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Online Quizzes as a Teaching and Learning Tool: Perceptions of Bioscience Students

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ABSTRACT

The COVID-19 pandemic has caused a major change in the delivery of knowledge and assessment practice worldwide and currently, a web-based formative online assessment has become the key feature in the teaching/learning process. This form of assessment arose due to the limitations of paper-based formative assessments in terms of delayed and inadequate feedback. Although online formative assessments have a sound theoretical basis in higher education settings, data to establish their educational benefits are still lacking. Thus, this study was conducted to identify biomedical students' perceptions on the significance of online quizzes towards enhancing their understanding of the subject taught. The researchers developed a suitable questionnaire based on the Technology Acceptance Model (TAM) using Likert scale-type questions to capture the perceptions of Biomedical Science degree students on the use of online quizzes. The quantitative data was then analyzed using SPSS version 23. The findings from the research shows clear evidence that the respondents' have an overall positive view on the perceived usefulness of the use of online quizzes with responses ranging from 58.8% to 90.2%. The findings on perceived challenges were enlightening as the respondents' highlighted those technical difficulties and accessibility to hardware and software were among the challenges faced most. The researchers are assured that online quizzes are perceived positively by the respondents' and it is advocated that they are used more extensively in the teaching and learning at institutions of higher education.

Keywords: online quizzes, teaching and learning, formative assessment, biomedical sciences, perceptions, Technology Acceptance Model (TAM)

1. INTRODUCTION

The emergence of the COVID-19 pandemic has created a paradigm shift in the teaching and learning process globally. Like many other countries around the world, the Movement Control Order (MCO) was enforced to flatten the curve of the spread of Covid-19 in Malaysia. The restrictions which were induced abruptly compelled many universities to shift from in-person to blended and/or total online modes of delivery (Mutseekwa &

Mudavanhu, 2021). This was done to adhere to the Ministry of Higher Education's announcement that all public and private universities in Malaysia are to conduct teaching and learning activities via online learning (MOHE, 2020). As a result, online education became the centre of attention recent years, especially during the Covid-19 pandemic and educational institutions have been forced to transit into fully online education within a short period of time (Kaur & Singh, 2020). Despite this, the academic fraternity were very resilient, quick to adapt and proactive

in overcoming the challenges presented by MCO (Chung, Subramaniam & Dass, 2020). Chung, Subramaniam & Dass (2020) went on to add that although it is undeniable that online learning is deemed the best solution to ensure continuity in learning in the era of what has been coined the “new norm”, there may be some setbacks due to lack of human touch such as sensing students’ incomprehension via facial expressions, cracking small jokes to enlighten mood, student engagement and interaction which can be done more effectively in traditional face to face learning. These setbacks had the most significant impact on health professions’ education (HPE). HPE is a separate domain of higher education that emerged in the 1960s with the responsibility to society to produce competent practitioners trained to work in a health or health-related fields (Blouin, 2022). According to Krishnapillai et al. (2022), there is a dearth of evidence covering the impact of the COVID-19 pandemic on higher education in Malaysia. He asserted that previous studies merely explored students’ perception (Sababathy et al., 2021), the efficiency of e-learning (Nordin and Nordin, 2020), and university employees’ well-being (Daud et al., 2020) during the pandemic and there are no evidence of research focusing explicitly on the challenges faced by HPE establishments in Malaysia. However, he identified that similar studies have been undertaken in other settings, including higher income countries where resources and familiarity with e-learning approaches such as the studies of Alrasheedy et al. (2021), Alsouf et al. (2020), Azlan et al. (2020), Azman and Abdullah (2021), Chowdhury et al. (2022), Dhawan (2020), Etando et al. (2021) and Sharma et al. (2022).

It must be noted that the paradigm shift in the teaching and learning process as a result of the pandemic did not only apply to online delivery of knowledge but also to the assessment processes. The digital world has given more opportunities for educators to be innovative with a variety of digital tools and the pervasive availability of information anywhere anytime. Furthermore, there is a tremendous capacity to creatively employ a diversity of assessment approaches to support and evaluate student learning in higher education (Boitshwarelo, Reedy & Billany, 2017). The use of technology both in the teaching and assessment of students has led to the popularity of the new term called blended learning which is dominant in the educational arena. According to Valiathan, (2002) the term blended learning is used to describe a solution that combines several different delivery methods, such as collaboration software, Web-based courses, Educator Performance and Support System (EPSS) and knowledge management practices. She went on to add that blended learning is also used to describe learning that mixes

various event-based activities, including face-to-face classrooms, live e-learning, and self-paced learning. Over the years, the terms blended learning and hybrid learning are used interchangeably and without a broadly accepted precise definition. However, Bonk and Graham (2012) described blended learning systems as a combination of face-to-face instruction and computer-mediated instruction. The development of blended learning parallels the development of online assessments. According to Ramsden, (1992) assessments have powerful effects on learning, and they went on to distinguish formative assessments from summative assessments. Michael Scriven (1967) has been often cited for first introducing the terms formative vs. summative methods when evaluating education curriculum. According to Frick (2021), these methods of evaluation are distinguished by their purpose where formative evaluation is used to improve teaching during its development whereas summative evaluation is used to determine its merit or worth when that development is completed. They assert that formative assessments are designed to give feedback on performance and suggestions for improvement and are intended to promote students’ learning where timely, relevant, and supportive feedback is provided to improve learning outcomes while in contrast, summative assessments are predominantly utilized for grading and certification at the end of a period of study, often without providing feedback to students on their performance (Rolfe & McPherson, 1995; Gipps, 2005).

Online formative assessments have a sound theoretical basis and are prevalent in higher educational settings, but data to establish their educational benefits are lacking. According to researchers (Zakrzewski & Bull, 1998), an online learning environment embedded with formative assessment tools presents key benefits. Among these are the timing is flexible to allow students to take the assessment at any time convenient to them but within a deadline, students can have several attempts at the assessment until they achieve the desired minimum grade and online formative assessment provides students with prompt feedback needed to assess their learning and remedy weaknesses in instruction and their learning (Wang, Wang, Wang & Huang, 2006; Zakrzewski & Bull, 1998). This is further supported by Noyez (2004) who said that past researches have shown that online assessments can reduce the “lag time” in reporting scores, increase the efficiency of assessment, achieve flexibility in terms of time and place, give immediate feedback and announce students’ scores immediately, analyse student performance that cannot be investigated from paper-based tests by implementing individualized assessments customized to student needs and minimize the paper

consumption and cost as well as duplicate or mail test materials. Velan et al. (2008) carried out research to identify whether participation and performance in integrated online formative assessments in the biomedical sciences have measurable effects on learning by junior medical students. Their research results support the contention that well-designed formative assessments can have significant positive effects on learning. According to Barnard and Mostert (2015), continuous formative assessment with timely feedback helps motivate students to work consistently, while the addition of just-in-time support may further motivate and support learning. Information and communication technologies have the potential to reduce the administrative burden of frequent formative assessment and enhance the provision of timely feedback. Assessment feedback has now become a topic of growing interest amongst lecturers as well as teaching and learning scholars, especially in Australia and the United Kingdom (Li & De Luca, 2014). Many researchers in the past have attributed this interest to the high rates of student dissatisfaction with the quality, quantity, and speed of feedback on written assessments which is a widespread and long-standing issue in universities in these countries (Bailey, 2009; Goel & Ellis, 2013). Thus, in current times, one of the major weaknesses of most modern higher education programs, as evidenced by course evaluation surveys is the failure to provide adequate feedback to students on their learning (Gibbs & Simpson, 2005). To cater to this weakness, over the years the use of Computer Assisted Assessment (CAA) has been increasing.

Research has proven that advances in Information and Communication Technology (ICT) offer lecturers new means of administering, collecting, marking, and returning feedback to undergraduate students (Espasa & Meneses, 2010; Gikandi, Morrow & Davis, 2011; Yeh & Lo, 2009). Niroula (2021) asserted that many studies (Junco et al., 2011; Guzacheva, 2020; Rani, 2017; Mikre, 2011) have adequately illustrated that online tools have assisted in the teaching and learning to a great deal during the COVID-19 pandemic. According to Özden, (2005) computer-assisted assessment (CAA) encompasses a range of activities, including the delivery, marking, and analysis of all or part of the student assessment process using stand-alone or networked computers and associated technologies. Bull and McKenna (2001) had shown in previous research that there is a range of motivations for implementing CAA in a course; to increase the frequency of assessment, motivate students to learn and encourage skills practice, to broaden the range of knowledge assessed, to increase feedback to students, to extend the range of assessment methods, to

increase objectivity and consistency, to reduce marking loads and to aid administrative efficiency. According to pre-service teachers, there were many advantages of carrying out online formative assessment activities such as allowing students to receive feedback to improve their performance (Yilmaz, 2020). Productive formative assessment activities increasing students' motivation depend on providing opportunities for students in obtaining feedback instead of points (Shepard, Penuel & Pellegrino, 2018). According to Wallihan et al. (2018) besides helping in content retention, formative assessment through quizzes can benefit both learners and teachers in several ways such as learners can identify areas of weakness and become accustomed to the exam timing and format while teachers can assess the efficacy of curricula and instruction methods, as well as identify learners who may be struggling or at risk for failure, allowing early, targeted intervention

According to Towle (1998), the encroachment of Information Technology (IT) in the past decade forced radical changes in health care delivery and patient-oriented care around the globe. These progressions resulted in worldwide amendments of pharmacy curricula and teaching methodologies to meet the increasing demands of an advanced IT-based healthcare system (Masys, 1998). This progression has also led to it being used for assessing students in these fields. Feedback on assessments is central to formative learning in higher education. According to Olson, (2015) advances in e-learning and e-marking has the potential to improve teaching and learning. Further, current research has also found that students perceive the use of multiple-choice quizzes, true/false quizzes, matching quizzes, gap-filling quizzes, e-portfolio, peer assessment, wikis, weekly assignments, offline assignments, essay type assignments, reflection, and database type assignments as effective tools of formative assessment in online learning settings (Ogange et al., 2018).

Past literature has also shown that online assessment or e-assessment can improve the procedure and method of assessment as it has the advantages of timesaving, immediate feedback, better use of resources and more efficient and convenient recording of assessment performance (Morris, 2008; Chen, Wei & Huang, 2009). Sorensen (2013) researched the Department of Chemical Engineering at University College London (UCL) into the use of e-assessment in a second-year module and, in particular, the student perceptions of this mode of assessment. The findings showed that the students felt that e-assessment added value to their learning, and they would like to see it implemented in other modules.

Although the quizzes designed in his study were intended to be mainly beneficial to the weaker students as they allowed them to go over key aspects of the material in their own time, the findings revealed that the stronger students were even more in favour of e-learning than the weaker students.

Dermo (2009) conducted a survey of a cohort of 130 students from several disciplines at the University of Bradford, who had taken part in an online assessment, either formative or summative, during the academic year 2007–2008 to gauge student opinion and the results showed that the most positive aspect of e-assessment in the eyes of the students was the benefits it can bring to learning and teaching. However, the findings showed that the students had concerns about fairness in the use of random questions from a question bank.

Concerning studies on the use of technology in teaching and learning, a model called Technology Acceptance (TAM) has emerged. In the TAM model, people who perceive technology as useful and easy to use will accept it more readily than those who do not, with usefulness more important than ease of use (O'Donnell, Molyneaux & Gibson, 2010). TAM was initially proposed by Davis (1989, 1993). It comprises two beliefs, the perceived utilities and the perceived ease of application which determine attitudes to adopt new technologies (Ordanini & Arbore, 2008). The attitude toward adoption will decide the adopter's positive or negative behaviour in the future concerning new technology (Wagner, & Klaus, 2009). TAM can be said to be one of the pioneering theories which aim to determine the behaviours of users towards particular technologies by employing two factors: perceived usefulness and perceived ease of use (Sezgin, & Yildirim, 2016). It is one of the most frequently employed models for research into new information technology acceptance. The TAM suggests that when users are presented with new technology, several factors determine their decision about how and when they will use it.

Among the key elements identified in the TAM model are perceived usefulness and perceived ease of use. These two beliefs (perceived usefulness and perceived ease of use) predict attitudes, which in turn influence the intended use of a technology (Mahfouz, 2009). This intention then consequently impacts the behaviour of actual system usage. Perceived usefulness is the degree to which a user thinks a technology would enhance performance or productivity in the study or workplace while perceived ease of use is the degree of lack of effort required by the user in adopting a given technology (Su, 2006).

According to Thandavaraj, Gani and Nasir (2021), past studies on online learning have determined that students are affected psychologically and show symptoms of depression and anxiety but there are many studies that have also presented opposite results. Further, past researchers have also identified that usage of online quizzes has been increasing since blended learning approaches came into existence in the field of teaching and learning in the 21st century. As noted, one of the advantages of online quizzes is their effectiveness as an assessment tool. As a result, numerous studies have been carried out to evaluate how using this tool enhances teaching and learning. Despite the increase in the use of computer-based assessments, research is lacking on students' perceptions of online assessments. Thus, this study examined students' perceptions of the use of online quizzes in the teaching and learning of Biomedical Sciences and to achieve this objective, the researchers adapted the TAM model to design their survey questionnaire.

2. MATERIALS AND METHODS

In this section, the materials and methods used in the research are discussed. A quantitative research method adopting an online survey was used to achieve the research aim which was to investigate students' perceptions of online quizzes in the teaching and learning of their courses and this was done using an online questionnaire. The researchers developed a suitable questionnaire based on the Technology Acceptance Model (TAM) developed by Davis (1989) which was further improved by various other researchers. A Likert scale-type questionnaire was used in this study to capture the perceptions of students accurately. The questionnaire for the students had two parts: demographic questions and perceptions of online quizzes in enhancing their learning. The perceptions' part was divided further into five sub-sections, namely perceived usefulness, perceived ease of use, perceived values, perceived challenges, and perceived intention for use. Using the original TAM Model of Davis (1989) as shown in Figure 1, and subsequent development to the model, the researchers designed the online survey questionnaires as indicated in Table 1.

The questionnaire was prepared using online Google form and was distributed to the students via email. The respondents comprised of Biomedical Science students from Year 1 to Year 4 in a private higher educational institution in Malaysia. All the responses were captured in real-time and subsequently, the data was extracted and analysed. The quantitative data were analysed using

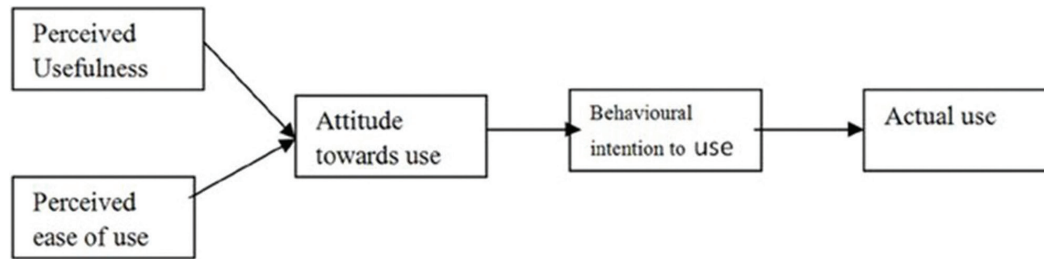


Figure 1. The Original Technology Acceptance Model TAM (Davis, 1989)

Table 1. Survey Questionnaire

PERCEPTIONS	SURVEY STATEMENTS
1. Perceived usefulness	1. Improves my learning process. 2. Acts as a self-check tool on my level understanding. 3. Improves my independent learning skills. 4. Improves my time management skills. 5. Gives me greater control over my learning process. 6. Makes my learning and revision process easier. 7. The content is informative. 8. A useful learning tool
2. Perceived ease of use	1. Provides flexibility and convenient to learn at my own pace. 2. Helps develop digital literacy skills. 3. Appropriate types of questions were used. 4. Immediate feedback system is very useful for me. 5. User friendly and simple to perform. 6. Instructions are clear and unambiguous. 7. Lecture notes and materials available online prepared me well for the quiz. 8. The timing was appropriate for the activity.
3. Perceived values	1. The activity was beneficial 2. Increases my confident level. 3. Fun and attractive. 4. Cost saving. 5. Promotes green technology.
4. Perceived challenges	1. Technical difficulties were experienced. 2. Need access to both hardware and software. 3. It may create room for cheating. 4. Limited type of questions were asked. 5. Tests only memorizing skills rather than application.
5. Perceived intention for use	1. I can use online quizzes to assist my learning. 2. I prefer to have my online quizzes graded.

SPSS version 23. Before this, the students had undergone online quizzes in various courses throughout their years of study in the institution. These quizzes were all conducted using the university's Moodle platform. The data collection was carried out after the necessary ethical clearance from the institution and survey respondents were obtained.

the use of online quizzes in the teaching and learning in their Biomedical Science degree program. The findings indicate that a majority of the respondents were females 86% (n=88) while the remaining 14% (n=14) were males. About the ages of the respondents, the findings indicated that they ranged from the age of 17 to 26 with a mean age of 20.55. The demographics of the respondents are shown in Table 2 and Table 3.

3. RESULTS AND DISCUSSION

This section will discuss the findings from the analysis of the data collected via a Google questionnaire. The discussion presents the demographics of the respondents including their gender, age and year of study. This is followed by a detailed discussion on their perception of

3.1. Perceived Usefulness

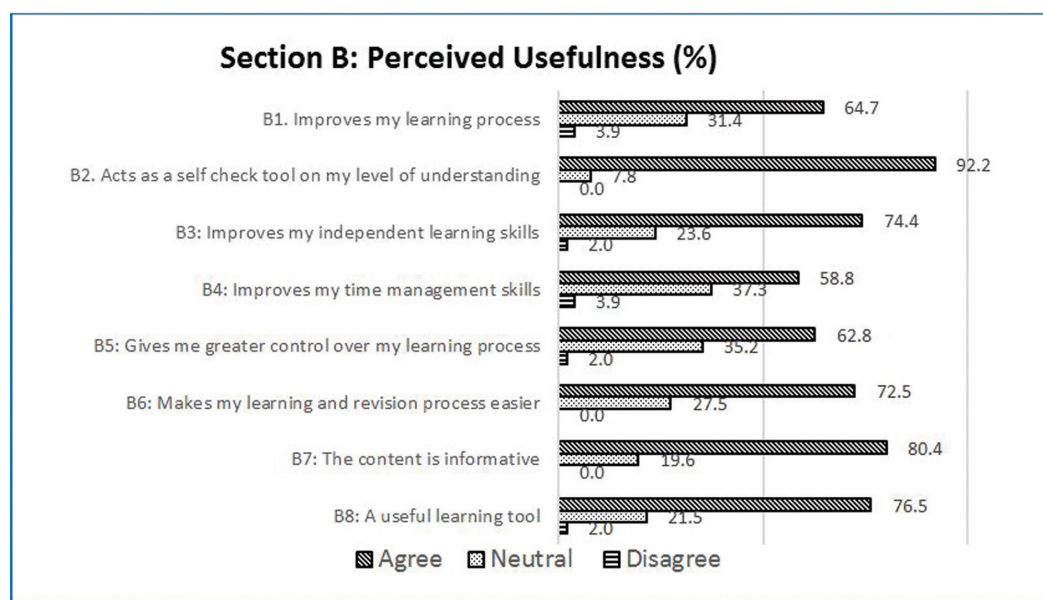
To gain insight into the respondents' perceptions of the usefulness of online quizzes, eight statements were given to them where they were required to agree, disagree, or take a neutral stand. The statements are

Table 2. Gender Distribution of Respondents

Gender	Frequency	Percentage
Male	14	86.3
Female	88	13.7
Total	102	100.0

Table 2. Year of Study of Respondents

	Frequency	Percentage
Year 1	42	41.2
Year 2	30	29.4
Year 3	28	27.4
Year 4	2	2.0
Total	102	100.0

**Figure 2.** Perceived Usefulness of Online Quizzes

shown in Figure 2. Of these eight statements, Statement B2 (Online quizzes acts as a self-check tool on my level of understanding) reflected the highest percentage of agreement (92.2%) while statement B4 (Online quizzes improves my time management skills) reflected the lowest percentage of agreement (58.8%). Su (2006) agrees that online learners should be assessed formatively with self-check quizzes, serving to inform future learning experiences. A correlation test between the year of study of the respondents and the eight statements of perceived usefulness indicated that only four statements (B4, B6, B7 and B8) had a positive correlation ($p < 0.05$). Past studies have also highlighted the benefits of online quizzes and students' positive attitude towards them (Cohen & Sasson, 2016; Wallihan et al., 2018) including improving student motivation, enhancing understanding and active learning, and deterring cheating, as long as the quiz questions are not too easy (Cook & Babon, 2017).

3.2. Perceived Ease of Use

Figure 3 portrays the findings of the respondents' perceived ease of use of the online quizzes. The highest

percentage of agreement (88.2%) is seen for Statement C5 (Online quizzes are user friendly and easy to perform) while the lowest percentage of agreement (64.7%) was seen in State C2 (Online quizzes help develop digital literacy skills). The user-friendliness which is mainly attributed to the Moodle platform used is supported by many researchers (Dougiamas, 2004; Kaminski, 2005). A positive relationship was seen between the year of study of the respondents and two out of eight statements of perceived ease of use (C4 & C7) with a significance value of $p < 0.01$ and $p < 0.05$ respectively in the bivariate correlation test that was carried out.

3.3. Perceived Value

The findings for the respondents' perceived values of online quizzes are shown in Figure 4. Both statements D2 (Online quizzes increase my confidence level) and D6 (Online quizzes promote green technology), reflected the highest percentage of agreement (90.2%) while the lowest percentage of agreement (58.8%) was seen in Statement D1 (The activity was beneficial). The correlation test carried out indicated that Statement D1

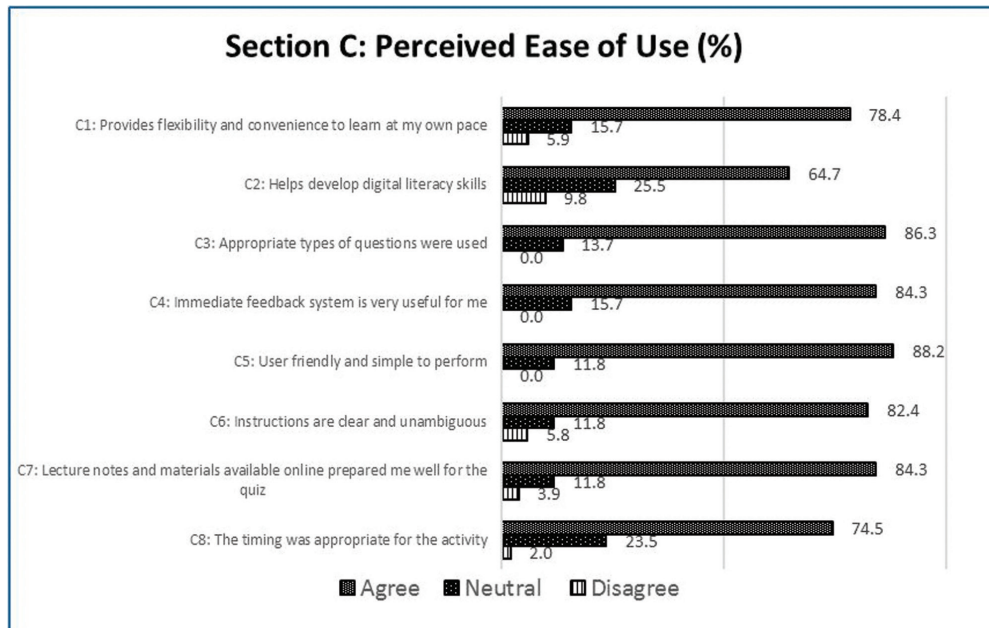


Figure 3. Perceived Ease of Use of Online Quizzes

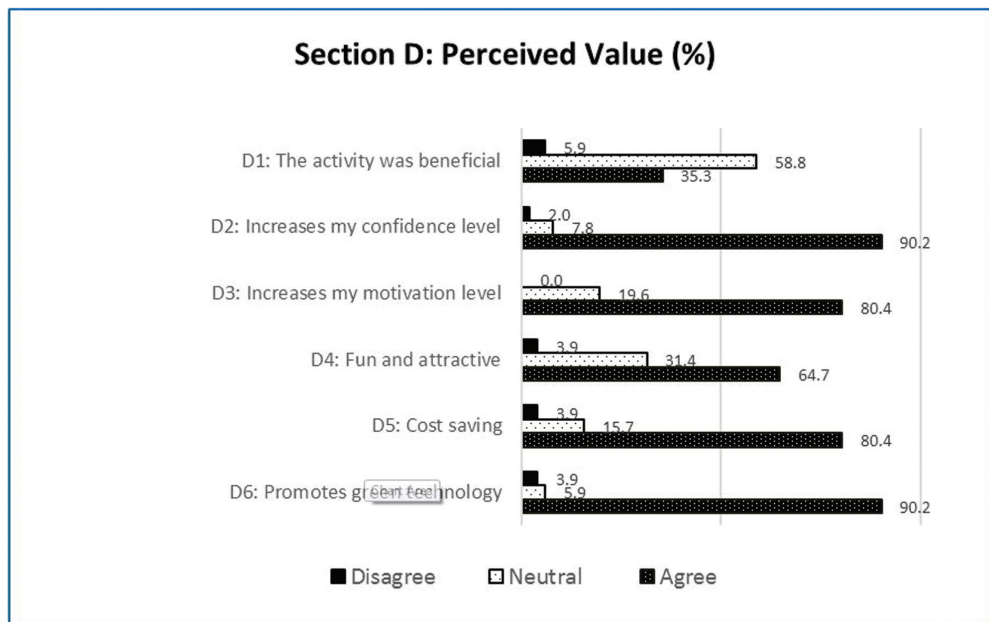


Figure 4. Perceived Value of Online Quizze

has a significant relationship with the year of study. The findings for statement B1 on motivation is supported by past literature where it has been stated that effective use of formative assessment can aid undergraduate online instruction in ways that improve student confidence (Ogange et al., 2018).

3.4. Perceived Challenges

Figure 5 shows that out of the five statements given on perceived challenges, Statement E1 (Technical

difficulties were experienced) reflected the highest percentage of agreement (60.8%) while statement E5 (Online quizzes tests only memorizing skills rather than application) reflected the lowest percentage of agreement (35.3%). A study by McBrien, Cheng & Jones (2009) also found that students rated convenience and technical issues as important elements in their online learning experiences. Similarly, according to Hickson et al. (2022), one problem mentioned consistently by all participants in his study was in regard to poor internet connectivity. He claimed that the participants had asserted that it did not only affect their learning

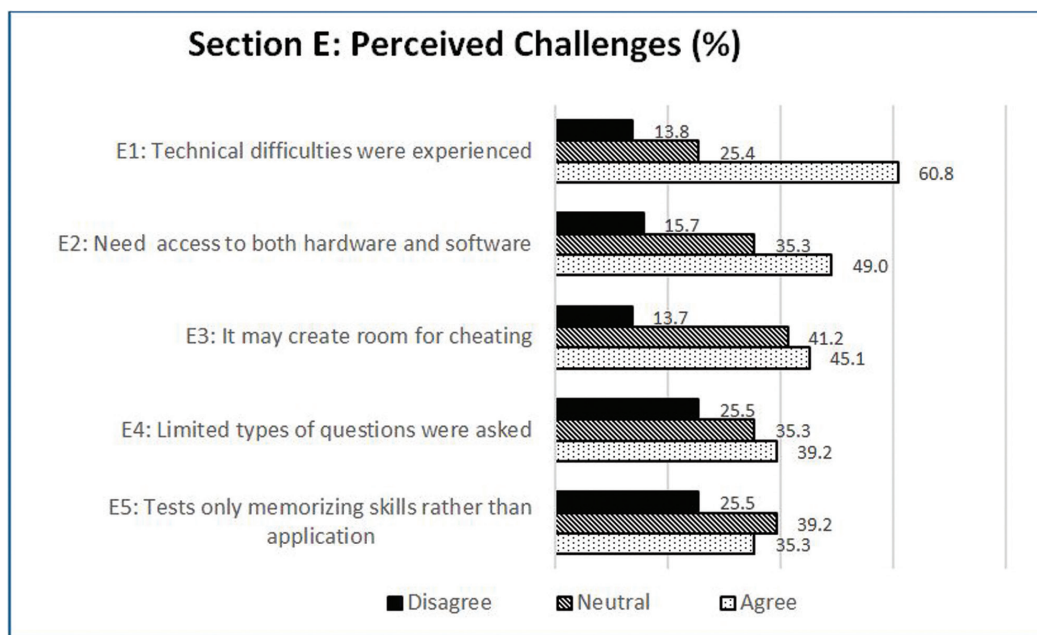


Figure 5. Perceived Challenges of Online Quizzes

but also their ability to interact with their fellow classmates. Further, Hickson also stated that the findings of his study revealed several instances where technology which intended to facilitate online learning has either failed to meet its intended purposes or, worse, has inhibited learning. It must be noted that I correlation test did not show any relationship between the year of study and respondents' perceived challenges.

3.5. Perceived Intention for Use

Findings from Subsection F on the perceived intention for use indicated that Statement F1 (I can use online quizzes to assist my learning) had the highest percentage of agreement of 80.4% while statement F4 (I prefer to have my online quizzes graded) recorded the lowest percentage of agreement (45.1%). The correlation test indicated a relationship between the year of study and the perception of respondents on Statement F4 with a significance at $p < 0.05$. Statement F5 of this subsection which required respondents to select their most preferred online activity indicated that 50.0% of the respondents' preferred online quizzes over other activities such as discussion forums, social media (e.g., Facebook groups) and online games. However, an interesting finding from this research was that 30.4% of respondents selected online games as their preferred activity. As research in the area of gamification in the teaching and learning of sciences is still scarce, this provides an area for future research.

4. CONCLUSION

The findings from the research shows clear evidence that the respondents' comprising of Biomedical Science degree students have an overall positive view on the perceived usefulness of the use of online quizzes with responses ranging from 58.8% to 92.2% of agreement. In the case of perceived ease of use of online quizzes, the respondents' agreed to a large extent, ranging from 64.7% to 88.2%. In reference to perceived value, the responses were also positive ranging from 58.8% to 90.2%. The findings on perceived challenges were enlightening as the respondents' related technical difficulties and accessibility to mostly hardware and software issues. Thus, as a conclusion, the researchers are of the opinion that online quizzes are perceived positively by the respondents, and it is advocated that this type of assessment is to be used more extensively in the teaching and learning of Biomedical Sciences at institutions of higher education. However, these findings are not conclusive due to the small sample and as such, it needs to be verified with future studies involving larger samples from diversified institutions and countries. Further, the researchers are of the opinion that to enhance the effectiveness of this technology-based learning tool, it is crucial that the institutions address the challenges faced by the respondents. Future research should also look at lecturers/teachers' perceptions of the use of this tool. This will provide a more comprehensive understanding of the effectiveness of online quizzes which will in turn ensure that the application is managed efficiently to provide better outcomes for both the learners and the

educators. In addition, the authors also advocate that besides online quizzes, other online assessment methods such as Kahoot, Padlet, Socrative, and Google forms can be used to evaluate the efficacy of the teaching and learning processes.

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7. Declaration of Conflicting Interests

The authors declare no potential conflicts of interest with respect to the research, authorship and/or publication of this article. This article is the sole work of the authors and has not been presented or published elsewhere.

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