DIGITAL QUESTION BANKING: A COMPARISON OF MANUAL AND ELECTRONIC QUESTION PAPER DEVELOPMENT

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Abstract

Educational assessors are adopting automated test development tools to reduce examination paper leakages and to increase efficiency in their work. In this regard, the Zimbabwe School Examinations Council (ZIMSEC) has adopted the Grademaker, a digital Item bank. This study adopted an experimental design approach to review the efficiency of the software in comparison with an existing manual development process. The intervention was then evaluated to test its effectiveness in solving the problem during which time pertinent observations were made in various forms. Instruments used to collect data were questionnaires and interviews. Subject managers at ZIMSEC, Item writers, Vetters and Proof readers were the main respondents in this survey. Results show that electronic systems are user friendly, interactive and more secure because they have security features that ensure the security of Question papers and non-leakage. The tracker within the software ensures that papers are not predictable from one year to another. They are also friendly to the environment by reducing the amount of paper used. This study recommends that examination boards adopt the technology to ensure credibility of examinations. Manual systems are easier to use but require more manpower.

Keywords: *Item bank, Question paper, leakage, Grademaker*

Introduction

Educators and assessors have always been looking for ways to enhance their assessment of candidates. They have devised different tools over the years including examination sessions, games and quizzes. The 20th Century has seen them devising digital software to do the same. Various Question banks have been developed in the process. Most of these can be used by educators and students alike. Assessors however develop their questions in systems divorced from school pupils for security reasons. The following are some of the Question banks available on the market.

An item bank is defined as an organised collection of test items that can be assessed for test development, Choppin(1985) says that an item bank or question bank is a collection of test items organized, classified and catalogued. Firozqureshi (2018) sees it as a planned library of test items designed to fulfil certain predetermined purposes. It makes available sound questions and model answers and thus facilitates design of question paper assess predetermined objectives. A Question bank presents items for any particular course, level, language, selected category and type of questions.

The Context of question paper development at ZIMSEC

Educational Assessors working manually produce questions for a specific examination session. When another session is due other questions would be produced again. There is no accumulation of questions nor is there a proper tracking process. There is therefore a tendency to repeat certain aspects and make the paper predictable. The manual process may involve many participants from item writers, typists, artists, Vetters, proof readers, subject Panelists and printers.

A question bank has certain characteristics that are common to them. A question bank should be based on sound ideas, purposes and should be adapted to the particular objective of mind. It should be within the range of the students' experiences and knowledge. A question bank should present a challenge which stimulates an educative response in keeping with the objectives. It should contain only one idea, a many faceted question only confuse the students, who usually answers but one phase and forget the remainder. It also should be exhaustive and cover entire syllabus content with a collection of questions prepared for a given subject and useful for students and teachers. Question banks are often made available on the internet.

Question banks are continuous process and are meant to improve the teaching learning process. Through instructional efforts the pupil's growth will be obtained. They are also aimed at improving evaluation process. The pool of test items can be used for formative and summative evaluation of the pupil's performance.

Questions are written or collected from various sources. Ready – made question may be lifted from old question papers, from standardized tests and from review exercise of good textbooks. They must fit into the specification and should be accompanied by answer keys, besides indicating objectives

and content area. In case of new questions, they may be invited from experienced teachers, examiners and paper setters on the basis of some specifications. Questions can be prepared by practicing teachers invited to a workshop for the purpose. This get together helps to discuss the questions face to face and get quality questions. In such a workshop, subject area and the objective may be allotted to a participants according to their competencies.

After the questions are written, questions sheets are passed on to other members of the group for their comments. These comments are passed on to author of the question, who in consultation with two or three participants finalizes the questions. Individual questions are written on paper followed by discussion by participants. This improves the quality of the question built and also provides good training to the participants for framing good questions.

Second level screening is done with the help of subject experts called panels, conversant with the technique of text construction. Questions are to be coded and classified in a manner that facilitates their use. This is necessary for quick location and production of papers. Coding can be done for the subject, in structural objectives and forms of question.

Fig. 1 Question paper Development process

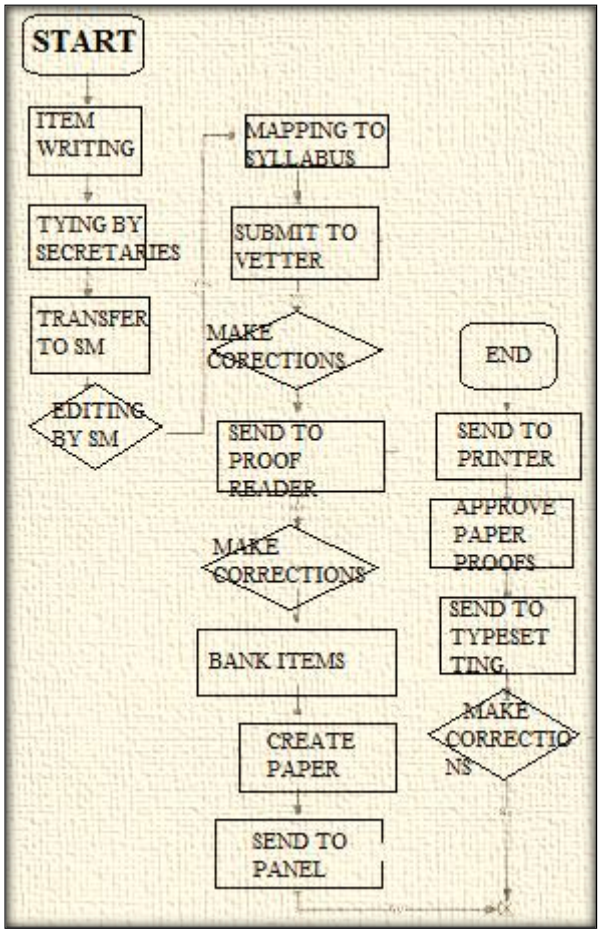


Fig. 1 above represents the question paper development process followed at ZIMSEC. They apply to both the manual and the automated question paper development. It starts when the Subject Manager identifies item Setters from a pool of Examiners in the data base. Five examiners are chosen per each subject component. Item writers then go through training on assessment and how to come up

with credible items. They are commissioned to come up with specific items for a component. Individuals come up with items at a central venue. Members come together and moderate each other's items making sure they cover the syllabus, they are suitable for the level and that they are well structured.

The Subject Manager collates approved items to make a paper. The Subject Manager extract all diagrams and give them to Artists for reproduction. The paper is then given to Confidential Typists for typing. As they type, the Subject manager will constantly edit and send back for corrections. When diagrams are ready they are pasted onto the typed question paper. The paper is then given to a Vetter who is also a practising teacher. The Vetter checks for conformity to syllabus specifications, layout, spelling errors and readability of the paper. Typists effect changes suggested by the Vetter. A proof reader is then given to check for errors as well. The paper is corrected again before it is given to Subject panellists. These sit together and go through the paper and check for errors.

The paper is temporarily stored as Camera ready copy to be retrieved for two quality checks. Inter Subject Exchange is also done were Mangers of different Subject Groupings exchange the papers and read through for potential errors. It is sent to the printers for final Printing. Printers make a Master copy which is proof read by the Subject Manager before mass reproduction for candidates. Papers are further proof read before despatch. If errors are detected at this stage, erratum notices are generated and despatched together with the papers.

The processes outlined above are also done in the Question bank. The major difference is that the processes are done to items and not full papers. The Subject Manager produces the paper as a very last stage after which only Panellists will view it. This way people have no way of predicting what will be selected and is envisaged to reduce malpractice.

Statement of the problem

Zimbabwe School Examinations Council has experienced problems of school examinations papers leaking. Examinations leakage has had serious negative effects on the ZIMSEC budget. Schools are equally affected when examination time tables are rescheduled, especially boarding schools which have to keep students a little longer than the planned time. In addition, the credibility of Zimbabwe's examination standards is compromised due to negative publicity when public examination papers are not handled properly. Examinations leaking also tarnish the image of the country's education system as some people are tempted to conclude that Zimbabwe's examining board is incompetent.

Among the leakages is premature access to exam papers. Paper leakage is due to a breach in the supply chain before the stipulated time the paper is meant to be sat. There is group of criminal minded people, with no value for integrity who use their most trusted positions to create avenues for the papers to find their way on the streets before time. It is very difficult to trace the leakage especially when there are just too many people involved in the production of the paper. Item setters, Secretaries, Vetters, proof readers, Subject Managers, Printers, Cluster centre supervisors and headmasters all have access to the paper before it is written. Question banks have been advanced as an easy way to produce question papers whilst reducing malpractice by limiting access to the full paper by Item setters, Secretaries, Vetters, proof readers, Cluster centre supervisors and headmasters. ZIMSEC has adopted one such question Bank, the Grademaker in a bid to solve these challenges. The problem is whether the

item bank really solves the problem of question paper leakage. Is it more efficient than the traditional manual method?

Justification of the study

Item banks are a fairly new phenomenon the world over let alone in Africa, and as such, educational assessors are not aware how they function. Subject Managers have not been equipped with the requisite knowledge to use them. There are no formal courses for the adoption of such technologies. This paper tries to bridge that gap by coming up with an assessment of Question banks.

Objectives of the Study

To assess question banks in terms of question paper leakage.
To assess question banks in terms of efficiency.

Research Questions

The following questions guide the research; do item banks solve the problem of question paper leakage? Are item banks more efficient than the traditional manual method?

Methodology

An experimental design approach was adopted whereby an item bank was installed and used then compared to an existing manual development process. This is partially an action research in that it is based on trying to solve the problem of Question paper leakages. Plans were made to adopt an Item bank as an interventionary strategy. The intervention was then evaluated to test its effectiveness in solving the problem during which time pertinent observations were collected in various forms.

The total population was used in the survey without sampling. All Subject Managers at ZIMSEC were included in the survey. There are twenty-one managers of which eleven are females and ten are males. Each of them has a Subject in the Question bank. The Subjects are broken into Sciences, Humanities, Languages, Practical Subjects and Commercials. They were chosen because each of them has a hands-on interface with the Question bank. Their Vetters and Proof Readers also work in the bank and were included in the survey. These were twenty-one Vetters and twenty-one proof Readers. The Researcher also used the Question bank in order to understand issues at hand.

Primary data collection dominated the survey. The main instruments for data collection were questionnaires. Questionnaires were administered to them from December 2018 up to February 2019 during their work. During this period, the Vetters and Proof Readers were invited to work on the items and were included in the research. **Fig. 2** below shows the respondents of the survey.

Fig. 2 Respondents by subject grouping

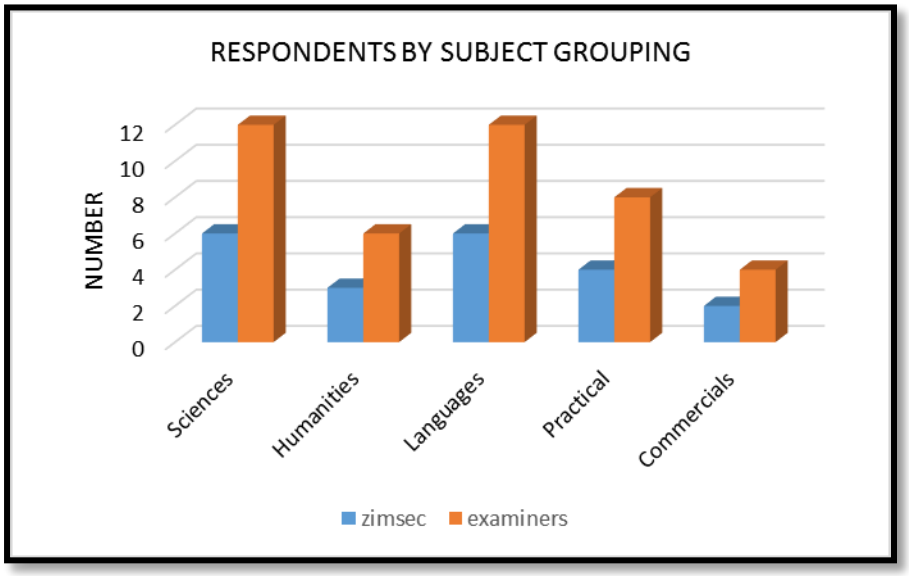
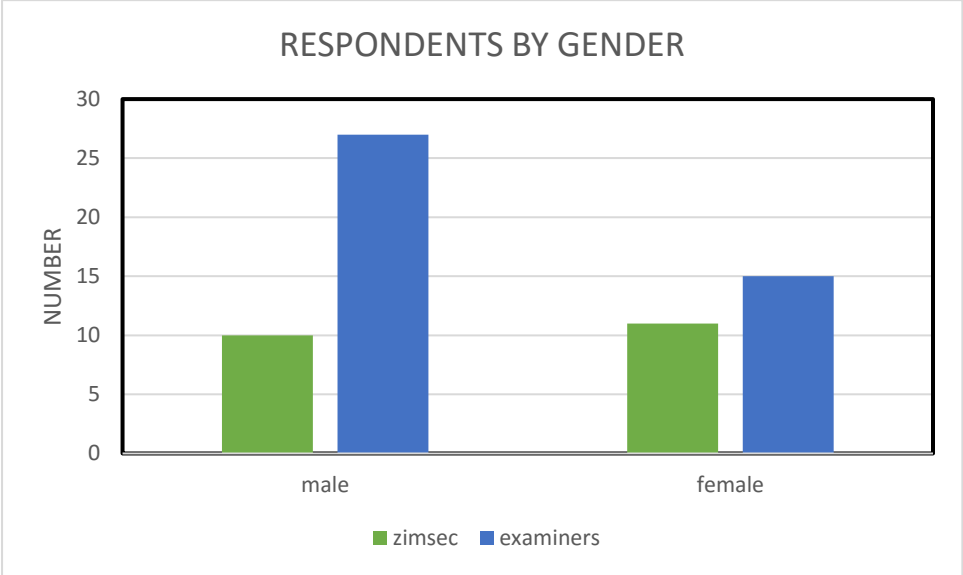


Fig. 3 Respondents by gender



PRESENTATION AND DISCUSSION OF RESULTS

Question banks can be assessed in terms of their usability but can also be assessed in comparison with traditional manual methods. This paper tries to do both. The ISO 9241 standard defines usability as, "The extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency, and satisfaction in a specified context of use". Usability evaluation is the analysis of the design of a product or system in order to evaluate the match between users and a product

or system within a particular context. This ease of use can further be looked at in terms of whether the software is effective, efficient, engaging, error tolerant or is easy to learn.

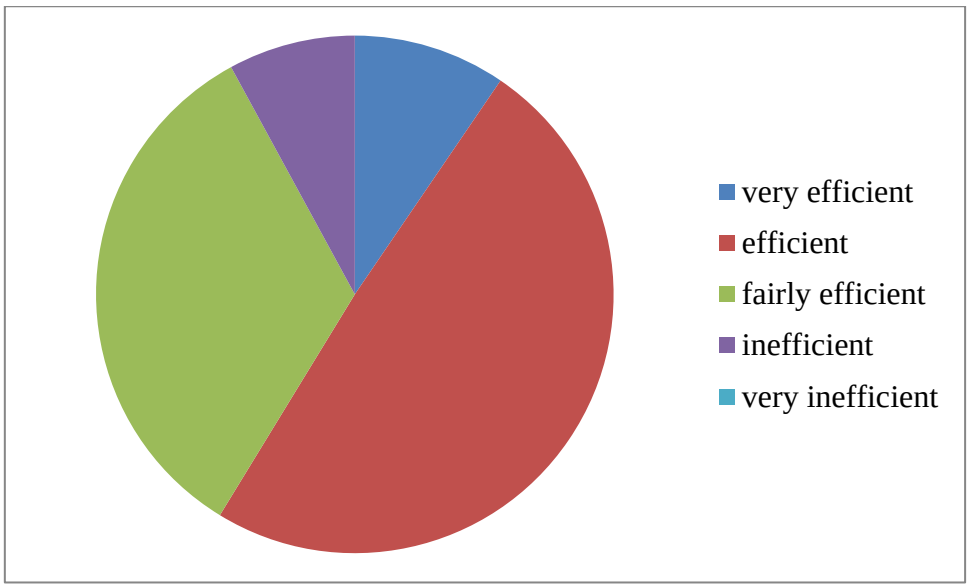
Effectiveness is the completeness and accuracy with which users achieve specified goals. It is determined by looking at whether the user's goals were met successfully and whether all work is correct (Quesenbery: 2018). The manual question paper development is less effective in terms of completeness of the goals. The period that it takes is too long. For our June 2019 question papers it took an average of ten months. This is so because of the multitudes of people involved in the process. A paper takes two weeks to have the items set by five people. The Subject manager puts the items together in approximately a week. An Artist then produces diagrams whilst a Typist types the paper. The Subject Manager constantly corrects the Paper and takes it to the Typist countless times. A Vetter, a proof reader and panelists all have to go through the paper. For a paper to sail through it takes up to a full year and thirteen to fifteen people. All these fifteen people will be working with a hard copy of a full paper. It makes it easier to remember or even to copy on a phone or to make a photocopy.

In a question bank, although the time taken to work on items is much shorter. Only panelists see the full paper but it will still be in a digital format and for a limited time. The Typist puts in all items at once. This may take two weeks per Subject. This is shorter and easier to do as she does not have to do numerous corrections. A Vetter takes two days to review five papers. A proof reader also takes two days to review items for five papers. In essence then a Vetter or a proof reader takes only three hours each per paper. This serves the Examination Board money in that if developed separately, each Vetter would come for five different occasions yet in a question bank, he only comes once for the five papers. Question bank also saves time in that the Subject Manager can always review the paper as and when he wants. In a question bank a paper will only take seven weeks to finish, two weeks for item setting, two weeks to input items into the bank, one week for vetting and proof reading, one week for question paper creation and one week for panel reviews.

Accuracy is compromised in the manual system in that other people involved are no subject specialists like the Typist and the Artist. In a question bank, The Subject manager has more control of the outcome of the paper. It eliminates the process were the Subject manager has to write corrections on the paper and take them constantly to the secretary.

Efficiency can be described as the speed (with accuracy) in which users can complete the tasks for which they use the product. ISO 9241 defines efficiency as the total resources expended in a task. Efficiency metrics include the number of clicks or keystrokes required or the total 'time on task'. The efficiency of the manual system depends on the individuals making up the paper. Some Typist may lag behind others in paper typing. Panels can also stall the paper development process. In a question bank, the efficiency is dependent upon one's Information Technology skills. A person who is skilled will quickly click on the relevant icon and move on. Generally, younger personnel are more at ease with use of digital platforms. Navigation design elements such as keyboard shortcuts, menus, links and other buttons all have an impact on efficiency. When they are well-designed, with clearly expressed actions, less time and effort are needed for the user to make navigation and action choices. Most question banks are informative and enable the user to interact with them.

Fig. 4 Efficiency of question bank



Respondents viewed question banks generally as being efficient as shown on Fig. 4 above. Almost 50 percent of them felt it was efficient, more than a quarter said it was fairly efficient while no one felt that it was very inefficient.

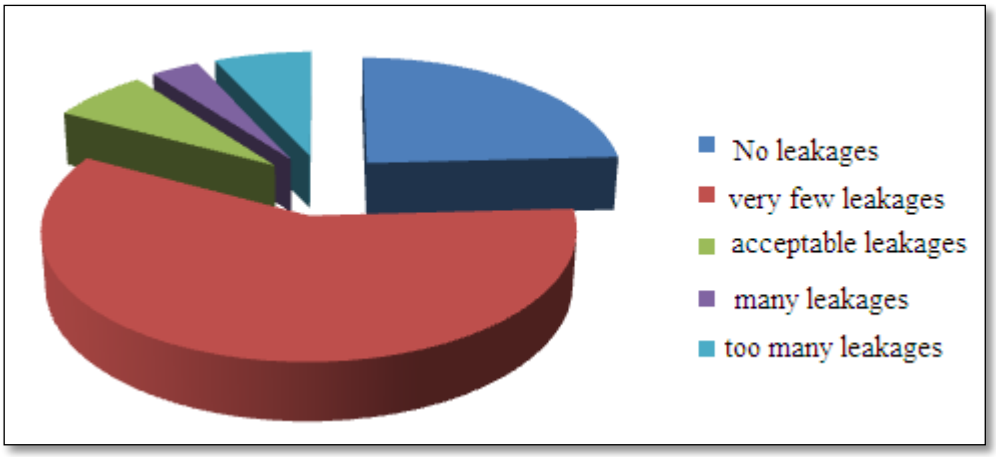
Question banks can also be assessed in terms of their ability to engage the user. An interface is engaging if it is pleasant and satisfying to use. The visual design is the most obvious element of this characteristic. The style of the visual presentation, the number, functions and types of graphic images or colours, and the use of any multimedia elements are all part of a user's immediate reaction. But more subtle aspects of the interface also affect how engaging it is. The design and readability of the text can change a user's relationship to the interface as can the way information is chunked for presentation. Equally important is the style of the interaction which might range from a game-like simulation to a simple menu-command system. Question banks have menu-command systems. At ZIMSEC the change in tasks that are brought by the user is low; however this is influenced by the change that the adoption entails. Subject Managers felt that they now had more work with the adoption of the question bank. Corrections were now the sole prerogative of the Manager. These Managers are already overworked. However when they used the system, they had very few problems with the system.

The ultimate goal is a system which has no errors. But, product developers are human, and computer systems far from perfect, so errors may occur. An error tolerant programme is designed to prevent errors caused by the user's interaction, and to help the user in recovering from any errors that do occur. Technical support is available for most question banks.

Question banks reduce leakages of papers in that as Examiners work with items, they will not see full papers. They will be working with a lot of items such that they cannot remember all of them as

what has been happening in the past. Examiners were internalising papers and then conducting workshops on the items. They are thus unable to pre maturely expose the papers. Reviewers are also unable to expose papers as they see them for a limited time before they return to the Manager's account.

Fig. 5 Leakage of papers in question bank

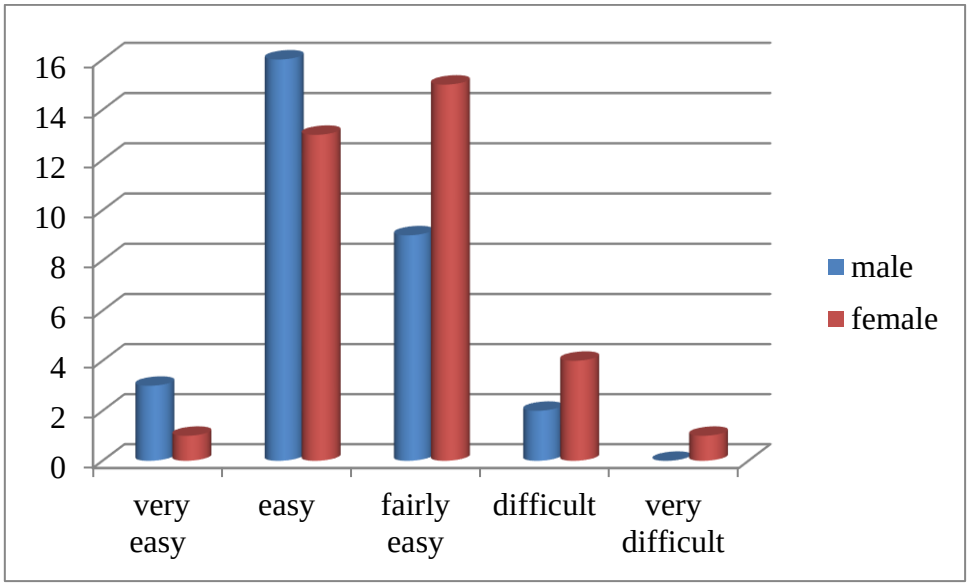


More than 60 percent of respondents felt that question banks offered security of papers. This means that people cannot access or view the question paper before examination time. An interview carried out with the Director revealed that the Directorate at ZIMSEC had migrated to question bank because they felt it was more secure in terms of hacking possibilities or data theft. The first batch of papers released from the software in November 2018 had no single incidence of paper leakages. The 7 % who felt it was very insecure had reservations with cloud as a server. They felt that it was susceptible to more hackers than a local server. The other worry was to do with the fact that it was not a local software but was developed by Stephen Austin in England who could control it if they so wished. They suggested that local software be developed by Zimsec personnel. Examinations leakage is a major challenge in most of our examination Boards. They could be reduced or even eradicate through adoption of question bank.

Question banks stores items for later use. This creates a rich bank for assessors to use. Question banks usually have trackers that can tell when an item was last used. This reduces the tendency to use the same question over and over. Tracking of question papers enables Subject Managers to use fresh items and make papers unpredictable.

The demerits of question banks are that it has high initial costs in installing internet and procurement of computers. However most assessors already have these and can just expand their use to include question bank. There is also need to train personnel in the use of the software. This for most is not a problem in that the use of technology is widespread that all it may take is familiarisation with the software. There are also costs associated with user licenses. They can be avoided by developing in-house software for use. Question banks are not suitable for curriculum that changes.

Fig. 6 Usability of question bank



Respondents in the survey did not seem to have problems in using the software as shown in **Fig.6** above. More than 70% found the question bank easy to fairly easy. A small proportion of respondents had difficulties with the software. When asked why they had problems with the question bank, it was found that these people's ability was affected by their limited computing knowledge in general. It had to do with the Microsoft Office use and not with Grademaker in particular.

Summary

There are many question banks aimed for the use of students in schools and colleges. Some banks can be adapted for assessment purposes. Where question banks are used for Educational assessment they increase efficiency, effectiveness, security and at times save money. It also reduces predictability of papers as filters can be used to safeguard constant use of the same item. However question banks are expensive. Depending on the platform they are being hosted on they may be prone to hacking. ZIMSEC Directors are skeptical of the cloud platform and tend to prefer hosting on local servers. Passwords are incorporated in order to boost security.

Recommendations

In light of the discussion above, the following recommendations can be made:-

- Educational assessment Board are encouraged to adopt the digital Question bank.
- Educational Assessors should aim at producing their own version of question banks that are cheaper to run.

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