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Open-book-based Assessment during COVID-19: Challenges and Opportunities

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Abstract. Open-book examinations (OBEs) are one of the assessment practices that have become a recommended practice at the University of Technology and Applied Sciences – Al Rustaq (UTAS-Rustaq, Oman) as a result of COVID-19. Views of effective assessment practices and students' intake of them have been an ongoing discussion in education while students' engagement and the place of higher-order thinking skills in assessment have been revisited over the decades. This exploratory study investigates the affordances and challenges of the use of OBEs from students' and teachers' perceptions at UTAS-Rustaq, Oman. It aims to address the following research questions: (a) What is the participants' definition of OBEs? (b) What are the benefits and challenges of OBEs from students' and teachers' perspectives? (c) How can OBEs be used effectively in the future? To achieve the aim, the views of 93 students and 23 teachers in the various majors at UTAS - Rustaq, including English, Mathematics, Biology and Chemistry, were investigated by means of questionnaires and interviews. The findings indicated that teachers and students had a shared understanding of the characteristics of OBEs and highlighted some factors such as the use of resources that can promote or hinder the effective implementation of OBEs. The findings of this study have the potential to inform the college stakeholders to raise awareness of, provide training in, and gradually implement OBEs.

Keywords: open-book examination; online assessment; learning; education; digital transformation

1. Introduction

Concerns regarding the effectiveness of assessment practices and tools are not new, especially considering their significant impact on the teaching and learning process. These concerns have been amplified by the shift towards online learning in 2020, which raised questions about the efficacy of closed-book examinations (CBEs) as an online assessment method. Specifically, the focus on lower-order

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thinking skills such as memorization, comprehension, and application, while overlooking higher-order thinking skills such as analysis, evaluation, and creation, has been a point of concern (Feller, 1994).

Additionally, the remote administration of CBEs has led to issues of cheating and plagiarism due to ineffective invigilation techniques, resulting in unreliable results (Yazici et al., 2023). To address these concerns and promote deep and active learning, teachers have shifted towards open-book examinations (OBEs). These allow students to refer to their course materials and notes when answering examination questions (Gray, 1994; Kaur, 2016; Swart & Sutherland, 2014; Vidya, 2019). This approach emphasizes higher-order thinking skills such as evaluation, problem-solving, and knowledge application, rather than mere memorization.

Despite OBEs being an established concept in assessment, they are not widely adopted or implemented in the classroom, while there is a lack of trust from academics and students, especially when there is insufficient training on their use. However, during the 2020 pandemic, the University of Technology and Applied Science (UTAS) in Rustaq instructed academics to incorporate OBEs alongside different forms of examinations, moving away from memory-driven assessments. Various assessment methods and tools were suggested, including individual and pair interviews, presentations, and performance-based assessments such as microteaching.

The aim of this research is to investigate the views of UTAS - Rustaq teachers and students regarding the effectiveness, opportunities, and challenges associated with OBEs during COVID-19. The research is guided by the main question and sub-questions. The main question of the research is:
What are the views of students' and teachers' at the UTAS - Rustaq regarding OBEs?

The sub-questions are:

1. What is the participants' definition of OBEs?
2. What are the benefits and challenges of OBEs from both students' and teachers' perspectives?
3. How can OBEs be used effectively in the future?

In order to examine this issue, theoretical underpinnings of constructive learning and students' engagement guided the design of the survey questionnaire for teachers and students. Following this, the benefits and challenges of OBEs from the participants' viewpoint are discussed according to what has been reviewed in the literature, highlighting the gaps in research. Finally, conclusions and implications were drawn from the research study in order to improve the current assessment practices at UTAS - Rustaq in Oman.

2. Literature Review

This section reviews the literature relating to OBEs, starting with the theoretical underpinning of OBE, its benefits and challenges. It concludes by highlighting the gaps in research.

2.1 OBEs from Constructivism Perspective

For decades, learners were regarded as passive recipients of knowledge, with their main role being the memorization of content presented by teachers (Bonder, 1986). This approach neglected deep learning and creativity, resulting in a lack of transferable skills to new learning contexts (Dagar & Yadav, 2016). Consequently, the behaviourist view of passive learning was logically replaced by constructivism, which emphasizes that knowledge is constructed by learners within supportive learning environments (Bonder, 1986). According to constructivist theory, learners actively construct knowledge by drawing upon their previous knowledge and skills in socio-cognitive learning environments.

This constructivist approach to teaching and learning is believed to yield better outcomes, such as preparing learners for future roles as teachers (Dagar & Yadav, 2016). Education has evolved through the adoption of constructivism, shifting the focus from content memorization to knowledge acquisition. Learners have become more creative and perform better in examinations (Dagar & Yadav, 2016). As constructivism discourages rote memorization, assessment practices should also prioritize meaningful learning. Dagar and Yadav (2016) suggest that assessments in constructivist classrooms should include real-life tasks that require students to solve problems independently. Such tasks are found in authentic formative assignments as well as open-book examinations.

Open-book examinations (OBEs) contribute to meaningful learning by enabling learners to construct their own understanding of the subject, making learning meaningful and applicable for immediate and future use. This aligns with the ultimate objective of education (Karagiannopoulou & Entwistle, 2013; Sam et al., 2020).

2.2 Benefits and Affordances of OBEs

The COVID-19 pandemic has served as a catalyst for changes in pedagogical and assessment practices, including the adoption of OBEs as a valid and reliable method of assessment. The use of OBEs can be traced back to the 1930s when Stalnaker and Stalnaker (1934) first implemented them and reported their findings. Their successful implementation of OBEs as effective assessment methods inspired other researchers and teachers to utilize them.

Related literature has highlighted several benefits of OBEs on cognitive skills, such as enhancing various cognitive abilities and promoting deeper learning. The OBEs actively engage students in critical thinking, analysis, synthesis, and evaluation of information, including assessing relevance and credibility (Gupta, 2007). For example, Vidya (2019) investigated medical students' perceptions of OBEs compared to CBEs by implementing OBEs for an experimental group of students at the end of each study week, followed by discussions with subject teachers. The control group underwent CBEs during the same period. After a month, both groups were assessed using both open and closed-book examinations, and the marks were compared. The results revealed that students' marks were significantly higher after OBEs, indicating an improvement in their understanding of the subject and acquisition of knowledge and skills. Students expressed their approval of OBEs following discussions about the assessment as

they had gained insights into how to use textbooks effectively during OBEs. Consequently, students favoured the use of OBEs for formative purposes for summative assessment, enabling them to gain experience and familiarity with OBE procedures.

Advocates of OBEs frequently discuss the potential benefits, including better comprehension of subject content, authenticity, relevance to future needs, and the cultivation of lifelong learning skills (Rehman et al., 2022; Sam et al., 2020). Unlike CBEs, OBEs can closely resemble authentic real-life situations or professional settings that students may encounter after graduation (Green et al., 2016). OBEs also have a positive impact on students' long-term learning, preparing them for real-world decision-making by aligning with graduate attributes such as self-assessment, resource location, and knowledge construction based on references, thus ensuring a more authentic assessment of cognitive, metacognitive, and behavioural skills (Gehringer & Peddycord III, 2013).

Moreover, OBEs have been found to have a positive impact on learners' affective skills, such as attitude, beliefs, values, and motivations, by developing learners' sense of ownership, control, self-efficacy, confidence, and self-development. The active engagement of students in their learning process helps them comprehend the value in learning and view it as a shared process in which they have an active role. Other benefits include reducing examination preparation time, broadening the range and sources of information beyond textbooks, supporting a learner-centred approach to learning, and reducing or eliminating examination cramming and associated anxiety (Green et al., 2016; Gupta, 2007; Quille et al., 2021). Moreover, OBEs can foster a growth mindset, resilience, and a deeper appreciation for the learning process.

Furthermore, OBEs can indirectly have a positive impact on learners' psychomotor skills by promoting efficient and effective use of resources. The active engagement of learners in efficiently navigating their course materials, locating relevant information, and applying it to answer examination questions effectively involves both physical and mental activity as well as coordination (Green et al., 2016; Gupta, 2007). The manual handling of resources, whether physical or virtual, such as flipping through pages of information, and the ability to integrate the information found in a coherent and organized manner (cognitive skills), while maintaining control over the resources and minimizing stress (affective skills), indirectly promote the development of learners' psychomotor skills.

The benefits of OBEs in physical environments can be similar to those in virtual learning environments (Rehman et al., 2022). Numerous studies, particularly in the field of medical education, have examined online assessment practices owing to the infeasibility of traditional paper-based examinations and the questioning of the effectiveness of established assessment practices. The integration of technology into assessment has provided several advantages of OBEs, including the development of cognitive, affective, and psychomotor skills, as well as flexibility in test design (content and organization), time, access to resources, and the modality or delivery of examination content and questions (Reid & Sam, 2020). Students' access to resources can be expanded to include electronic copies of

course materials, images, videos, and audios, which may not be available in physical examination hall settings. This feature is not exclusive to OBEs; it can be utilized in all online and electronic assessment methods. Moreover, navigating online resources is not the same as navigating actual textbooks, as the latter takes up physical space and may require more time to find information.

Kaur (2016) summarized the benefits of OBEs as follows:

- OBEs accommodate different learning patterns and minimize reliance on memorization, promoting deeper and more meaningful learning.
- OBEs equip learners with learning strategies and higher-order thinking skills, which are essential for further learning in the immediate and distant future. Students develop not only subject content knowledge but also effective research and study skills, such as comprehension and synthesis.

Overall, the literature extensively highlights the benefits of OBEs, including their impact on cognitive, affective, and psychomotor skills, and reports findings from various experiments on the implementation of OBEs. However, it is important to acknowledge that implementing OBEs is not without challenges.

2.3 Challenges of OBEs

Open-book examinations (OBEs) still face challenges in higher education compared to closed-book examinations (CBEs) in terms of practicality, validity, and reliability. The practicality of preparing for an OBE can mislead students. Some may spend a significant amount of time searching for resources to answer the test, while others may perceive OBEs as an opportunity to relax and ignore examination preparation. This becomes problematic during the examination when students waste valuable time searching for and copying answers instead of applying the knowledge they have gained from their previous study and critical thinking skills (Chan, 2009; Kaur, 2016; Vidya, 2019).

Another issue related to sourcing information is the availability and selection of resources. When instructors specify the sources, it is assumed that all students have equal access to them, whether online or in the institution's library. However, if students are left to judge and finance their own resources, financially privileged students may have access to quality materials, while less privileged students face challenges that can negatively impact their academic performance. Additionally, students bringing excessive resources to the examination hall can burden the physical capacity and cause anxiety (Gray, 1994), leading to information overload, minimal preparation, and examination anxiety.

Concerning validity, designing OBEs can be a time-consuming process for teachers and test designers. Careful consideration must be given to the test questions to assess higher order thinking skills, making it more difficult to plagiarize from online sources (Gary, 1994; Green et al., 2016). The question arises: do these tests measure students' subject-related knowledge and skills or simply test their soft skills, such as searching and copying information in the era of artificial intelligence? The temptation to copy answers is even greater in online OBEs, where the 'copy-paste' function facilitates the process, jeopardizing the integrity of assessment and learning (Gehringer & Peddycord III, 2013). Moreover, grading students' answers in OBEs requires significant time and effort

from teachers, as the sources of information and the number of answers can vary, making automated grading less applicable.

Furthermore, the reliability of teachers' grading and scores may be compromised when students' answers vary, making it difficult to establish consistent grading standards. Subjectivity in scoring is influenced by the accessibility, scope, and quality of resources available to students, which can be linked to issues of access and financial backgrounds, as discussed earlier. Technical issues such as Internet connectivity in online OBEs can negatively impact score reliability, as a student's underachievement could be attributed to the platform's reliability rather than the student's performance (Gehringer & Peddycord III, 2013). Ensuring reliability in OBEs requires careful question design and clear grading criteria.

Overall, the validity, reliability, and practicality of OBEs depend on various factors, including the learning outcomes being assessed, the nature of the subject matter, and the specific context of the examinations. It is crucial to consider the design of questions, assessment objectives, and the availability of appropriate resources to ensure that OBEs effectively measure students' understanding and abilities (Cahill-Ripley, 2015). Communicating expectations and criteria clearly to students through test blueprints and specifications can contribute to well-designed test questions and positive washback effects of OBEs, such as the development of cognitive, affective, and psychomotor skills. However, neglecting the importance of training, mutual understanding, and expectations between teachers and students can result in negative washback effects of OBEs, including misconceptions about the nature and objectives of the test and a lack of focus on the intended skills.

2.4 Rationale for the Study – Gaps in Research

This research is motivated by the shift towards online teaching and learning, along with the need for more convenient assessment tools that address issues related to online education, such as proctoring and academic integrity. Reviewing the literature on OBEs and their use in higher education reveals that they are still an unpopular form of assessment, used cautiously by teachers and often feared or trivialized by students. There is limited research highlighting the practical benefits of OBEs in higher education and reporting the challenges faced, especially within the local context where traditional open examinations are still rare and met with resistance from students.

Furthermore, the integrity of online OBEs is not fully trusted by teachers owing to factors such as the lack of built-in proctoring systems, students' unfamiliarity with OBEs, and concerns about plagiarism. Additionally, designing OBEs and determining the appropriate types of questions require training for teachers, raising questions about their level of understanding and expertise in OBEs. As the shift towards OBEs is relatively new, fostering a culture of OBEs at UTAS is essential to align with the University's strategic plan for 2022-2025, which aims to create a stimulating environment. This aligns with Gupta's (2007) findings mentioned earlier, highlighting how OBEs can promote deep learning and the development of higher cognitive skills.

Moreover, UTAS aims to enhance digital transformation (Objective 1.4) by improving digital practices. In this context, the research team believes that OBEs contribute to achieving UTAS's second strategic goal, which involves providing students with an inspiring and transformative learning experience that equips them with the necessary knowledge, skills, and values to thrive in a dynamic global environment. In addition, OBEs align with UTAS's focus on critical thinking, analysis, and problem-solving skills, which involve synthesizing knowledge, facts, and data to provide constructive criticism and effectively solve problems (strategy 2.2.8). These findings are consistent with the research by Gehringer and Peddycord III (2013) mentioned earlier, emphasizing the importance of OBEs; however, their successful implementation requires time and clear guidelines.

Therefore, this study is significant as it contributes to the literature on online OBEs by exploring the perspectives of students and teachers at UTAS - Rustaq. The study aims to provide practical tips for the effective implementation of OBEs in higher education, enriching the understanding and application of this assessment method.

3. Methodology

3.1 Approach

This study utilised exploratory mixed-method research to explore teachers' and students' views of the use and effectiveness of OBEs on students' knowledge and skills. This study design was guided by the theoretical underpinnings of constructive learning and students' engagement (Nichols & Berliner, 2008). This research was preceded by a pilot study utilising semi-structured interviews as the qualitative part of this mixed-methods research approach to help define the research questions, test the proposed study design and process, explore different techniques related to OBE, determine the feasibility of the study to avoid waste of resources and time, and provide preliminary data that can be used to improve research validity and reliability (Majid et al., 2017).

3.2 Research Context and Participants

Data were collected from UTAS - Rustaq, encompassing academics and students across various academic departments, including English Language Teaching, Mathematics, Chemistry, Physics, and Biology. The convenience sampling method was employed to ensure easy access to participants who were readily available. Three female English language teachers participated in the semi-structured interviews at the pilot study stage. Moreover, an electronic questionnaire, created using Google Forms, was distributed to all teachers and students at UTAS - Rustaq. Only those who responded to the questionnaire were included in the study, resulting in a total of 20 teachers and 93 students providing responses. Out of the student participants, 55 were male, while 38 were female. The majority of these student respondents (87) were pursuing studies in English Language Teaching (ELT) at UTAS - Rustaq (as indicated in Appendix 1). Additionally, 21 out of the 23 teachers had more than 10 years of teaching experience, and 16 out of the 23 participants were female teachers as indicated in Table 1 below:

Table 1: Respondent distribution

Data collection/participants	Students		Teachers	
Semi-structured interviews-pilot stage	Female	Male	Female	Male
	0	0	3	0
Questionnaires	Female	Male	Female	Male
	38	55	13	7

The research objectives were explained thoroughly to the interview participants while the questionnaire survey highlighted the purpose of the research, its use and the confidentiality of the participants' identities, as well as that of the data collected (Creswell, 2014). Researchers carefully observed ethical considerations from obtaining approval to conduct this study (ethical approval number: 2022 ENGL1 in compliance with Scientific Research Policy no 18) to the publication stage.

3.3 Data Collection and Analysis

3.3.1 Data Collection Tools

Semi-structured interviews and questionnaires served as the primary methods for data collection in this study. With regard to interviews, the pilot study aimed to explore the perspectives of English language teachers regarding the use of OBEs. Three English language teachers, who incorporated OBEs in their courses, participated in individual semi-structured interviews. The interviews focused on three main questions: (a) How do EFL teachers perceive OBEs? (b) What challenges have these EFL teachers encountered when implementing OBEs? and (c) What measures could be taken to enhance the current practice of OBEs? The decision to select teachers exclusively from the English language department was based on the researchers' familiarity with these teachers' utilization of OBEs, as opposed to teachers from other major subjects who predominantly relied on quizzes. Although this approach introduces bias and limitations in obtaining preliminary insights on OBEs, the researchers considered it to be the most useful and beneficial technique at the time.

Based on the obtained results and the key themes identified in the three pilot study interviews, a questionnaire was developed to investigate the perspectives of a broader range of participants regarding the use of OBEs (Codó, 2008; Creswell, 2014). This questionnaire encompassed the viewpoints of all teachers and students at UTAS - Rustaq, compensating for the limited coverage of participants in the pilot study interviews. The primary aim of the questionnaire was to explore both the advantages and challenges encountered by teachers and students when implementing OBEs during the COVID-19 pandemic. The questionnaire comprised ten items that specifically targeted participants' perspectives on OBEs. These items included aspects such as the practicality of the test in terms of its design, preparation effort and time requirements, as well as the impact of the test on cognitive abilities, emotional aspects, examination preparation and management strategies (For further details, please refer to Appendix 1, Table 1).

Ensuring the validity of the questionnaire involved implementing various measures. Firstly, preliminary insights and themes for constructing the questionnaire were obtained through a literature review on OBEs and by exploring the perspectives and experiences of teachers during the pilot study interviews. Subsequently, the questionnaire items were reviewed by multiple team members to assess their construct and face validity.

Furthermore, the reliability of the items was assessed using both unidimensional reliability and a Kaiser-Meyer-Olkin (KMO) test. According to Pallant (2016), the internal reliability of the multi-item scale in the students' questionnaire, which consisted of 10 items, was deemed good (Cronbach α=.87). Moreover, the overall KMO test yielded a score of 0.86, indicating a satisfactory relationship among the variables.

Likewise, it is important to note that the internal reliability of the 10-item questionnaire for teachers was also good (Cronbach α=.74). However, the KMO test score for the teachers' questionnaire was lower (KMO=.56), as outlined in Appendix 1 - Table 2. It is worth mentioning that items 5, 6, and 10 were reverse-coded as they were negatively worded. This approach was taken to mitigate any potential negative effects on the reliability of the scale, as noted by Moore et al. (2012) and Pallant (2016).

3.3.2 Data Gathering Procedures and Timeline

This study commenced with the piloted study interview, which took place in June 2021. Preliminary analysis of the collected data was conducted in July and August 2021. The identified themes from the thematic analysis were then utilized to construct the questionnaire. The questionnaire was disseminated to teachers and students during the spring of 2022. The data collected through the questionnaire were analysed during the summer of 2022 and autumn of 2023. The following timeline (Figure 1) illustrates the data collection process:

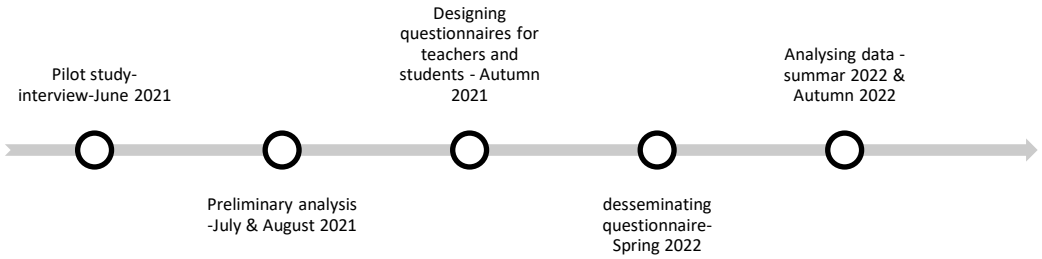

Figure 1: Data collection process

3.3.3 Data Analysis Tools

Thematic analysis, as well as descriptive and inferential statistics, was employed to analyse the collected data. The pilot study interviews were analysed using thematic analysis to identify major themes that assisted in designing the questionnaire. Both deductive and inductive themes were utilized (Creswell, 2014). Deductive themes were derived from the existing literature, focusing on areas such as developing students' sourcing, critical thinking, and time

management skills. Inductive themes, on the other hand, emerged from the data itself, including identifying misconceptions and overlapping definitions and understanding of OBEs.

For the analysis of the questionnaires, the Jeffery Amazing Statistics Programme (JASP) was utilized. Descriptive statistics, including means, were important in describing the sample. Furthermore, inferential statistics, specifically independent samples t-tests, were used to compare the perspectives of male and female students. The Shapiro-Wilk test of normality indicated that the data were non-normally distributed, necessitating the application of non-parametric tests in the analysis, such as the independent samples Mann-Whitney U test (Moore et al., 2012).

4. Findings and Discussions

Results and findings regarding students' and teachers' views and experiences of OBEs are highlighted in this section, in accordance with the research questions. Both quantitative and qualitative data are combined to discuss and explain the findings in relation to previous research findings. The main research question is: *What are students' and teachers' views of OBEs at University of Technology and Applied Sciences - Rustaq?*

4.1 Students' and Teachers' Views of OBEs

Students' responses to the survey questionnaire, exploring their views and experiences of OBEs, are highlighted in Table 2. The majority of students rated their experience of OBEs highly, as indicated by the median score of 4, reflecting positive views towards OBEs.

Table 2: Descriptive statistics of students' responses

Variable/ Descriptive Statistics	*Mean*	*Md.*	*SD*	*Skew.*	*Kurt.*	*Shapiro-wilk*	*P-value of Shapiro-Wilk*
It was easy to prepare for OBEs.	3.72	4	1	-0.46	-0.26	0.88	< .00
I felt relaxed when preparing for OBEs.	3.46	4	1.18	-0.32	-0.95	0.89	< .00
Preparation for OBEs required less time than closed-book exams.	3.67	4	1.16	-0.22	-1.24	0.86	< .00
It was easy to answer the OBEs questions.	2.98	3	1.14	0.09	-0.72	0.92	< .00
Having different course resources available to answer a question can be overwhelming.	3.13	3	0.98	-0.26	-0.43	0.9	< .00
OBEs assessed your knowledge and skills in relation to course's outcome.	3.71	4	0.94	-0.35	-0.34	0.88	< .00
OBEs measured my knowledge and skills better than CBEs.	3.73	4	1.02	-0.31	-0.76	0.88	< .00
I have enough practice and knowledge on how to answer OBEs.	3.31	3	1.06	-0.38	-0.53	0.9	< .00

I feel confident that I can answer future OBEs.	3.47	3	1.06	-0.32	-0.36	0.9	< .00
I would like OBEs to replace all closed-book exams.	3.58	4	1.24	-0.35	-0.94	0.88	< .00

Note. Md = Median, Sd= Standard deviation, skew= skewness and kurt= Kurtosis

Examining the difference between male and female students' responses using the Mann-Whitney U test revealed significant differences between males and females regarding their preferences for examinations, confidence in answering future OBEs, and their views on the effectiveness of the two types of tests. Male students showed a preference for OBEs and expressed higher levels of confidence in their ability to answer future OBEs (see Table 3). For instance, a Mann-Whitney U test indicated a significant difference in their preference for the type of future test, with male students (Md=4, N=55) being more eager to have OBEs replace CBEs compared to females (Md=3, N=38), U=1344.5, p=.02, r=.3 (Moore et al., 2012).

Table 3: Independent samples Mann-Whitney U test results from students' surveys

Item / stats	*G/N*	*Mean*	*Md*	*W*	*P*	*Rank-Biserial Correlation*
It was easy to prepare for OBES.		*3.76* *3.66*	*4* *4*	*1106*	*0.62*	*0.06*
I felt relaxed when preparing for OBES.		*3.49* *3.42*	*4* *4*	*1072.5*	*0.83*	*0.03*
Preparation for OBEs required less time than closed-book exams.		*3.66* *3.68*	*4* *4*	*1033*	*0.93*	*-0.01*
It was easy to answer the OBEs questions.		*3.18* *2.68*	*3* *3*	*1289*	*0.05*	*0.23*
Having different course resources available to answer a question can be overwhelming.		*3.24* *2.97*	*3* *3*	*1215*	*0.17*	*0.16*
OBEs assessed your knowledge and skills in relation to course's outcome.	*M/55 F/38*	*3.66* *3.79*	*4* *4*	*960*	*0.49*	*-0.08*
OBEs measured my knowledge and skills better than CBEs.		*3.94* *3.42*	*4* *3*	*1326.5*	***0.02***	*0.27*
I have enough practice and knowledge on how to answer OBEs.		*3.36* *3.24*	*3* *3.5*	*1105.5*	*0.62*	*0.06*
I feel confident that I can answer future OBEs.		*3.78* *3.03*	*4* *3*	*1452*	***< .00***	*0.39*
I would like OBEs to replace all closed-book exams.		*3.84* *3.21*	*4* *3*	*1344.5*	***0.02***	*0.29*

Note. Mann-Whitney u test. For the Mann Whitney test, effect size is given by the rank biserial correlation. G/N= Group/Number, Md= Median, M=male, F= Female
Note. $p < 0.05$

Likewise, descriptive statistics indicate that teachers agreed that OBEs can improve students' higher-order thinking skills and prevent them from relying on rote learning, as indicated by the median scores. However, it was observed that students require more time to explore different resources and answer the test, as shown in Table 4:

Table 4: Descriptive statistics of teachers' responses

Variable/Descriptive stats	*Mean*	*Md*	*SD*	*Skew.*	*Kurt.*	*Shapiro -Wilk*	*P-value of Shapiro -Wilk*
I use OBEs as the only method to assess my students.	2	2	0.73	0	-0.93	0.82	0
It was easy to design the OBEs questions.	2.5	2.5	1.19	0.31	-0.67	0.91	0.06
Preparation for OBEs required less time than CBEs.	1.85	2	0.81	0.95	1.18	0.81	0
OBEs requires prior preparation on students' part.	3.65	4	0.93	-0.49	-0.39	0.86	0
Students need less time to complete and submit OBEs.	1.9	2	0.45	-0.55	2.66	0.61	< .0
OBEs improve students' higher thinking skills	3.5	4	1	-0.18	-0.92	0.88	0.02
OBEs discourage students from rote learning.	3.6	4	1.39	-0.88	-0.32	0.83	0
I would like OBEs to replace all online CBEs.	3.25	3	1.21	-0.34	-0.54	0.92	0.1
When teaching on campus is back, I will not employ OBEs.	2.4	2	1	0.13	-0.88	0.89	0.03
I use OBEs as the only method to assess my students.	2.5	2	0.95	1.24	1.45	0.79	< .00

Note. Md = Median, SD= Standard deviation, skew= skewness, kurt= Kurtosis

Table 5 indicates that teachers did not show enthusiasm for replacing all CBEs with OBEs. Checking for significant differences between male and female teachers' views on OBEs revealed that female teachers had more confidence in their ability to design OBEs (Md = 3, N = 13) compared to male teachers (Md = 1, N = 7), as indicated by a Mann-Whitney U test (U = 18, p = .03, r = -.6) (Moore et al., 2012).

Table 5: Independent samples Mann-Whitney U test results from teachers' surveys

Scale items/ inferential statistics	*G/N*	*Mean*	*Md*	*W*	*p*	*Rank-Biserial Correlation*
I use OBEs as the only method to assess my students.		*1.86*	*2*	*38*	*0.55*	*-0.17*
		2.08	*2*			
It was easy to design the OBEs questions.		*1.71*	*1*	*18*	***0.03***	*-0.60*
		2.92	*3*			

Preparation for OBEs required less time than CBEs.	*M=7 F=13*	*1.71*	*2*	*40*	*0.66*	*-0.12*
		1.92	*2*			
OBEs require prior preparation on students' part.		*4.29*	*4*	*72.5*	***0.02***	*0.59*
		3.31	*3*			
Students need less time to complete and submit OBEs.		*1.71*	*2*	*33.5*	*0.19*	*-0.26*
		2	*2*			
OBEs improve students' higher thinking skills.		*3.43*	*3*	*42.5*	*0.84*	*-0.07*
		3.69	*4*			
OBEs discourage students from rote learning.		*2.86*	*3*	*32*	*0.29*	*-0.30*
		3.46	*4*			
I would like OBEs to replace all online CBEs.		*2*	*2*	*31*	*0.25*	*-0.32*
		2.62	*2*			
When teaching on campus is back, I will not employ OBEs.		*2.57*	*3*	*53*	*0.53*	*0.17*
		2.46	*2*			
OBEs increase grade inflation.		*2.14*	*2*	*60*	*.25*	*.32*
		2.69	*3*			

Note. Mann-Whitney U test. For the Mann-Whitney test, effect size is given by the rank biserial correlation. P <0.05, M= Male, F= Female, Md= median

4.2 What are the Participants' Definitions of OBEs?

The majority of responses from teachers and students revealed shared understandings of the meaning and nature of OBEs, as indicated in Table 6.

Table 6: Teachers and students' definitions of OBEs

Teachers	*Students*
"Exams in which students are allowed to refer to the book during the exam. Therefore, the exam questions should not simply ask for disposition of the book content, but the implications of it".	*It is "an exam that we can search from other resources for the answers."*
	It is an exam where "you have the chance to open your book to answer the questions".
	There is "an effective need for students to know how to extract information. It is an effective way to activate the mind and skills".
They are exams "for PhD candidates as it requires research skills".	*It aims to "test students' comprehension rather than testing their memory…. allow students to refer to the book during the test time".*

They are "exams with no invigilation, and the examinee has the full freedom to use whatever resources that he/she has at his disposal to answer the exam questions". *They are 'practical' in nature.*	*"It is like doing the assignments where the students are allowed to open their books or notes …."* *"Each student will get a random set of questions from them. So, students can't copy answers from others. Also, they won't be able to share questions".* *It is a means to get "free marks".*

Opportunities to 'open your book' or 'refer to the book' were frequently observed in teachers' and students' responses, indicating the resources that students can utilize to answer OBEs. This has implications for the types of questions and the nature of responses required. Mere retrieval of information or memorization is not sufficient to demonstrate students' understanding of the subject. While a person's short-term memory can store information crammed a day before the examination, indicating mastery of the key concepts at the time of the exam, it does not imply students' active use of the concepts in different situations where they can connect, evaluate, and use ideas effectively. Likewise, information stored in short-term memory can be easily forgotten after a test (Sarma & Yoquinto, 2020). OBEs, however, aim to activate students' minds and skills to extract information from different reliable sources, highlighting the importance of the availability and reliability of resources in answering OBEs and how it impacts students from various backgrounds, as mentioned earlier in the Challenges section.

This shared understanding of the objective of OBEs in testing comprehension and skills beyond mere memorization of subject content aligns with Gupta's (2007) definition of OBEs, where the focus is on students' higher-order thinking skills to enhance their criticality and deepen their comprehension of topics and ideas. Similarly, the reference to open-access resources, including textbooks, by students and teachers, has been emphasized as a key characteristic of OBEs in related literature (e.g., Kaur, 2016; Swart & Sutherland, 2014; Vidya, 2019). Students are allowed to use their textbooks and any notes or course materials that will assist them in answering the examination questions correctly. Having different resources to form and support arguments is authentic in nature (Gehringer & Peddycord III, 2013) as it corresponds to independent, lifelong learning, graduate attributes, and future job skills.

Interestingly, some students consider OBEs as 'free marks,' referring to the preparation period before the assessment, thinking that they do not need to prepare for examinations and specifically, they will not be required to learn core concepts and content. However, this contradicts the nature of OBEs, as students are expected to find resources, explore them, and take notes on the location of information for different topics and how they complement each other to answer a question. This view indicates a misunderstanding of the requirements for successful completion of OBEs, as having resources available does not necessarily mean that students can locate information and answer questions efficiently and

successfully. The aim is to ensure that students do not simply copy and paste the answer, as indicated by the interviewed teachers. Critical thinking, synthesis, and organization skills are key to answering OBEs questions. Furthermore, a teacher's view of OBEs as a 'PhD assessment method' that does not fit within undergraduate studies may imply an underestimation of students' ability to tackle assessment methods that target higher-order thinking skills (Green et al., 2016). This view may result from a lack of practice and may require a shift in belief and training in order to implement OBEs efficiently and effectively in higher education.

Misconceptions about the nature of OBEs have emerged from both students' and teachers' responses. Some students' responses highlighted confusion between OBEs and other alternative methods of assessment, such as writing a research paper or designing an educational web page. This misconception was attributed to blurred measures of practicality concerning the time for the test and proctoring measures, as highlighted in the literature (e.g., Chan, 2009; Kaur, 2016; Vidya, 2019). However, the bulk of available literature does not discuss the boundaries between OBEs and alternative assessment methods as mentioned above, resulting in different interpretations of the nature of OBEs and practicality measures.

4.3 What are the Benefits and Challenges of OBEs from Students' and Teachers' Perspectives?

Figure 2 highlights participants' responses to 'What are the benefits and challenges of OBEs from students and teachers' perspectives?' The findings indicated three sources of opportunities (benefits) and challenges of OBEs from teachers' and students' perspectives: skills gained, design and modality of OBEs.

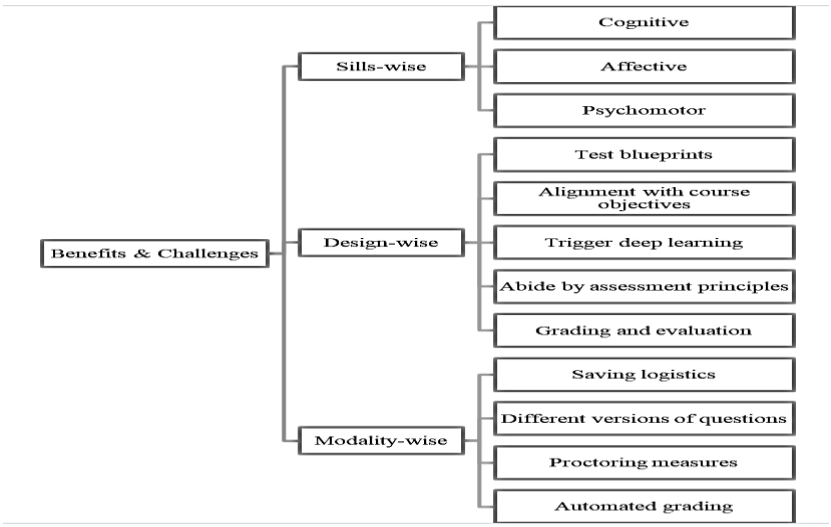

Figure 2: Benefits and challenges of OBEs: teachers and students' perspectives

Skills-wise benefits and challenges in OBEs include students' self-regulated learning skills, namely cognitive, metacognitive, affective, and behavioural skills. Based on the findings, students' cognitive skills, comprehension of subject content, and critical thinking improved, as reported in Kaur's summary of OBEs (Kaur, 2016). Metacognition and critical thinking skills require training for

students. Without practice in answering questions that target critical thinking, their responses may remain superficial and descriptive, rather than utilizing analysis, synthesis, and creation skills.

Furthermore, participants emphasized students' behavioural, study, and research skills. Effective OBE experiences relied on students' time management, resource utilization, and information retrieval. However, some students reported struggles in meeting deadlines due to the number of resources they needed to consult, highlighting the importance of resource availability and accessibility. In addition, OBEs can contribute to the development of students' psychomotor skills, such as navigating and using resources effectively (Green et al., 2016; Gupta, 2007).

Moreover, affective factors, such as students' attitudes and perceptions of OBEs, can significantly influence their performance and experience. A teacher reflected that students' negative attitudes or lack of awareness regarding the nature and benefits of OBEs can limit their positive impact on their learning, including knowledge acquisition and skill mastery. This was in reference to some students perceiving OBEs as "free marks," "easy," or assessments requiring zero preparation, which can be counterproductive. It is crucial for students to recognize the value of OBEs and reflect on their role in assessment for OBEs to have a positive effect on their affective skills (Quille et al., 2021).

Design-wise benefits and challenges revolve around the design of OBE questions. Teachers expressed awareness of the nature of OBE questions and the importance of designing them carefully. Moreover, OBE questions should align with the course objectives and learning outcomes, while also assessing students' deep learning, critical thinking, and research skills (Cahill-Ripley, 2015; Kaur, 2016; Swart & Sutherland, 2014; Vidya, 2019). However, clarity of question requirements and their correspondence to Bloom's taxonomy can pose challenges for teachers who are accustomed to designing memory-recall or comprehension-based questions and have not received training in crafting synthesis, analysis, evaluation, and creation skills-oriented questions. Similarly, students may find OBE questions difficult, confusing, unclear, or not well-suited for them owing to a lack of practice in answering questions that target higher-order thinking skills.

Designing OBEs based on Bloom's taxonomy can help meet teachers' aim of developing differentiated, practical, reliable, and authentic assessment tools that provide a more accurate picture of students' level and actual performance in assessments. Two interviewed teachers argued that OBE tests “distinguish between those who rely on memorization and those who truly understand the subject”, thereby yielding “reliable results”. However, designing valid and reliable OBEs can be a time-consuming and challenging process for teachers until they master this skill, as frequently highlighted in the OBE literature (Cahill-Ripley, 2015; Green et al., 2016). The grading process also poses challenges, particularly when evaluating and grading a variety of student responses, especially if the allowed resources for students are not clearly defined or unlimited.

Modality-wise benefits and challenges revolve around the platform used for administering OBEs and its practicality. Teachers found online OBEs to be time-

saving owing to the availability of auto-grade functions. Online examinations can be fully automated and problem free, saving logistical and examination administration efforts. The online modality also allows for random question sets for each student, minimizing the chances of cheating or plagiarism from peers or the Internet. However, auto-grade functions, while useful for grading objective questions in CBEs, may not be helpful for OBEs that require critical analysis and synthesis of information, as they result in different answers.

Nevertheless, some teachers believed that OBEs are not beneficial in distance learning without the incorporation or consideration of plagiarism detection and examination proctoring systems. Without such measures, there is an increased risk of copying answers from peers or the Internet, impacting examination scores and the learning process (Yazici et al., 2023). This finding aligns with a recent study that suggests providing teachers with resources and built-in proctoring programmes to minimize cheating risks. Additionally, online OBEs can lead to frustration if Internet connectivity is unstable and unreliable, and if access to online resources is limited, which were previously highlighted as drawbacks of online OBEs (Gehringer & Peddycord III, 2013).

These skills, design, and modality-related challenges of OBEs can become opportunities if carefully considered and thoughtfully addressed in the design and implementation of OBEs. The following section will address the final research question regarding the effective future use of OBEs, serving as key to a fruitful discussion of OBEs.

4.4 How can OBEs be used Effectively in the Future?

The findings from this research highlighted some **key considerations for successful implementations of OBEs**, which have been represented in Figure 3. A model of successful implementation of OBEs includes key considerations for students, teachers, and policymakers. For instance, raising students' awareness of assessment value and objectives, having clear procedures and rules for implementation, the need for training and practice, and reliable infrastructure are key for the effective utilization of OBEs in the near future.

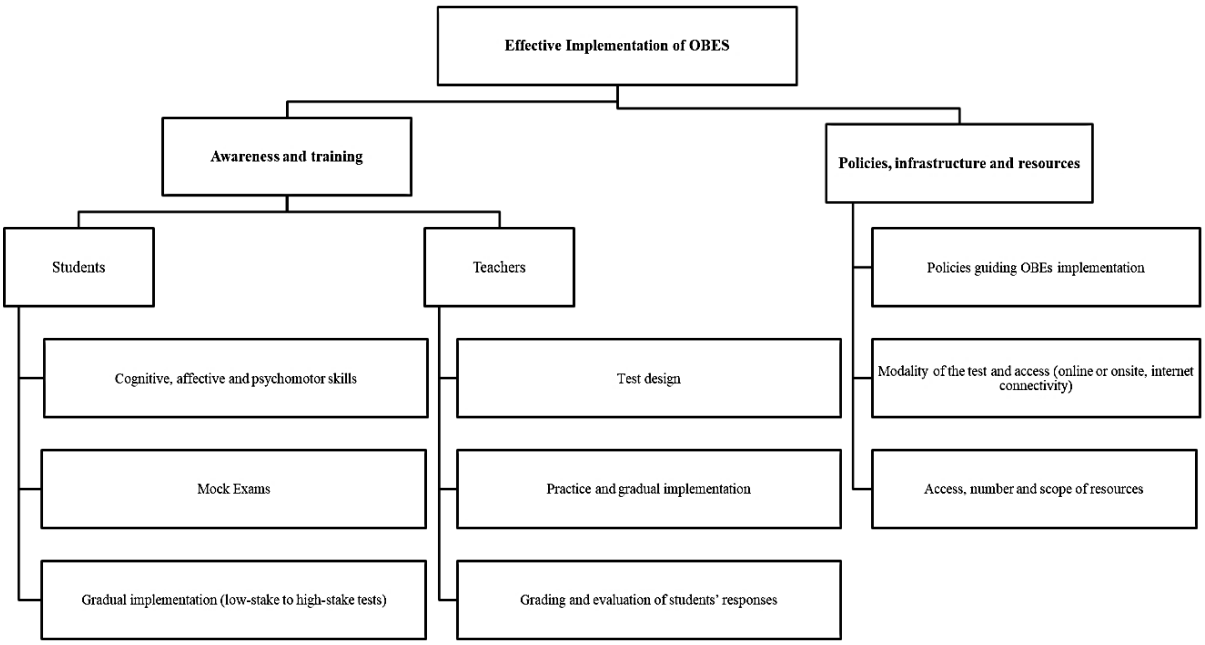

Figure 3: Model of key considerations for effective implementations of OBEs in HE

To begin with, OBE should align with the objectives and aims of the course of study (Cahill-Ripley, 2015). These objectives and aims should be clearly and explicitly discussed and negotiated with the students, who are active participants in and contributors to the learning process. This helps in developing students' cognitive skills. For instance, expectations of the students' role in the teaching and assessment process should be clearly identified, negotiated, and clarified (Evans, 2016; Johnston & Rooney, 2020). One such expectation is students' awareness of the policies and procedures managing the process of conducting an OBE. It is essential for them to comprehend this unfamiliar process and respond accordingly by accepting their roles as responsible and active learners, aligning with the constructivist perspective of learning (Bonder, 1986).

Awareness of the nature and characteristics of OBEs is a prerequisite for any experimentation with this form of assessment. The findings from this research emphasize the necessity of discussions on the definition, features, and boundaries of OBEs. For instance, it is important to highlight that OBEs are time bound, and the time for submission does not extend beyond a few hours. Assessments with timeframes and deadlines extending to a day, a week, or months are classified as different types of alternative assessments. Similarly, students' familiarity with the assessment tools, platforms, guidelines, types of questions, and the required answers promotes their trust in the process and serves as a motivation to prepare for OBEs and believe in their value as effective assessment tools. By raising students' awareness and ensuring their buy-in, their behaviour and attitudes can shift to those of active participants who embrace their roles in the assessment process (Evans, 2016), thereby developing their affective skills. Their responsibility can include, but is not limited to, examination preparation and utilizing various resources as part of the psychomotor skills development process.

Furthermore, training and gradual practice are mandatory to manage the fear of the unknown, facilitate students' induction into this new type of assessment, and minimize the tendency towards plagiarism. Gradual implementation serves as an introduction to what is required from the students. This step should emphasize study skills, critical thinking, and self-regulated learning skills, including managing emotions, which can promote a positive attitude towards OBEs. Training is not only necessary for students but also for teachers, who can benefit greatly from a training course on designing and grading OBEs. The design of the test should align with the course objectives and the requirements of the academic degree, making it meaningful for students during college and even after graduation. The skills that students utilize and practise while preparing for and taking OBEs are lifelong skills that can assist their learning in the workplace after graduation. Similarly, teachers should carefully select and include questions in OBEs that target the use of these skills by students (Rehman et al., 2022; Sam et al., 2020). Therefore, the questions should be practical and critical, as well as promoting students' higher order thinking skills, thereby enabling autonomous and deep learning. Training in writing examination questions of this nature is crucial. Sound and well-designed OBEs align with the principles of assessment, being practical, valid, authentic, reliable, and having a positive washback (Gehringer & Peddycord III, 2013; Green et al., 2016; Vidya, 2019).

Additionally, teachers should consider designing OBEs for both summative and formative purposes. Mock examinations can help students focus on skills and promote their cognitive, affective, and psychomotor abilities needed to answer OBEs questions, which are formative in nature and can be considered low-stakes assessments. However, OBEs as midterm, final, or comprehensive examinations are considered high-stakes assessments, and students should not be introduced to them without prior training. This gradual implementation of OBEs is essential to ensure a successful and trusted process for both students and teachers. Moreover, teachers designing OBEs need guidance and training on how to evaluate and grade students' diverse answers to the same questions as this can be a challenging process given the various resources available for students' use. Supporting teachers through training in the unfamiliar process of designing and grading OBEs is of great importance for the successful implementation of OBEs.

Finally, students’ and teachers' training in the use of OBEs remains incomplete without well-established policies and procedures as well as reliable infrastructure in place. This includes regulations that guide OBEs, efficient devices, and reliable Internet connectivity. The nature of OBEs offers students a significant opportunity to complete their assignments online as OBEs require students to reference resources. Therefore, Internet connectivity and access to resources should be guaranteed and ensured by educational institutions, at least within their premises. Failing to meet this condition can negatively impact the efficiency and effectiveness of OBEs. Similarly, institutions must ensure the availability of resources and equal access for students to complete OBEs successfully and derive all the proposed benefits of this assessment tool.

5. Study Limitations and Contributions to OBEs Literature

The findings and implications discussed above were obtained from a sample of students and teachers at UTAS - Rustaq regarding their views and experiences of OBEs during COVID-19. However, there are some limitations that need to be acknowledged. Firstly, although the study aimed to explore the views of teachers and students at UTAS - Rustaq (scope of the study), the majority of respondents from the questionnaire were from the English Language and Literature (ELL) Department. Therefore, future research should include students and teachers from other majors in addition to participants from the ELL department. Similarly, exploring different campuses at UTAS to examine the use of OBEs across different majors and subjects and whether the utilization of OBEs is subject specific could provide valuable insights. It is important to determine whether OBEs respond to the nature of certain subjects and courses more than others.

Moreover, owing to time constraints, the study relied solely on questionnaires. However, conducting follow-up interviews would have provided more reliable and comprehensive data to investigate students' and teachers' responses in depth. This is particularly important for exploring their definitions of OBEs, which appeared to vary, as well as understanding the skills gained from OBEs considering the limited exposure to OBEs. Therefore, future research of OBEs could replicate this study with a wider range of participants and employ data triangulation by combining survey questionnaires with follow-up interviews to enrich the data, generate in-depth findings, and draw further recommendations to enhance the current practice of OBEs.

Despite the limitations regarding the scope, methods, and sample size of this study, the findings have contributed to the understanding of OBEs in practice, including their affordances and challenges. The study has shed light on a major source of misconceptions about OBEs, namely the difference between OBEs and other alternative assessments that are less restricted by time and can be conducted without proctoring measures. The findings can help students distinguish between OBEs and tasks such as writing a research paper. Furthermore, the study has highlighted that misunderstandings about the nature of OBEs can occur among both teachers and students, emphasizing the need for training in OBEs and the importance of not overlooking training despite the availability of resources as the latter can be considered by students as permission to skip the examination preparation stage.

Moreover, the OBEs implementation model proposed in the previous section can assist policymakers and practitioners in focusing on the fundamental factors required for the effective implementation of OBEs in educational institutions. While this model is not fully developed or implemented, future action research utilizing this model can further improve it and establish it as a working framework for guided implementations of OBEs. This helps establish clear guidelines for teachers before any OBEs take place in practice. It will also help teachers construct test specifications and blueprints highlighting the skills to be tested.

6. Conclusions and Recommendations

This study investigated students' and teachers' views of OBEs during COVID-19 at UTAS - Rustaq, Oman. Specifically, the study aimed to explore students' and teachers' knowledge and definitions of OBEs, as well as their perceptions of OBEs' affordances and challenges. The goal was to identify practical procedures for the effective implementation of OBEs. Ninety-three students and twenty teachers participated in the study by responding to two questionnaires; one for the students and another for the teachers. Prior to the questionnaires, three teachers also participated in a pilot semi-structured interview.

Overall, the findings revealed a positive view of OBE examinations among both teachers and students. Male students, in particular, showed a stronger preference for OBEs and expressed more confidence in their ability to answer future OBEs. This indicates that they see OBEs as a valuable examination method that promotes student engagement and can improve academic performance. Additionally, the study identified several benefits of practising OBEs as reported by the participants. These benefits included the enhancement of lifelong learning skills such as cognitive, affective, and psychomotor skills for students, as well as the ability for teachers to design practical and critical questions that measure students' skills and subject knowledge.

However, the study also revealed a number of challenges associated with OBEs. These challenges included infrastructure facilities, such as Internet connectivity and the availability of resources, as well as time management in preparing for and taking examinations. Furthermore, challenges related to OBEs' design, grading, and evaluation were also identified. It is crucial for students, teachers, and policy makers to acknowledge and address these challenges in order to implement OBEs effectively. This includes raising awareness, providing training, and ensuring the availability of appropriate infrastructure and resources.

Teachers are advised to train students in using OBEs and related skills, such as note-taking, revision strategies, and application through classroom practice and mock examinations. Gradual implementation of OBEs should align with the course objectives and the skills to be acquired. This gradual implementation should be effective prior to conducting any assessed OBE. Moreover, OBEs should be implemented for both formative and summative assessments, while the data collected should include both quantitative and qualitative measures to obtain a more reliable assessment of the effectiveness of OBEs as a method. Training would also support teachers in designing examination questions, successfully conducting OBEs, and grading them. The training and implementation of the OBE process should follow a systematic and rigorous approach to testing, which can be strengthened by utilizing various trusted assessment methods and tools. The infrastructure and resources resulting from the findings of this study and highlighted in the implementation model should support the implementation of OBEs, including sufficient time and reliable Internet connectivity to ensure a smooth and successful process of practising OBEs.

Furthermore, future research on OBEs should focus on the practice of, and current policies regulating the use of OBEs. Research can investigate teachers'

implementation of OBEs in their classrooms, the procedures for such implementations and how these are different from those of other teachers. Exploring the design, implementation, and grading process of OBEs in different subjects and by teachers of various teaching philosophies can provide insights about the effects of the subject matter and beliefs on the use and results of OBEs. Moreover, exploring the assessment policies within a higher education institution can help understand the teachers' practice, and how well they can embrace change and experiment with assessment methods and techniques, letting go of well-established traditional methods of assessment as CBEs. Research on assessment philosophies and use can enrich and advance assessment practices.

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