

CASE STUDY

Moving Towards a Digital Question Paper Development Process

The Zimbabwe School Examinations Council Experience with GradeMaker

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GradeMaker
Pro

Quality | Efficiency | Security



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Abstract

The Zimbabwe School Examinations Council (ZIMSEC) completed localisation of ordinary and advanced levels high stakes examinations in 1995 and 2003 respectively. **The QPD was entirely a paper based, manual and fragmented process.** The QPD process lacked flexibility, reusability and also an immediate tracking system.

Commissioning of item writers was done three months in advance, and they would work on complete question papers from

their respective stations before they convened for a rigorous moderation and refinement of the draft items.

This had a barrage of loopholes which the organisation worked hard to plug. 2017 saw the introduction of GradeMaker for ordinary level subjects. The facility is electronic and allows for simplified authoring and banking of items.

GradeMaker contains inbuilt question creation tools, authoring management tools, security features and quality assurance facilities. The platform offers an immediate audit trail.

The researchers sought to interrogate the end users so as to establish their perceptions after interaction with GradeMaker. A qualitative approach was used which included observations, hands on experience and informal interviews of 20 participants. The focus of the research was on usability of the platform, security, and audit trail, tracking and comparability with the previous approach.

It was envisaged that GradeMaker was highly user friendly and flexible, inclusive, cost effective, neat, secure, and highly dependable.

The participants observed that GradeMaker worked more efficiently with a shift of mind set. They also observed that supervision models remained traditional and failed to evolve in line with the flexibility of digital QPD platform.

The researchers recommended that the whole QPD process should now be purely digital across levels. The platform should link original items to duplicated modified items in such a way that when the original paper is assembled the modified question papers are automatically built. The users should be fully capacitated so that they optimally exploit all the features inherent in GradeMaker.

Background to the Study

The Zimbabwe School Examinations Council (ZIMSEC) was established through an Act of Parliament (*Zimbabwe School Examinations Act of 1994*) as an assessment body mandated to administer examinations for primary and secondary education in Zimbabwe (*Abraham 2003*). ZIMSEC then moved towards the localisation of ordinary and advanced levels high stakes examinations which was completed in 1995 and 2003 respectively (*ZIMSEC, Retrieved 25 July 2014*).



The ZIMSEC Act (1994:67) endowed ZIMSEC with the powers to, among other functions, **maintain the integrity of examinations at primary and secondary level**, organize and conduct examinations in a bouquet of subjects that comprised the course at primary and secondary levels of education. The latter function included a question paper development (QPD) process which was entirely paper based, manual and fragmented.

The paper-based process lacked flexibility, reusability and immediate tracking system.

Jasenovcova (2021) retorted that physical documents get mixed up, misplaced, spilled on, too far and become outdated. This has negative impact on productivity. Jasenovcova also cited studies which purported that 70 % of all businesses would not last a month if they lost their paper records in case of a natural disaster. This explained why paper based QPD processes were deemed wasteful, risky and less secure.



The traditional QPD process involved commissioning of item writers three months prior to the rigorous moderation and refinement processes of the draft items. Item writers would author complete question papers from their respective stations (*ZIMSEC Item Writing Procedure Booklet, unpublished 2004*).

This had a barrage of observable loopholes which the organisation worked hard to plug. ZIMSEC had no control over the draft items since there was always a possibility of item writers keeping copies of these draft items.

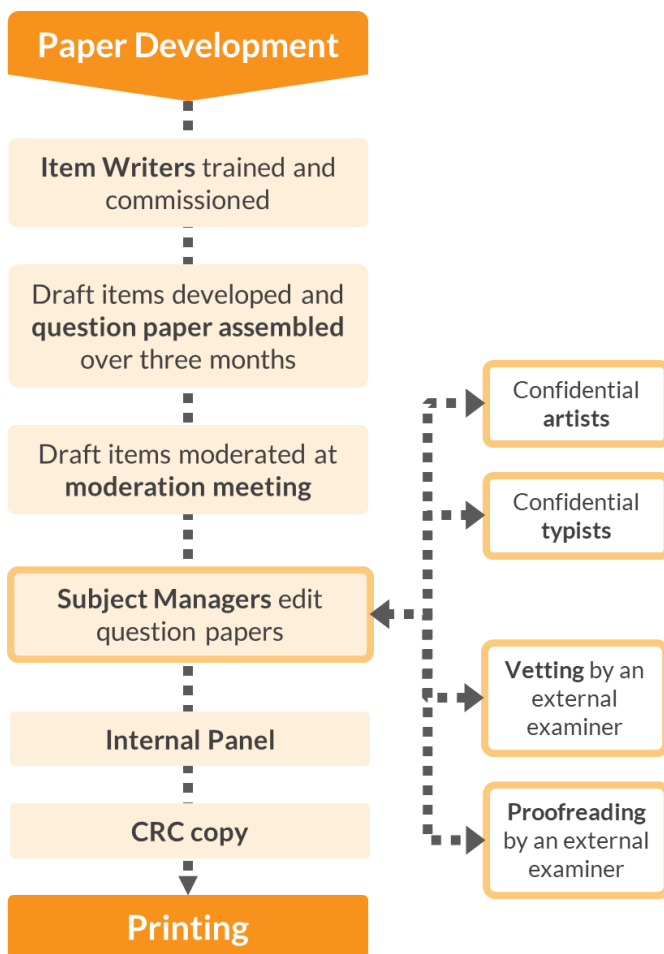
The fact that they would develop a complete paper meant that chances for authors to be tempted to cheat the system were very high.

Plagiarism from other examination bodies was another challenge ZIMSEC had to contend with.

Item writers tended to recycle the same items leading to the predictability of what was contained in the assessment instruments. Very good items which discriminated well and had acceptable facility index would be used once and there was no way of banking them for future use.

The lack of an item banking system in this traditional QPD process meant that numerous item writing workshops were needed to replace used items and this had financial implications on ZIMSEC.

The traditional QPD process is modelled below:



While ZIMSEC was grappling with the challenges of question paper development, the global trend was moving towards paperless processes.

Information Communication Technology usage was taking an upward trajectory since there had been a vigorous campaign for eco-friendly methods of doing business (Rosenstadt, 2020).

This digital wave has not spared educational assessment processes. Thus educational assessment processes were

also bound to greatly improve and ZIMSEC had no option but to also embrace digitalisation of the question paper development processes.

2017 saw the advent of GradeMaker which then ushered in a new approach to question paper development.

ZIMSEC started using GradeMaker with only 5 big subjects (those with large entries such as English language and Mathematics among others). ZIMSEC gradually added other subjects. By 2021 a larger bouquet of 37 Ordinary level subjects was in the GradeMaker platform.

Examinations possess a vital role to measure the capabilities of learners. Authoring and developing question paper in an effective way is a critical job for educational assessors (NoorfaizalFarid, Nadhirah, Izzati 2019). The authors observed that using traditional methods, of question paper development is monotonous and time consuming.

According to Cen et al., (2010), three approaches can be applied to digitalise question paper development which are storing questions, display and then select, storing questions and select using randomisation techniques embedded in the application and customising randomly stored questions according to the user to produce more versions of question papers.

GradeMaker Pro is a unique, fully-featured authoring and item banking system for print and online examinations (GradeMaker Ltd, 2022).

This technology-based system supports every step in the authoring process from first draft to final published test.

It possesses critical features which include assessment authoring, security enhancement, question item banking, test building, quality assurance and test publishing (GradeMaker Ltd, 2022). The software is cloud-based and very user-friendly.

Mapungwana (2019) also observed that the GradeMaker system is user friendly, interactive and more secure because they contain security features that ensure no leakage. The tracker within the software ensures that papers are not predictable from one year to another (Mapungwana, 2019).

She further asserts that the platform was also friendly to the environment since it reduces the amount of paper used.

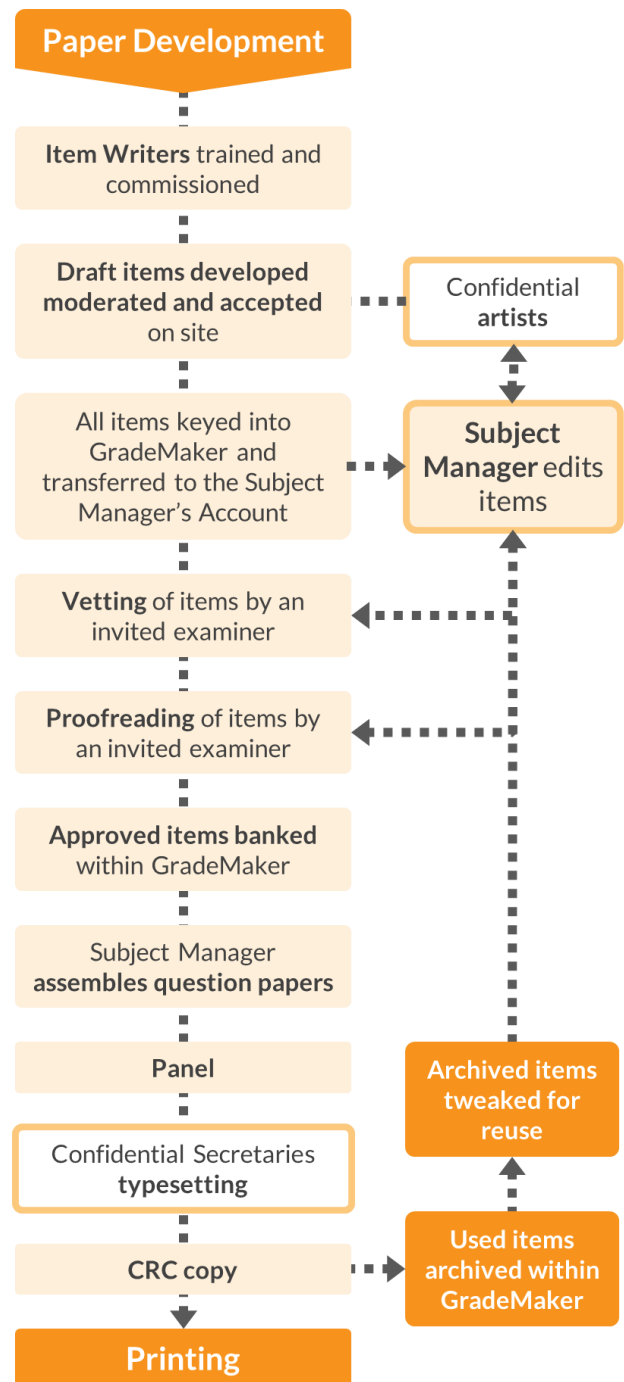
The platform has a variety of tools and functions that were observed:

- It enhances security and the development process is made easy
- No items and instruments are saved on local devices
- User and teams are managed and the content they access is restricted to what is relevant to them
- Users can be locked and unlocked in the system to restrict times to use the platform
- Total accountability in case of leaks through inbuilt audit trails like access logs

- 2 factor authentication secures content for users
- Data is backed up on secure cloud every six hours

(GradeMaker Ltd, 2022).

The following is the ZIMSEC flow chat of the QPD process through GradeMaker.



This research, therefore, sought to solicit and establish the perceptions that emanated from the experiences the subject managers, confidential secretaries and confidential artists had with the new approach to question paper development.



Statement of the problem

The background to the study has revealed that ZIMSEC experienced a barrage of challenges during the traditional question paper development process which was entirely paper based.

It has also been highlighted in the background to the study that the examination board embraced GradeMaker as a move towards a digital question paper development.

The adoption of a digitalised model of QPD is likely to have brought challenges emanating from users', knowledge about the new model and the perceptions they develop towards the system. This research focussed on interrogating the perceptions that emanated from the experiences ZIMSEC users who are

subject managers, confidential secretaries and artists had with GradeMaker.

Research Question

The study was guided by the following main research question:

How is GradeMaker, as a digitalisation drive of the Question Paper Development Process, perceived by Users at the Zimbabwe School Examinations Council?

Sub-research questions

The study was guided by the following sub-research questions:

- How knowledgeable are the ZIMSEC users about the GradeMaker approach to question paper development?
- How usable/accessible is GradeMaker as a tool for question paper development to the ZIMSEC user?
- What factors affect the use of GradeMaker as a ZIMSEC's question paper development tool?
- Is GradeMaker compatible with the philosophy of inclusivity as envisaged by ZIMSEC users?

Aim of the Study

The study sought to examine the knowledge acquired and perceptions developed from the experiences ZIMSEC users had with GradeMaker.

Objectives of the Study

The objectives of the study were to:

- Solicit the functional knowledge ZIMSEC users had about the GradeMaker approach to question paper development.
- Establish the usability/accessibility of GradeMaker as a tool for question paper development to the ZIMSEC user.
- Determine the factors that affected the use of GradeMaker as a ZIMSEC's question paper development tool.
- Establish from users if GradeMaker is compatible with the philosophy of inclusivity as envisaged by ZIMSEC.

The Significance of the Study

The study was critical in that soliciting perceptions of critical people in question paper development, who are the users of GradeMaker, would result in improvements and innovations that are user-centred.

The organisation's senior management would be kept informed of the strengths and weaknesses of their approach to QPD so that they worked towards making critical adjustments and improvements that were helpful, robust yet still cost-effective measures.



Literature Review

In an era of rapidly changing social and economic environment, organisations are facing unimagined and rapid, unsettling competition and new challenges. These urge organisations including educational assessment organisations to adapt their processes, practices and operations, essentially adopt particular business models to capitalise on incipient business opportunities so as to remain competitive (von Delft et al., 2019).

Petana and Rosa (2020) observed that digital transformation compels organisations to extent to a new level of productivity. Kokolek, Jakovic & Curlin (2019) concurred as they viewed digital transformation (DT) as a driver of positive and radical changes in an organisation.

They claimed that digitalisation is multifaceted and affects all sectors of the society and the economy. Purpose and ultimate goal of the DT process are effective business processes and operations with concentrated use of information and communication technologies (Kokolek, Jakovic & Curlin, 2019).

Jasenovcova (2021) reiterated that digitalisation help organizations to boost efficiency, eliminate waste and cut costs.

Garth (2022) observed that the digital revolution concerns a new, adaptive and interactive framework that defines an amalgamated digital strategy that becomes the "heart" of the digital enterprise and propels new energy, ideas, and innovations that will redefine the business model. Digitalisation even of educational assessment processes creates new experiences, products and services, new outcomes, new business and revenue models. Gartner (2014) highlighted digitalisation benefits which were that it lowers the risks of errors and operating costs, speeds up processes, enhances customer satisfaction and improves specific components of the business.

Digitalisation of assessment processes demand that the functionaries be knowledgeable and skilled. Zbucha & Vidu (2018) postulated that knowledge transfer is key to efficient management of all types as it leads to increased effectiveness, increased performance and better relationships with stakeholders and partners.

Voss (2021) argued that the relevant question is not which knowledge or technical skills to teach, but which abilities workers need in the digitalised age to translate the amazing abundance of knowledge into purposeful action. Individuals and organisations should have utility for solving organizational problems,

from component knowledge sourced from within and beyond organization, and across time, and which derive from individual and group contributions, facilitated by both formal and social processes (Zahra et al., 2020) without which efforts to revolutionise educational assessment process will not sprout.



Voss (2021) postulated that knowledge is immediately productive and enabling. ZIMSEC educational assessors simply had to be taught the working of new technologies, the knowledge on GradeMaker and immediately applied it to their context. Knowledge creation, acquiring, deposit, analysis, transfer among others is tightly related to data technologies and to digitalization of organizations (Zbucha & Vidu 2018). Thus the ability to exploit and interact with GradeMaker requires the user to be knowledgeable about the functions of this critical platform.

Knowledge about the technology alone is not sufficient. Edison & Geissler (2003) asserted that while technology progressively affects every individual, it is not viewed as positive by everyone.

There exists a range of response to technology which is connected to the concept of attitude towards technology (Edison & Geissler, 2003). Some individuals are not comfortable with technological change they do not enjoy the insecurity and are reticent to embrace these tools and ideas. Other individuals embrace technological change and enjoy the challenge (Edison & Geissler, 2003)

The role of attitude in explaining technology acceptance behaviour is critical. Davis et al., (1989) propounded that a person's perceptions concerning usefulness and ease of use of IT determine that person's attitude toward the digitalisation.



A user who strongly holds a favourable attitude toward using GradeMaker, for example, may adopt and continuously use the technology. The reverse will be true for a user who weakly holds a favourable attitude toward using the technology (Amiruddin, Pontoh and Sriningsih, 2020).

In the original Technology Acceptance Model (TAM), two primary determinants of system use which include the perceived ease of use and perceived usefulness (Davis et al., 1989) influence attitude. Davis's model specifically postulates that technology usage is determined by behavioural intention to use the technology. Behavioural intention is in turn determined by attitude towards using the technology and by perceived usefulness.

According to Davis (1989) perceived ease of use could be a causal antecedent to perceived usefulness.

Thus, technological platforms that are easy to use with easy and simple interfaces should be useful for people in their jobs. Davis believed that perceived usefulness and ease of use, as antecedent variables, constitute essential determinants of users' technology acceptance and which then affect their actual usage behaviour (Teo and van Schaik, 2012). Venkatesh et al. (2003) expanded the TAM through empirical research by adding such factors as social influence, cognitive structure, and experience and the factor of subjective norm that had not been adopted in the original TAM.

Apart from the issue of attitude discussed above there are other factors that influence the way individuals embrace technology. Digital self-efficacy which is the individual's perception about their ability to use technology in various

contexts (Thatcher, Perrewe, 2002) critically affects their desire to use it.

A plethora of research on self-efficacy has clearly shown the determinative relationship between an individual self-efficacy and the desire to embrace technology (Sang G, et al., 2010; Jeung, 2014; Celik, Yesilyurt 2013; Ball & Levy, 2008).

Ball & Levy (2008) identified computer anxiety as one other factor central to use of technologies. Computer anxiety refers to the apprehension felt by individuals when they consider the possibility of computer utilisation. According to Thatcher and Perrewe (2002), it is the user's fears of the consequences of their use of technology like losing vital information or committing major blunders. Anxiety has always been viewed as central to influencing technology acceptance (Agarwal, Karahanna, 2000; Korukonda, 2007). According to Harrington, McElroy (1990) the consequences of computer anxiety is stress, and it influences performance leading user to avoiding technology usage.

The same idea is also reiterated by many researches (Arigbabu, 2009; Jain, 2005). The studies according to Awofala, et al. (2019) showed that computer anxiety intensified struggle with technology and it is a barrier to a person's intention to use technology including the adoption of it. Several studies have emphasized that behavioral intention positively influences the use and adoption of technology (Alshmrany & Wilkinson, 2017; Yakubu &

Dasuki, 2018; Aljazzaf, 2020; Tarhini, Hone, Liu, 2013).

Yakubu and Dasuki (2018) in their study on the factors influencing the adoption of e-learning technologies in higher education in Nigeria concluded that behavioural intention was an essential determinant of technology actual usage.



One of the research question addresses Inclusivity through technology and this justifies this section of literature. Paper commissioned for the 2020 Global Education Monitoring Report, Inclusion and education, (2020) observed that not all learning technologies are appropriate for learners with disabilities. Many of the initiatives to introduce technology into education have been without consideration for the needs of people with disabilities and other minority groups.

Wong et al., (2009) reiterated that most hardware and software designed for the mainstream population did not pay adequate attention to diverse capabilities and to people with disabilities. Williams (2012) also retorted that the needs of

people with disabilities have been neglected for a long time and most valuable digital resources are useless for people who are deaf or hard of hearing and for those with blindness and low vision. This scholar argued that those who create digital projects almost always fail to take these needs into cognisance.

The technologies need to be totally accessible to learners with disabilities taking into account the social and cultural concerns (Heemskerk et al., 2005; Tondeur et al., 2016). Imbedded in technologies should be values and sensitivities of the diverse populations that might use it.

Digital instructional tools possess a potential to create change when used to equalise opportunities for all learners (Sunagul, 2019).

Articulating accessibility and assistive technology accommodation requirements across assessment types ensures that the digitalisation system supports all learners.

Assessment accommodations are essential for learners with disabilities to ensure their inclusion in academic success (Cawthon, 2011). Through technology, curriculum, particularly assessment should be explored by all types of learners (Hartmann & Weismer, 2016).

Williams (2012) exhorted digital designers to embrace the concept of universal design, the idea that we should always keep the largest possible audience in mind as we make design decisions, ensuring that our final product serves the needs of those with disabilities as well as those without. CITES, (2022) advised that the commitment to inclusivity calls for the recognition and value of diverse populations. It also means that institutions should take measures to improve the success of specific groups.

The lack of involvement of people with disabilities (PWDs) results in technologies which are not fully accessible to some groups of PWDs or which are very time consuming and difficult to use for the same cohort (Wong et al., 2009). Inclusion has stimulated much interest in using various ICT applications for integrating learners with disabilities into the mainstream school environment, teaching learning and assessment (Williams et al., 2006).

The above literature review is a snapshot of what scholars are discussing in relation to technology driven processes which include assessment. These researchers anchored their research on *Moving Towards a Digital Question Paper Development Process: The Zimbabwe School Examinations Council Experience with GradeMaker*. On the above literature. The factor that affects technology use pre-equipped the researchers as they went out to collect data. Issues of inclusivity were not trivialised.

Methodology of the Study

The researchers employed a qualitative research design since they needed to extract rich data from the participants available. Interview, focus group discussion and observation were the main instruments used for data collection. Participatory approach was also employed since the researchers themselves were also users of GradeMaker.

The researchers administered interviews and focus group discussions from an informed perspective. Purposive sampling was applied to strictly those participants who interacted with GradeMaker. 22 subject managers, 2 research managers, two artists and 4 confidential secretaries participated in the research.

Data Presentation and Analysis

The data collected was presented and analysed in thematic form since it was qualitative data. The sub-research questions which had been the foundation of instrument development were then converted into themes that informed the chronology and analysis of data.

Research Findings

The research findings from interviews, focus group discussions and observations were presented in thematic form.



Comparison between GradeMaker and the traditional paper based QPD

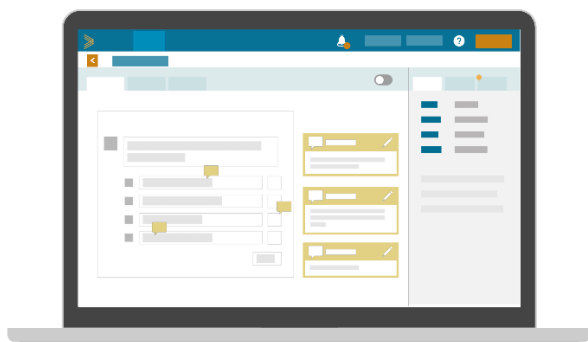
All the participants appreciated and were agreed that the use of GradeMaker as a question paper development tool had advantages that far outweighed the traditional approach.

The fact that many items were vetted and proofread in a short space of time created a huge bank from which a number of question papers could be built.

GradeMaker gives subject managers the sole responsibility of question paper construction using the banked items. This is viewed as making it difficult to predict testing instruments especially by external reviewers. Building question papers is easier. The inbuilt analysis of question papers and the fact that items were mapped, tagged and tracked meant that more balanced question papers could be built.

The banked items were exposed only to the subject manager and this further lowered the risk of loss or exposure.

Most of the users like the fact that a large unlimited bank of item was maintained. Researchers also observed that banked and used items could be tweaked to create new items for reuse. Another positive, pointed out by users was that used items were not discarded but archived and reused after tweaking.



General factors that affect optimum interaction with GradeMaker

Participants were asked on the factors that affected their interaction with GradeMaker. The participants concurred that there were a number of factors that influenced the use of GradeMaker which ranged from those inherent in the user and other external factors. The majority of the users pointed out that there was need for a sound knowledge about GradeMaker and also self-efficacy with the ICT gadgets and the GradeMaker user platform.

Personal attitudes towards technology in general was also cited as influencing use of GradeMaker at ZIMSEC. While the majority of the participants were aware of the usefulness of GradeMaker in question paper development, some still perceived it as difficult to use. Observations are that such participants would not work independently, they would from time to time request help from super users repeatedly.

The most commonly mentioned factors by ZIMSEC users were availability of electricity and the participants highlighted the need for a reliable internet connectivity. Weak connectivity slows the user, while the absence of it made content inaccessible. Also raised was limitation to access computer hardware in the designated workrooms especially during the keying in of items at item writing stage where some laptops have to be hired for the purpose. Participants worked with limited user accounts which made it difficult especially when item writers are available. This then made the whole process slow.

ZIMSEC user knowledge and self-efficacy with GradeMaker List the aspects they are familiar with.

The majority of the participants showed that they were knowledgeable and highly interactive with GradeMaker.

They worked independently. It is observed that most users at ZIMSEC

were able to navigate with ease through the features and functions of GradeMaker. However, about 10% of the users needed to be constantly guided and shown how to perform certain tasks in GradeMaker.

It was noted that these few comprise those who were new at the time of the research, one who had a weak background on the use of computer gadgets and negative romanticism towards ICT. The participants complained that there were no induction workshops for new users hence they learn by discovery and also became dependent on the super users. They went further to suggest capacity building. The features of GradeMaker that researchers observed to have been mastered by most of the ZIMSEC users included:

- creating items and question papers
- transferring created items to users with rights to a subject
- pasting diagrams and other assets to items
- mapping items to skills, Blooms taxonomy, syllabus and paper
- tagging items using numbers and names
- duplicating items and question papers for specialist candidates
- sending items and question papers for review and closing such cycles
- banking approved items and archiving used items including deleting rejected items
- using filters in searches
- tracking item developing and usage

- sending question papers to Confidential Secretaries for typesetting

The usability/accessibility of GradeMaker

When asked about how accessible GradeMaker was, the majority of the users appreciated the fact that it was very user- friendly and quite easy to manipulate and navigate. Only a few highlighted challenges.

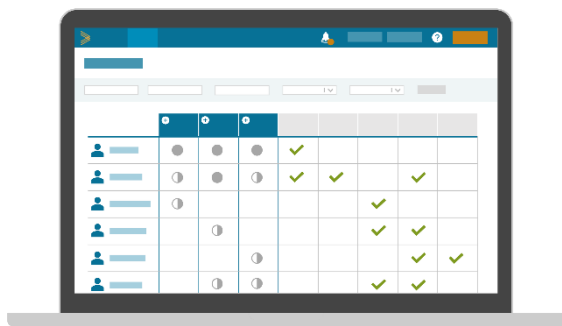
Quite a significant number found the application user friendly and with constant training, accessibility of some GradeMaker features could be better appreciated. Some participants raised the concern that some mathematical symbols were not yet found in the GradeMaker system. They also pointed out the difficulty in editing equations once a question paper is downloaded to word. The tab key could not be used for its function in the GM and users would use the space bar instead. Content and question blocks downloaded to word had borders that become visible when the cursor is moved and these made editing of the word document and translation to Braille difficult. Some participants were worried about the duplicate of banked items which went back to the drafts and restarted the cycle instead of remaining in the bank as a refined item.

Security

The majority of the users agreed that GradeMaker was secure while a few

expressed uncertainty. The researchers observed that the fears raised were a result of the fact that the users did not understand how the cloud-based system functioned. The cloud system meant that content was not stored on the device's hard drive. Loss of hardware does not expose the content to unwanted third parties. However, the researchers also observed that GradeMaker required login credentials that users entered to access their profiles and content.

The security included a two-factor authentication in which user names and passwords were not shared. User managers could not give themselves rights and were not able to view subjects' content.



Access to content was limited to those with rights to subjects and what users could do with the content was also limited and controlled. Users also appreciated the automatic logout feature which aimed at protecting content should one forget to logout or was not active for a given period of time (30 minutes). The participants also observed that GradeMaker accounts could not be accessed from the browser history without entering login credentials. All external and internal panels accessed

content electronically so lowering the risk of loss and misplacement. The user manager was able to view an audit trail of login and activities by users. Also noted was that the user accounts could be locked and unlocked at specified times by the user managers.

From the observations discussed above it was evident that the GM was indeed secure.

Inclusivity and GradeMaker

From interactions with GradeMaker and ZIMSEC users, it was observed that special needs candidates also catered for. Special needs items and question papers for candidates with visual impairment especially those who used Braille and those with hearing impairment and requiring language modification could be developed alongside those of the mainstream candidates. For items, this could be done before or after assembling items into a question paper. Items and question papers could be duplicated for modification so that they conform to the respective special needs candidates. It was noted that the development cycle for special needs items and question papers was the same as that for mainstream ones.

In addition, all such items and/or question papers also involved input and validation by the Special Needs Manager who also had access into GradeMaker. The critical facets of items such as skills tested, and responses expected were maintained to eliminate the stigma that usually come with writing different examinations.

Conclusion and Recommendation

From the findings the researchers concluded that:

- The ZIMSEC users of GradeMaker had positive perceptions and fully embraced the digital process of question paper development.
- The majority of the participants were to a greater extent knowledgeable and possessed adequate self-efficacy about the utilities of GradeMaker.
- The participants agreed that GradeMaker was a secure digital question paper development platform.
- GradeMaker as a QPD drive would in the long run become cost effective as it will reduce manpower, the number of item writing workshops since some items could be archived and tweaked, the quantities of bond paper and cartridge to be used among other materials that were of use during the traditional process.
- With the availability of electricity, internet connectivity, appropriate hardware, right attitudes, adequate knowledge and efficacy, the use of GradeMaker as a question paper development tool would be a success story at ZIMSEC.
- GradeMaker is inclusive as it embraces development of Braille, language modified question papers and the use of various indigenous languages.



The researchers recommended that:

- The Advanced level bouquet of subjects should also be developed through GradeMaker.
- ZIMSEC should embrace the use of tokens such as numerical pins as second layer of security and authentication at login.
- ZIMSEC should constantly capacitate users through workshops, refresher courses and study visits. The users should be fully capacitated so that they optimally exploit all the features inherent in GradeMaker.
- GradeMaker should design a platform which allows automatic construction of question papers for candidates with special needs so that as the mainstream paper is being developed the duplicate papers are also produced at a click of a button.

- The platform should link original items to duplicated modified items in such a way that when the original paper is assembled the modified question papers are automatically built. A software should be added so that even assessors with blindness could use it.
- There should be a complete change of mind set amongst the users and their supervisors so that monitoring and supervision procedures move from the traditional QPD to the current digital one. Remaining in the previous mode would frustrate users who would want to enjoy the flexibility that come with digitalisation.
- GradeMaker should make it possible for a duplicate of a banked item to remain in the bank instead of going to the drafts and restart the cycle.



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