 | 76 | 72 | 96 | 100 |
| 14 | | | 31 | 44 | 51 | 40 | 16 | 48 | 180 |
| 15 | | 62 | 33 | 92 | 76 | 52 | 16 | 72 | 86 |
| 16 | | 60 | 92 | 76 | 80 | 32 | 44 | 96 | 90 |
| 17 | | 82 | 79 | 80 | 86 | 88 | 52 | 64 | 88 |
| 18 | | 60 | 25 | 88 | 45 | 64 | 68 | 88 | 93 |
| 19 | | 18 | 04 | 04 | 7 | 00 | 00 | 08 | 00 |
| 20 | | 68 | 8 | 52 | 70 | 40 | 24 | 48 | 85 |
| 21 | | 80 | 54 | 76 | 80 | 68 | 56 | 88 | 85 |
| 22 | | 46 | 17 | 44 | 42 | 44 | 12 | 32 | 79 |
| 23 | | 90 | 21 | 84 | 79 | 68 | 44 | 24 | 85 |
| 24 | | 24 | 35 | 80 | 71 | 60 | 36 | 64 | 95 |
| 25 | | 68 | 8 | 56 | 54 | 40 | 24 | 56 | 68 |
| 26 | | 34 | 17 | 24 | 24 | 28 | 4 | 08 | 40 |
| 27 | | 70 | 67 | 96 | 76 | | 80 | 96 | 88 |
| 28 | | 68 | 25 | 72 | 61 | 52 | | 80 | 71 |
| 29 | | 80 | 67 | 98 | 80 | 88 | 28 | 96 | 80 |
| 30 | | 22 | 4 | 68 | 60 | 28 | 12 | 80 | 79 |
| 31 | | | | | | | | | |
| 32 | | 48 | 42 | 20 | 60 | 80 | | | 43 |
| 33 | | 60 | 8 | 52 | 54 | 32 | 12 | 80 | 75 |
| 34 | | 72 | 17 | 64 | 56 | 60 | 28 | 80 | 85 |
| 35 | | 30 | 17 | 37 | 39 | 36 | 12 | 32 | 83 |
| 36 | | 72 | 67 | 72 | | 48 | 36 | 88 | 93 |
| 37 | | 68 | 12 | 60 | 47 | 28 | 20 | 40 | 80 |
| 38 | | 80 | 50 | 72 | 72 | 44 | 32 | 40 | 80 |
| 39 | | 88 | 67 | 88 | 84 | 76 | 64 | 96 | 93 |
| 40 | | 68 | 21 | 84 | 62 | 56 | 28 | 96 | 84 |
| 41 | | 36 | 17 | 32 | 46 | 36 | 20 | 34 | 46 |

*Figure3: Sample of the Manual Records*

**Electronic Records**

The electronic records were either kept in Ms Word format or MS- Excel. One school kept the candidate assessment data in Ms Access relational database which made it easier for analysis and generation of various reports about a candidate's performance in the various assessments given.



Grade 7_End_of_Term2_Results - Excel

| Grade 7 End of Term 2 Results - 2017 | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Candidate Number | Candidate_Name | Sex | English | Social Studies | Mathematics | Integrated Science | Cinyanja | CTS | Special paper1 | Special paper II | |
| [redacted] | | M | 65 | 60 | 55 | 52 | 52 | 48 | 45 | 42 | |
| | | M | 72 | 70 | 68 | 67 | 65 | 64 | 61 | 45 | |
| | | M | 63 | 60 | 55 | 55 | 54 | 48 | 47 | 46 | |
| | | M | 68 | 67 | 63 | 62 | 54 | 54 | 48 | 46 | |
| | | M | 73 | 52 | 52 | 50 | 48 | 47 | 42 | 41 | |
| | | F | 71 | 70 | 60 | 60 | 56 | 56 | 52 | 47 | |
| | | M | 79 | 67 | 66 | 65 | 63 | 63 | 62 | 40 | |
| | | F | 52 | 50 | 47 | 38 | 32 | 30 | 25 | 22 | |
| | | M | 64 | 50 | 48 | 47 | 43 | 41 | 41 | 39 | |
| | | F | 82 | 80 | 76 | 75 | 74 | 62 | 60 | 50 | |
| | | F | 76 | 60 | 56 | 49 | 45 | 44 | 41 | 41 | |
| | | F | 65 | 57 | 56 | 52 | 48 | 45 | 37 | 32 | |
| | | M | 75 | 67 | 67 | 64 | 57 | 56 | 45 | 39 | |
| | | M | 67 | 65 | 61 | 57 | 56 | 52 | 42 | 39 | |
| | | M | 71 | 65 | 62 | 60 | 52 | 52 | 43 | 40 | |
| | | F | 70 | 65 | 64 | 55 | 49 | 45 | 44 | 43 | |
| | | F | 77 | 72 | 72 | 70 | 64 | 58 | 58 | 57 | |

*Figure 4: Sample of the electronic Records*

**Services offered by Zambia National Data Centre (ZNDC)**

The Zambia National Data Centre (ZNDC) Ltd is a State Owned Enterprise created to oversee and operate the SMART ZAMBIA Phase I deliverable of Tier III Data Center consisting of production center, backup and disaster recovery data centers spread across the country. ZNDC offers the following services CoLocation, Cloud Storage, Physical Server Renting, On-site Managed Service, Cloud Virtual Machine, Backup as a service, Disaster Recovery as a Service and Physical Storage and Renting. (Zambia National Data Center, 2018)

The main purpose of the Zambia National Data Centre which is managed by Center of Excellence for e-Government and ICT, a wing of the Ministry of Communications and Transport is to consolidate government ICT resources hence introduce efficiencies in the acquisition, management and maintenance of those resources. The three-tier data centre will be able to store information for Government as well as private institutions. (DataCentre News, 2017) (Chibuye & Phiri, 2017)

**Discussion of findings**

With these findings in mind and the analytics of big data, how then can this data be captured for it to be used to inform stakeholders on some very important decisions. For example in Zambia the results of the national examinations are used for progression to the next level and

due to limited space not all learners' progress. The results of just one examinations should determine the verdict of a candidate when there are other assessment results that have been accumulated over the many years of schooling. Integrating this data would be of great importance as it would inform decision makers of the learner's performance throughout their schooling time.

Putting all this data together will help decision makers track learner's performance and even decide whether they would proceed to the next level as opposed to using only one time national examination.

Most of the records examined were in manual form. In relation to big data, the main concern here is electronic records, what about the manual records that are lying in the Zambian schools containing valuable information about the performance of learners in the school assessments? Should these records be converted into digital format? What about the cost? These are some of the challenges we face as a country. How can these data be easily converted into digital form so that they fit in the 'Big Data' paradigm and contribute to the national examinations?

How can the ZNDC be of benefit in the storage and retrieval of learner's data?

From the services offered by ZNDC, the Ministry of General Education can take advantage and buy storage space so that all schools could store their learner's data there. This would make it easier to use the available big data analytic tools to link these data to the national examinations data and assist in decision making. As it is now, it is impossible to link a learner's assessment data from Grade1 up to the time they sit the national examinations at primary school, junior and senior secondary school.

In our investigations we endeavoured to dig the value of school assessment data of learners in relation to how it can be linked to the national examinations data in order to inform stakeholders.

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