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SURVEY ARTICLE

Readiness of Human Capital in Implementation of E-Marking of National Examinations in Malawi

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ABSTRACT

The aim of this study was to investigate readiness of the Malawi National Examinations Board (MANEB) examiners' in e-marking of national examinations and general use of technology with focus on their computer proficiency and perception. The study followed an explanatory sequential mixed methods research design and data was collected from sampled examiners through a questionnaire, a focus group discussion (FGD) and a computer proficiency assessment test. The findings show that over 90% of the participants had moderate to very high computer proficiency levels. The findings also show that both age and gender did not have any effect on the technology readiness index (TRI) of Primary School Leaving Certificate of Education (PSLCE) examiners but on Malawi School Certificate of Education (MSCE) examiners. The findings also indicate no effect of the examiners' years of marking experience on their TRI. The distribution of examiners across TRI segments shows that the number of examiners increases with the increasing order of adoption propensity. In line with this, most examiners showed positive perception of e-marking of national examinations as well as moderate to very high computer proficiency level.

Keywords: E-marking, Technology Readiness Index, Technology readiness segments

1 Introduction

Rapid innovations in information and communication technology (ICT) have changed the way organisations operate by providing advanced tools for improving efficiency and productivity as well as for achieving economic growth (Kang, Wang, & Ramizo, 2021). In that regard, examination bodies are not exceptional. As other African examination bodies such as the Zimbabwe School Examinations Council (Masiri, 2020) and the West African Examinations Council (Current School News, 2020) adopt technology to enhance their productivity and competitiveness in the way they mark examinations, it is inevitable that MANEB will follow suit.

MANEB was established by a 1987 Act of the Malawi parliament to, among others, administer PSLCE and MSCE examinations for primary and secondary schools respectively. Primary and secondary school teachers are engaged as examiners (markers) to mark the examinations (Chiwaya, 2020). The examiners usually converge at more than one marking centre. Examination scripts are transported from a warehouse to the marking centres prior to the exercise; and back to the warehouse after the exercise. At the marking centres there is also another daunting task of carrying the cartons from storage rooms to marking rooms and vice versa. This movement of huge loads of examination scripts has increased with the growing candidature over the years. For instance, the PSLCE candidature in 2010 was 190,609 (MoEST, 2010) while in 2020, it increased to 279, 084 (The Phenomenal Stevo, 2020).

The results of these two examinations feed into important national processes. The PSLCE results are used by the Ministry of Education, Science and Technology (MoEST) to select candidates into public secondary

schools (Maravi Express, 2021) whereas the MSCE results are needed for selection and enrolment of students into various universities and colleges (HEC Media, 2021; HEC Media, 2020). It is, therefore, required that the results of the examinations are released on time for the processes to take place in accordance with the academic calendar. To a large extent, delays in releasing examination results are caused by long marking periods, which go up to 4 weeks (Chakwera, Khembo, & Sireci, 2004). Any such delays in releasing examination results do affect several stakeholders. According to Nyasa Times (2013), the delay in releasing the results does also affect private schools in terms of income. The delay in releasing the 2020 MSCE results made students, parents and guardians argue that it made them fail to plan accordingly (Mia, 2021).

Like in other countries, MANEB candidates are allowed to appeal for re-marking of their MSCE examination scripts after the release of the results; and every year, MANEB receives applications from candidates who are not satisfied with their examinations results (Chafutwa, 2017). Human errors are a known cause of this challenge; and where marking is done manually, human errors cannot be avoided (Thomson, 2020).

Literature suggests that most of these problems could be solved by switching to e-marking of examinations (Thomson, 2020; Boxall, 2020). E-marking, also known as on-screen marking, is the use of education technology to mark learner assessment scripts which could be scanned scripts or online responses (Tovuti LMS, 2021). Several e-marking technologies are available which offer lasting solutions to these problems; and some of the technologies provide for online marking which allows examiners to mark without necessarily converging at one place (Boxall, 2020; Thomson, 2020).

In its 2016-2021 strategic plan, MANEB highlighted the need to adopt e-marking technologies with an aim of curbing these problems. Researchers like Napitupulu, Syafrullah, Rahim, Abdullah, and Setiawan (2018) have argued that user attitude towards technology is key to successful use of such technologies like e-marking. They pointed that positive attitude encourages users to take advantage of ICT and realise its efficacy, while negative attitude creates a barrier. However, there is no study done to assess the readiness of MANEB's human capital to adopt these technologies. Hence the need for a contextual study to understand how ready MANEB examiners are to adopt e-marking technology. Technology readiness assessment helps in informed decision-making so that uncertainty regarding technology adoption is reduced, and consequently increases the probability of successful adoption (Johnk, Weißert, & Wyrtki, 2021). Therefore, the readiness assessment of the examiners provides the necessary information required for the successful implementation of e-marking. Thus, the study was conducted to explore perceptions of prospective users of e-marking system as well as assessing their computer proficiency levels in order to establish human capital readiness gaps.

2 Research Methodology

This study followed an explanatory sequential mixed methods research design (Creswell & Creswell, 2018). Quantitative and qualitative data was collected from sampled MANEB examiners.

2.1 Study population and sampling

The study targeted 830 primary school teachers and 840 secondary school teachers. The study involved single-stage sampling procedure (Creswell & Creswell, 2018). The population was stratified based on gender; thus, names of female and male examiners were entered into different Excel sheets so that random sampling was applied on each stratum.

In a survey involving the TRI questionnaire, 270 PSLCE examiners and 271 MSCE examiners were sampled. The sample size for the survey involving the computer proficiency tool was 230 examiners. In both cases, the sample size was obtained using Slovin's formula with a confidence level of 95 percent and an error margin of 5 percent (Tejada & Punzalan, 2012, p. 129).

PSLCE and MSCE examiners who participated in FGDs were selected through purposive sampling technique (Dudovskiy, 2018). To select examiners across a broad spectrum relating to the topic of study or

with diverse characteristics, the sample included examiners who were less and more experienced, computer literate and illiterate, and of different age groups. It also included examiners with different marking speed (slow, average and fast markers). A sample size of 21 participants from each group of PSLCE and MSCE examiners was selected from the group of questionnaire respondents.

2.2 Data collection sites and methods

Data was collected from MANEB marking centres which were located in Blantyre, Zomba and Machinga districts in Malawi. The research techniques used were observations, FGDs and a questionnaire.

Data about the examiners' computer proficiency was collected through direct observations. To achieve that, a prototype of an e-marking application was developed and installed on computers which were used to assess the examiners' computer proficiency level. A computer proficiency assessment tool was used to assess computer skills like ability to enter login credentials and to use the e-marking application. Each examiner's computer proficiency level was rated on a scale with ordinal values ranging from 0 to 5, which represented very low, low, moderate, high and very high. With permission from Parasuraman and Rockbridge Associates Inc., a TRI questionnaire was used to collect data about MANEB examiners' perceptions in the four dimensions of the TRI model (Parasuraman & Colby, 2014).

FGD technique was used after the administration of the TRI questionnaire. FGDs involved PSLCE and MSCE examiners sampled from those who gave their responses on TRI questionnaires. The aim was to seek corroboration and correspondence of results from the two methods. A total of 6 FGDs were conducted, 3 FGDs involved PSLCE examiners while the other 3 FGDs involved MSCE examiners. Such a number of FGDs was chosen because as few as four FGDs are sufficient to achieve code saturation (Hennink, Kaiser, & Weber, 2019). Each FGD involved 6 to 8 participants and lasted for 2 hours. FGDs involving PSLCE examiners were held separately from those involving MSCE examiners in order to achieve sample homogeneity (Guest, Namey, & McKenna, 2017). The participants were similar with respect to profession, employment and examination level which they were responsible for. Each FGD session followed semi-structured interviews. Data was collected by recording each FGD session using a sound recorder and also by taking notes. Fictitious names were used in order to protect the identities of the participants.

2.3 Data analysis and interpretation

Statistical package for social sciences (SPSS) software was used to conduct statistical analysis of the quantitative data. To determine relationships between participants' attributes (age and gender) and their TRI scores, statistical tests on the data were conducted. Correlation analysis, independent samples t-test and Kruskal-Wallis tests were conducted. Descriptive statistics were also used to determine the participants' distribution across TRI segments. The results were presented in tables and charts for easy interpretation. Data interpretation was based on the means, standard error of the means, standard deviations, correlation analysis, independent samples t-test and Kruskal-Wallis test of the TRI scores and data about the attributes of the participants.

Qualitative data collected from FGDs was analyzed using thematic analysis procedure (Caulfield, 2019) through which audio recordings of the FGDs were transcribed into written form. The transcripts were read several times so as to ascertain the transcription accuracy and to identify core ideas. Thereafter, the core ideas were isolated and coded. After coding, themes were created by grouping several codes together. The created themes were assigned labels and then used to validate results obtained through TRI questionnaire.

3 Results

3.1 Computer proficiency level of PSLCE and MSCE examiners

Figures 1 and 2 show the proportion of the participants at each computer proficiency level. None of the participants had very low computer proficiency level. The participants' computer proficiency levels ranged

from low to very high. Incidentally, there were examiners who had never used a computer before in each category of computer proficiency level.

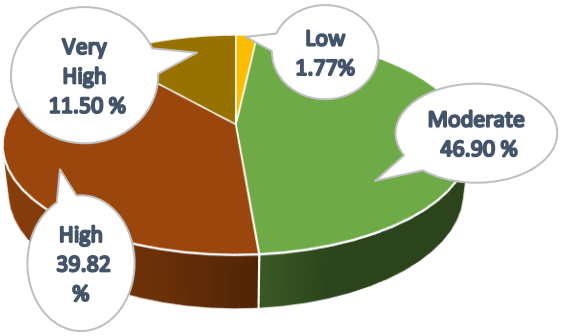

Figure 2: *Computer proficiency of PSLCE participants*

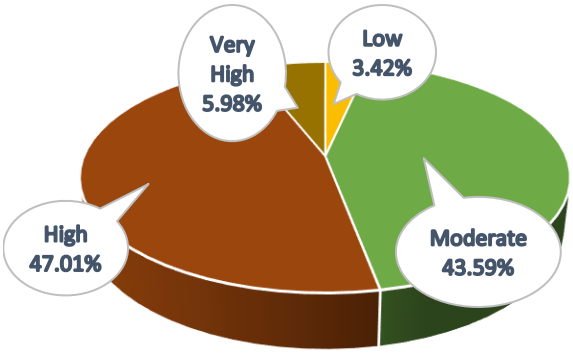

Figure 1: *Computer proficiency of MSCE participants*

In general, the findings show that 98.22% of the PSLCE participants and 96.58% of the MSCE participants had moderate to very high computer proficiency levels (see Figures 1 and 2).

3.2 Technology readiness of PSLCE and MSCE examiners and how their age affects it

The PSLCE examiners who participated in the survey had an overall mean TRI of 3.61 with a standard deviation (SD) of 0.64 and standard error (SE) of 0.04. The SD of 0.64 means that individual scores were not clustered around the mean (see Figure 3).

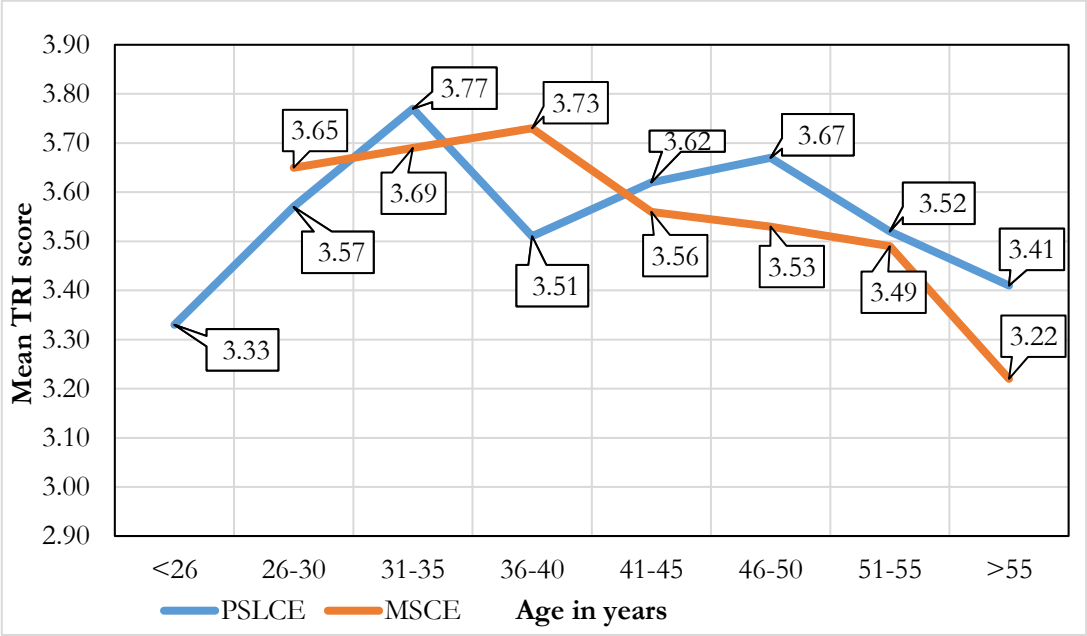

Figure 3: *Mean TRI scores of MANEB examiners against their age groups*

To determine if there was statistically significant difference in TRI scored by PSLCE examiners with respect to their age as a grouping factor, a Kruskal-Wallis test was conducted. The result of this test ($X^2(7) = 5.59$, p=0.59) showed that, at $a < 0.05$ significance level, there was no significant difference on TRI scores among the age groups.

A correlation analysis was also conducted to find out if there was any relationship between PSLCE examiners' age and their corresponding TRI scores. The Spearman's rho did not reveal any statistically significant relationship between TRI scores and age of PSLCE examiners ($r_s[270] = -0.001$, $p = 0.98$).

MSCE examiners who participated in the survey had an overall TRI score of 3.59 with an SD of 0.58 and an SE of 0.04. As can be seen from Figure 3, the scores were also widely distributed. A Kruskal-Wallis test

was also conducted and the result ($X^2(5) = 6.69$, $p = 0.24$) did not reveal any significant difference on TRI scores among the age groups. However, when a correlation analysis was conducted, the Spearman's rho, at $a<0.05$ significance level, indicated that there was a statistically significant relationship between TRI scores and age of MSCE examiners, $r_s[271] = -0.15$, $p = 0.01$.

3.3 Technology readiness of PSLCE and MSCE examiners and how it is affected by gender

The finding shows that male PSLCE and MSCE examiners had higher mean TRI scores than their female counterparts (see Figure 4).

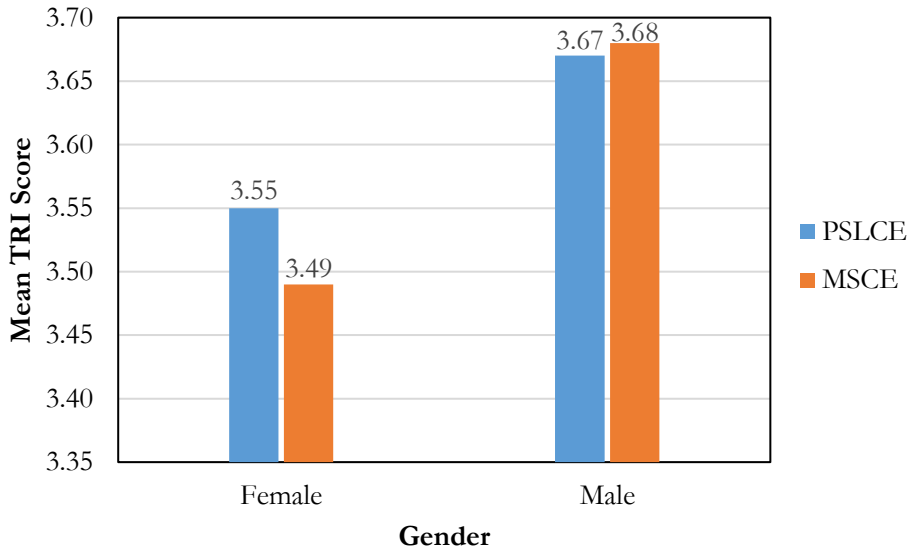

Figure 4: *The relationship between TRI scores and gender*

To determine the effect of gender on TRI scores, independent samples t-tests were conducted on data collected from PSLCE and MSCE examiners. For data collected from PSLCE participants, the result ($t(268) = -1.51$, p= 0.13), at $a<0.05$ significance level, did not reveal any statistically significant difference between the mean TRI scores for female and male PSLCE examiners. The Spearman's rho, at $a<0.05$ significance level, did also not reveal any statistically significant relationship between TRI scores and gender, $r_s[270] = 0.11$, $p = 0.08$. On the other hand, the result from independent samples t-test on the data collected from MSCE participants was $t(269) = -2.73$, p=0.007; and at significance level of $a<0.05$, the result showed that the mean TRI scores for female and male MSCE examiners were significantly different. The Spearman's rho, at $a<0.05$ significance level, also revealed that there was a statistically significant relationship between TRI scores and gender ($r_s[271] = 0.16$, $p = 0.01$).

3.4 How PSLCE and MSCE examiners perceive e-marking of national examinations

Quantitative analysis of the participants' responses to questionnaire statements about their perception of e-marking shows that 63.0% of the PSLCE examiners and 69.1% of the MSCE examiners felt they could easily adapt to e-marking while 32.9% of the PSLCE examiners and 28.8% of the MSCE examiners felt they could not easily adapt to the system. This finding agrees with what was obtained through FGDs. One of the themes was "adaptability to e-marking" and the finding shows that most PSLCE and MSCE examiners (about 66.67% of PSLCE examiners and 72.23% of MSCE examiners) who participated in the FGDs indicated that they would adapt to e-marking. The participants cited several reasons for their perceived adaptability to e-marking. In one group a PSLCE examiner said:

> *I would adapt easily because I already know how to use a computer.*

In another group, a similar response was given by an MSCE examiner who said:

> *I already know how to use a computer and with my long time experience as a marker, I hope to adapt to e-marking.*

However, about 33.33% of the PSLCE participants and 27.77% of MSCE participants felt they would not be able to adapt to e-marking because of varied reasons such as computer illiteracy and short marking experience.

The study also sought to determine whether learning to use computers to mark examinations would be fascinating. The finding shows that 62.2% of the PSLCE examiners and 67.6% of the MSCE examiners felt that it would be fascinating while 32.2% of the PSLCE examiners and 30.6% of the MSCE examiners felt that it would not be fascinating. Through the FGDs, two subthemes emerged and these were: "area of fascination" and "reason for the fascination or not". In their responses, 77.78% of PSLCE participants and 94.44% of MSCE participants indicated some areas which they felt would fascinate them while the remaining 22.22% of PSLCE participants and 5.56% of MSCE participants indicated none. One examiner said:

> *It would be quite fascinating especially marking on a computer screen instead of doing it on paper.*

The results of quantitative data analysis also show that 66.3% of the PSLCE examiners and 65.6% of the MSCE examiners indicated that using computers to mark examinations would be better than manual marking whereas 30.8% of the PSLCE examiners and 32.2% of the MSCE examiners had a contrary perception. Furthermore, 64.1% of the PSLCE examiners and 65.3% of the MSCE examiners indicated that marking examinations using computers would be safe and secure while 32.2% of the PSLCE examiners and 31.5% of the MSCE examiners had an opposite perception. From the FGDs, "E-marking versus manual marking" also emerged as a theme. This theme emerged from the participants' responses which tried to compare e-marking with manual marking. Most participants (72.22% of either PSLCE or MSCE) felt that e-marking would be better than manual marking while the remaining 27.78% of either PSLCE or MSCE participants felt otherwise. One participant argued for e-marking as follows:

> *I believe computers can do a better job but I would only fear for our jobs.*

On the other hand, another participant argued against e-marking as follows:

> *I think using computers would bring some problems. For example, some of us would not be as fast as we normally are when marking manually.*

Another theme which emerged from the FGDs was "safety with e-marking". This theme emerged from the participants' responses about their perception of e-marking with regard to general safety. From this theme two subthemes emerged: "whether e-marking would be safe" and "why e-marking would be safe or not". On whether e-marking would be safe or not, most of the PSLCE and MSCE examiners (77.78% of either group) indicated that e-marking would be safe. On the contrary, 22.22% of either PSLCE or MSCE participants felt that e-marking would not be safe. Different reasons were given by the participants to support their viewpoints. For instance, one participant had this to say:

> *We should mark exams using computers for the safety of the scripts as well as our safety. Even the current system is not safe for us as well as for the scripts. Dirty scripts make us get some diseases like coughing.*

Among other reasons, participants who felt e-marking would be better argued that it would be faster, reduce human errors and provide good marking environment devoid of dusty or dirt scripts. On the part of PSLCE and MSCE participants who perceived e-marking as not being any better than manual marking, they felt e-marking would be slow and difficult to mark open-ended answers like English compositions.

3.5 How PSLCE and MSCE examiners are comparatively distributed across TRI segments

The study categorized the examiners into five segments based on their TRI scores.

To show the distribution of the examiners across the TRI segments, the frequency percentage of the examiners at each TRI segment were calculated and the results are shown in Figure 5.

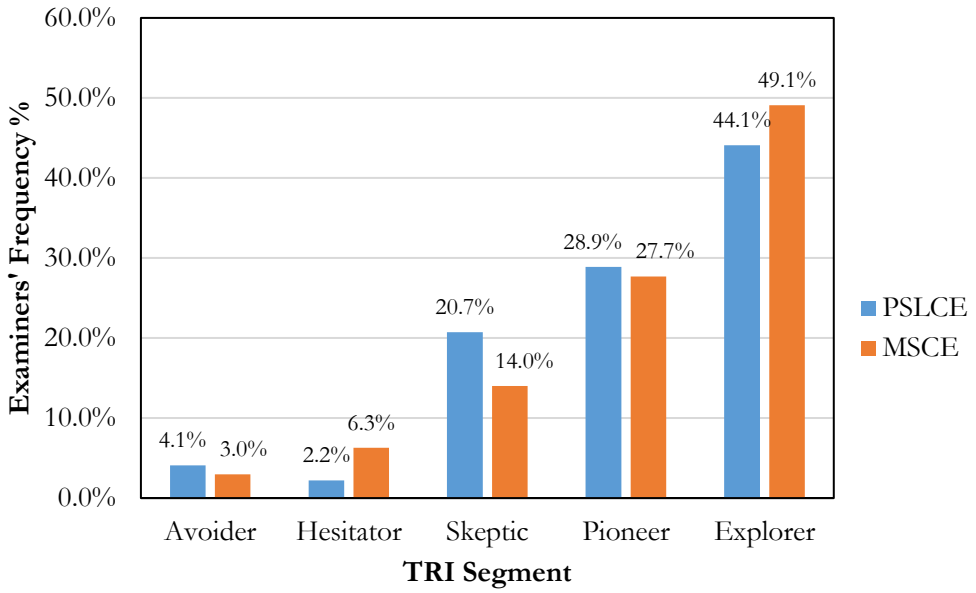

Figure 5: *Distribution of PSLCE and MSCE examiners across TRI segments*

The finding shows that there were more explorers among PSLCE and MSCE examiners than at any other TRI segment within each group (see Figure 5). Explorers and pioneers constituted a total of 73.0% of the 270 PSLCE examiners and 76.8% of the 271 MSCE examiners. The TRI segment with the least number of MSCE examiners was that of avoiders whilst among PSLCE examiners, it was the category of hesitators. Generally, the distribution showed a similar trend among PSLCE and MSCE examiners. However, there were more avoiders, skeptics and pioneers among PSLCE examiners than there were among MSCE examiners. On the other hand, there were more hesitators and explorers among MSCE examiners than there were among PSLCE examiners.

4 Discussion

The finding shows that the computer proficiency level of most MANEB examiners range from moderate to very high. Considering that some of these examiners had no prior experience with actual computers, this could possibly be attributed to the proliferation of computer related gadgets like smartphones. According to Rung, Warnke and Mattheos (2014) the use of a smartphone is an important parameter of computer literacy. It is argued that people gain some basic computer literacy through the use of smartphones which they also use for various online activities (Daily FT, 2020; Department of Census and Statistics, 2020). This agrees with Wicht, Reder and Lechner (2021) who also argue that some people acquire ICT skills through informal learning processes such as through their frequent and intensified use of ICT in everyday life. In their study about the assessment of basic computer proficiency among active internet users, Bradlow, Hoch and Hutchinson (2002) found that people who had more online experience tended to demonstrate greater computer proficiency. Considering that 655,366 households (about 2,883,610 people) in Malawi have access to the internet (National Statistical Office, 2019), it is most likely that some of the PSLCE and MSCE examiners who own smartphones use them for online activities like accessing chat rooms. Therefore, it is such online experience and other forms of ICT-related social practices (Wicht, Reder, & Lechner, 2021) which would explain how examiners without prior experience with actual computers gained their computer proficiency.

The finding also indicates that technology readiness of PSLCE examiners is the same across their age groups. This finding is similar to what Wyatt, Poon and Skinner (2021) and Rojas-Mendez, Parasuraman and Papadopoulos (2017) also found. On the contrary, the finding shows that technology readiness of MSCE examiners is not the same across the age groups. A similar result was found by Chen, Li, Liu, Yen

and Ruangkanjanases (2021); and Adams, Chuah, Bambang and Mohamed (2021). Thus, in these separate studies young participants were found to be more technologically ready than old ones. According to Makkonen, Frank and Koivisto (2017), a young individual is more likely to hold a positive view of technology and have a belief that it offers people increased control, flexibility, and efficiency in their lives. This agrees with Rose and Ogunmokun (2010) research which found that cognitive young participants in their study were more likely to be explorers with more positive feelings towards adopting technology. The study also found that cognitively older participants were more likely to be laggards and least likely to adopt technology. The willingness of old age groups to adopt technology is partly associated with having confidence in learning the technology (Berkowsky, Sharit, & Czaja, 2018). The more confident one is, in learning a technology, the more likely one will adopt it. People in old age groups may not want to use a technology that places demands on their declining abilities (e.g. vision and memory) as such demands on these weak abilities erodes their confidence in learning the technology.

The finding also indicates that gender has no effect on the technology readiness of PSLCE examiners. This result agrees with the findings by Zampetakis, Melas and Moustakis (2011) and Chen, Li, Liu, Yen, & Ruangkanjanases (2021). On the other hand, the finding shows that male MSCE examiners had higher propensity for technology than their female counterparts. Na, Lee and Yang (2021) also found that the mean scores of optimism and innovativeness were higher in men than in women, whereas that of discomfort was higher in women than in men. In what would appear as an explanation to this finding, Zagel, Süßmuth and Glomann (2014) established that females show less trust of technology and its associated service. According to Parasuraman and Colby (2014), distrust of technology inhibits one's desire to embrace and use technology as it stems from skepticism about its ability to work properly and concerns about its potential harmful consequences.

Most PSLCE and MSCE examiners who participated in this study indicated that they would adapt to e-marking of national examinations. Additionally, most of them felt that learning to mark examinations using computers would be fascinating; and also that e-marking would be better than manual marking. This is an indication that the examiners had positive perception of e-marking. According to Adelakun (2013), this positive disposition of the examiners towards e-marking of public examinations may be connected to the fact that ICT has the potentials to accelerate, enrich, and deepen skill; to motivate and engage its users in critical thinking, and contribute to radical changes in assessment. The examiners' positive perception of e-marking technology is crucial to foster its implementation and acceptance. (Khan, Vivek, Nabi, Khojah, & Tahir, 2021). Furthermore, the fact that most participants held the perception that they would adapt to e-marking gives the impression of high levels of computer self-efficacy. According to Binyamin, Rutter and Sally (2018), computer self-efficacy represents an individual's perception of his abilities to use computers to perform a task. Furthermore, computer self-efficacy determines the level of confidence and proficiency one has in one's computer skills (Ogwu & Ogwu, 2012).

This study also provides the TRI segmentation of PSLCE and MSCE examiners. Over 70% of them were found to be pioneers and explorers; and less than 10% were found to be avoiders and hesitators. A similar result was found by Lai (2008). Explorers are early adopters of technology and tend to have a high degree of motivation and low degree of resistance whereas avoiders are late adopters of technology and tend to have a high degree of resistance and low degree of motivation (Parasuraman & Colby, 2014). Pioneers are optimistic and innovative but are slightly resistant to technology (Ramírez-Correa , Grandón , & Rondán-Cataluña, 2020); and so they need little convincing to adopt technology but require more support to be satisfied (Parasuraman & Colby, 2014). Skeptics are lowly motivated and need to be convinced of the benefits of using the emerging technology (Lai, 2008). Hesitators believe in emerging technology's benefits but are held back from it because of their high level of insecurity and discomfort (Badri, Al Rashedi, Yang, Mohaidat, & Al Hammadi, 2014).

5 Conclusions

The study's findings indicate that most examiners do generally have the technological readiness required for e-marking implementation. This is evident in the fact that most PSLCE and MSCE examiners who participated in the research showed positive perception of e-marking so much that they would be eager to adopt the technology when implemented. Additionally, most examiners would be able to use an e-marking application regardless of whether they are first-time computer users. This is substantiated by the computer proficiency test results which indicate that even examiners who had never used a computer before demonstrated good computer proficiency level. The findings also indicate that an MSCE examiner's age may have an impact on the examiner's technological readiness for e-marking implementation. Thus, young to middle aged examiners would be more technologically ready than beyond middle aged examiners. On the contrary, age has no influence on the technological readiness of PSLCE examiners. The study has also revealed that gender may have a bearing on an MSCE examiner's technology readiness, that is male MSCE examiners had a higher level of technology readiness than female examiners. This effect of gender on the examiner's technology readiness was not observed among PSLCE examiners. Therefore, the study concludes that gender has no influence on the technology readiness of PSLCE examiners. On the basis of these findings, the study recommends that negative perceptions about e-marking should be sorted out through perception management which involves skills training as a critical component to enable people get over the fear factor. During implementation, the training of e-marking prospective users should be as fascinating as possible so that the trainees learn all the required skills. Before e-marking implementation, the study recommends further research to determine the sustainability of any chosen e-marking technology considering that none of these technologies is locally produced.

6 Declarations

6.1 Study Limitations

The computer proficiency assessment procedure involved the method of observation, and as such the findings could not be generalized to the rest of the examiners. However, with the use of the Slovin's formula to obtain the number of participants and the random sampling technique, the findings still gave a picture of the whole population.

6.2 Informed Consent Statement

All the participants were furnished with all necessary information about the study including its purpose, procedures and benefits. They were accorded an opportunity to participate voluntarily or opt out without any duress. They were also informed of how the study would take care of their confidentiality.

6.3 Data Collection Approval

Permission to collect data from examiners was sought from the Executive Director of MANEB; and all MANEB rules and regulations were adhered to throughout the data collection, analysis and reporting.

6.4 Competing Interests

The authors declared that no conflicts of interest exist in this publication.

6.5 Publisher's Note

AIJR remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

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