

Evaluating the Impact of Alternative Assessment on Student Performance and Perception in an Undergraduate Biological Science Unit

Suk Kuan Teng^{1*}, Juwaini Abu Bakar², Ashish Dutt³

School of Science, Monash University Malaysia

*Corresponding Author: teng.sukkuan@monash.edu

ABSTRACT

The development of diverse assessment formats is crucial for evaluating teaching and learning. Conventional assessments in science education often create stress, negatively impacting student performance and learning outcomes. Consequently, alternative assessments are considered more effective for evaluating students' knowledge and understanding. However, limited research exists on the feasibility of implementing alternative assessments, especially in large student cohorts. A study was conducted to explore learners' performances and experiences in a first-year biological science unit, which replaced the final examination with major (alternative) assessments. The study used a mixed-method approach to compare the performance of first-year undergraduate science student and to gather qualitative feedback of their learning experience and perceptions. The results showed that students performed better ($p \leq 0.05$) in major assessments compared to the final exam, leading to improved overall performance. More than 90% of the participants felt that alternative assessment was a better mode of assessment than final examination, with more than 50% of them agreeing that it enhanced their understanding of the content and effectively evaluated their performance. Key benefits identified included improved knowledge inquiry, emotional well-being, and technical skill acquisition. However, some students preferred conventional assessments, providing justifications and suggesting the need for varied assessment modes to better evaluate learning. The study also discussed implications for assessment design and improvement.

Keywords: alternative assessment, conventional, summative, learning experience, final examination

INTRODUCTION

Assessment is an important aspect of higher education in evaluating learners' knowledge and ability to apply what they have learned, as well as provide opportunities for learning and practising necessary skills for future life and work (Samuelowicz & Bain, 2002; Weurlander et al., 2012). This has led to the development of various forms of assessment with the aims of promoting independent learning, empowering learners to be responsible for their learning, and providing positive learning experiences (Playfoot et al., 2023). In the past, conventional assessments in the form of tests and examinations have been widely used in STEM education in South America, South East Asia, South Africa and the Middle East regions (Villarroel et al.,

2019; Das, 2020). It is traditionally used to assess factual knowledge, emphasizing content, administrative effectiveness, and grading reliability. However, certain aspects and skills cannot be evaluated if conventional assessment is used exclusively (Pereira et al., 2017).

Alternative assessment, which is also known as classroom-based, qualitative, authentic, constructive, informal or performance assessment, represents an alternative way of assessing learning aside from conventional assessment (Williams, 2013; Janisch et al., 2007; Maclellan, 2004). It can be conducted continuously within a specific timeframe, context, and environment, either during or at the end of the semester. Projects, presentations, portfolios, problem-based learning, and prototype development are examples of alternative assessment (Das, 2020), where educators can evaluate learners' progress and mastery of a particular subject (Litchfield and Dempsey, 2013). These tasks encourage learners to proactively explore and apply knowledge while equipping them with transferable skills. Janisch et al. (2007) discussed two opportunities for alternative assessment in promoting positive teaching and learning experiences: educators and learners have rich sources of information about a learner's level of achievement through responsive instruction and feedback, and the capacity for learners to enhance their metacognitive awareness through gaining greater control and mastery over their own learning process.

Generally, many first-year undergraduate science units comprise a large number of students with various levels of prior knowledge and academic competencies. The design of assessments is frequently influenced by constraints such as workforce and workload, reliability and fairness in assessment grading, resulting in standardization and limited choice of assessment methods. Despite the growing recognition of the importance and implementation of alternative assessment in science education, there is limited research on its application and impact in courses or units with large student numbers. The present study addresses this gap by comparing students' performance before and after the implementation of alternative assessment and evaluating students' perceptions to explore its potential application in science education. By examining students' attitudes, experiences, and perceptions of alternative assessment, we can gain better insights into its effectiveness and identify areas for improvement in biological science education.

METHOD

Research Design

A mixed-method study was designed to examine the effectiveness of alternative assessment and to explore learners' perceptions of this assessment method in biological science education. The unit under study is a first-year introductory biological science unit taught over two semesters (12 teaching weeks) annually. Before 2023, the final examination was one of the main assessments of the unit, contributing 50% of the total mark. In-semester assessments are graded assessments that are assessed throughout the 12 weeks, which include weekly quizzes and lab assessments.

In 2023, the final examination was replaced with three major assessments, each contributing 15%. These major assessments were designed to meet the learning outcomes of the unit, which included a lab report aimed at evaluating students' data analysis and scientific presenting skills, an oral presentation of a selected biological science topic requiring peer

collaboration and writing a science article that challenged students to communicate scientific findings to a general audience, enhancing their scientific communication skills. Each task was accompanied by comprehensive instructions and clearly defined rubrics to ensure students had a clear understanding of the expectations and assessment criteria. To support students in meeting these expectations, weekly seminars were conducted to provide opportunities for clarification, discussion, and to receive preliminary feedback. Feedback was provided when the grades for each major assessment were released during the semester, which enabled students to identify areas for improvement and make meaningful progress during the semester. To accommodate the major assessments, the frequency of minor assessments was reduced by redesigning the weekly quizzes into biweekly content quizzes. Table 1 outlines the assessment components and their weightage for the academic years 2022 and 2023.

Table 1. Weightage of various components of the assessment between 2022 and 2023

Assessment	2022	2023
In-semester assessments:		
Lab assessments	20%	25%
Weekly quizzes	30%	-
Content quizzes	-	30%
Final examination	50%	-
Major assessments	-	45%
Total	100%	100%

A questionnaire was developed to gather students' feedback and perceptions regarding alternative assessments after reviewing relevant literature and similar studies. The questionnaire consists of two main parts to gather participants' basic demographic information and their experience with major assessments. The questionnaire was reviewed and approved by the Human Research Ethics Committee of Monash University under the Australian Code for the Responsible Conduct of Research (Project ID: 39166). Before submitting the questions for ethics committee approval, a pilot study was carried out among academic staff and teaching assistants of the school to obtain their feedback on the suitability, relevance and clarity of the questionnaire. The questions were then reevaluated and finalized according to the feedback received. The responses and comments are included in the Appendix.

The participants recruited were first-year undergraduate students of the School of Science, Monash University Malaysia, who enrolled in the unit in the July and October semesters of 2023. The unit is compulsory for all first-year students, covering basic biological science topics such as evolution, plant and animal physiology, reproduction and core ecological concepts. Students from other schools (non-science background) can also take this unit as an elective.

Participants were recruited by an experimenter who was not involved in grading the assessments. Demographic data collected included gender and nationality, and anonymity of the participants was maintained. Participants were recruited in the last two weeks of the semester as we were interested in students' experiences after completing most of the assessments.

Participants completed a questionnaire that included demographic information and quantitative and qualitative questions about their perceptions of major assessments in terms of the effectiveness of the assessment method, knowledge retention, feedback and practicality. Quantitative questions included a five-point Likert scale, ranging from 1 = strongly disagree to 5 = strongly agree.

A total of 122 students (68 from the July semester and 54 from the October semester) volunteered to participate in the study. Participants who agreed to provide their email addresses received a chance to take part in a lucky draw to win an RM10 e-wallet voucher as compensation for their participation in the study.

Data acquisition and statistical analysis

Students' results for the July and October semesters of 2022 and 2023 were obtained from the education management office (EMO) of the School of Science. The demographic characteristics of the students are comparable as both academic years admitted students based on the same criteria. Students were taught and assessed by the same qualified teaching team in a consistent manner over the two years.

Several statistical analyses were performed using IBM SPSS version 29 software to compare the means of student performance through One-way ANOVA. The Games-Howell post hoc test was selected as the homogeneity assumption was violated. The level of statistical significance was set at $p < 0.05$. All data are presented as mean $\pm$ SEM. Qualitative responses were interpreted by identifying common and repeated terms present in the responses. Main themes were generated based on the frequency of these terms, which were presented as both frequencies and/ or percentages.

RESULT AND DISCUSSION

Comparison of Student Performance

The present study compares the performance of students undertaking the final examination in 2022 and major assessments in 2023 and students' perceptions of alternative assessment. Data analysis revealed significant improvement in students' overall performance in the academic year, where the final examination was replaced with major (alternative) assessments. The study also reported positive student perceptions about alternative assessment. The demographic information of the students is shown in Table 2. In 2023, students' performance improved overall, particularly with the implementation of major (alternative) assessments (Figure 1). They performed better in these major assessments than in the final examination, which contributed to their overall better performance. There was no significant difference in their in-semester assessments in that they were maintained and similar between these academic years.

Table 2. Demographic information of students under the academic year 2022 and 2023

Academic year	Gender		Nationality	
	Male	Female	Malaysian	International
2022	100	233	250	83
2023	88	206	212	82

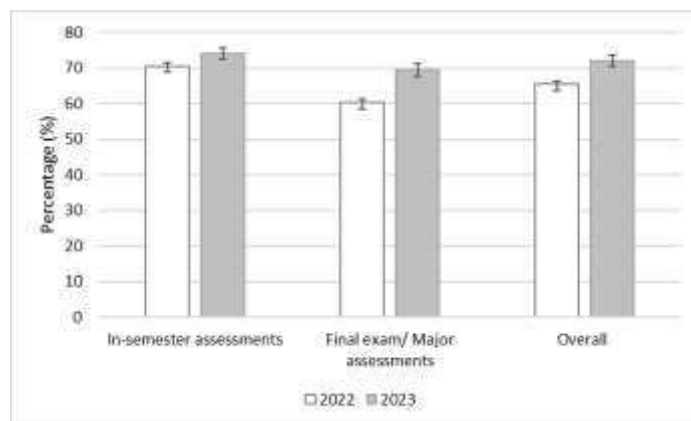


Figure 1. Comparison of different forms of assessment and overall performance between academic years 2022 (with final exam) and 2023 (with major/ alternative assessment). Error bars represent 95% confidence intervals.

The performance of male and female students demonstrates a similar trend for all forms of assessments (Figure 2), with better performance ($p \leq 0.05$) in the major assessments and overall (Figures 2b and 2c). The results suggest that the introduction of alternative assessment had a positive impact on students' performance.

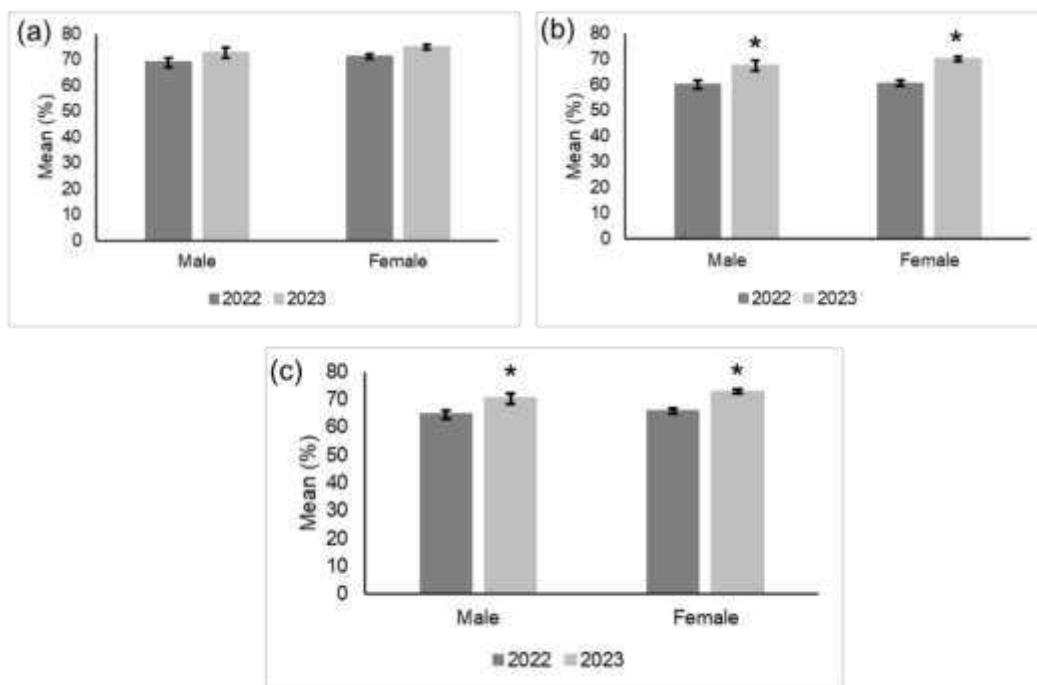


Figure 2. A comparison of male and female students' performance between 2022 and 2023 (mean $\pm$ SEM) for (a) in-semester assessments, (b) final examination in 2022 and major (alternative) assessments in 2023, and (c) overall results. (* mean difference is significant at the 0.05 level, Games-Howell)

Response rate and demographic data

There were 122 students who participated in the study, which represents 36.6% of the students enrolled in the unit. The response rate and demographic information are shown in Table 3. More than 90% agree that major (alternative) assessments are a better means of assessing performance. Participants were then asked to comment on the reasons or benefits (if any) of having major assessment tasks over the final exam, or vice versa.

Table 3. The response rate of the qualitative survey and participants' demographic information for the academic year 2023

Semester	Enrolled	Respondent	Response rate (%)	Gender			Nationality	
				Male	Female	Other	Local	International
July	236	68	28.8	26	40	2	63	5
October	97	54	55.7	11	41	2	32	22

Perceptions of Alternative Assessment

Participants were asked to respond on the effectiveness of major assessments in increasing engagement with biological content, enhancing understanding and applicability, assessing learning, and providing feedback for improvement for future assessments. Their responses are presented in Figure 3. Among the five levels of the Likert scale, both the mode and median are "Agree". More than 50% of the participants agreed and strongly agreed that alternative assessments help enhance their understanding of the content and effectively assess their performance. They also agreed that the feedback provided during the semester helped them to perform better in the subsequent assessments.

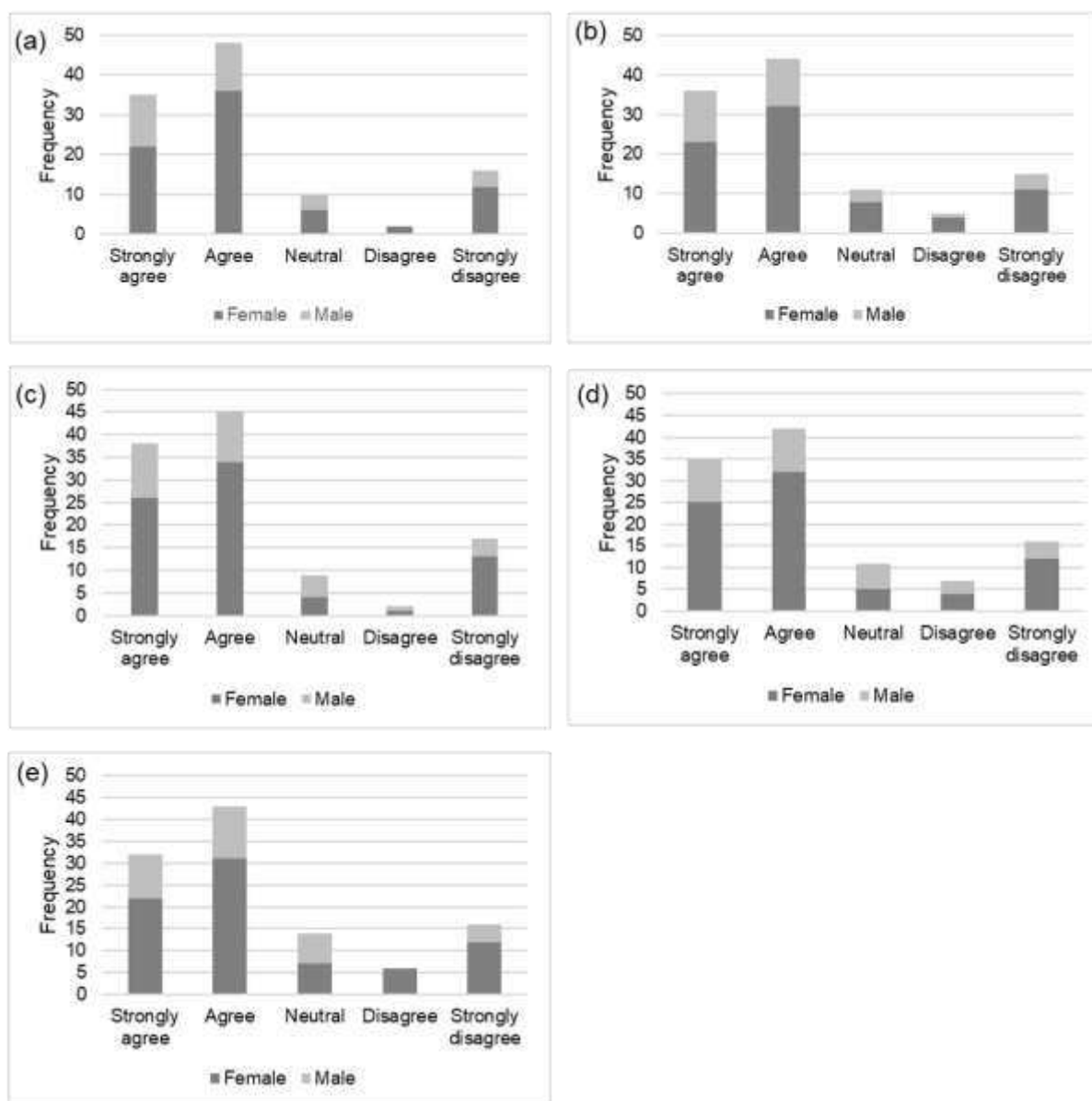


Figure 3. Participants' perspectives on the effectiveness of major assessments in assessing understanding and enhancing learning experience and performance. Participants were asked to rate these statements: (a) Major assessments made biology more relevant to me and increased my engagement in biological content. (b) I can apply the knowledge from the learning content very well when doing the major assessments. (c) Major assessments helped to improve my learning experience in this unit. (d) Major assessments reflect my performance in a unit. (e) The feedback given helped to improve my performance in my subsequent assessments.

There was no significant difference ($p > 0.05$) between the responses of females and males, indicating that gender does not substantially influence students' perceptions of alternative assessment. This may also be attributed to the design of the questionnaire, which was objective

and unbiased, resulting in similar perceptions among the participants. Other studies have reported similar findings (Atwa et al., 2024; Lim, 2019).

Qualitative Analysis of Participant Responses

Participants expressed positive views on alternative assessment, highlighting their satisfaction with its benefits for their learning experience. Based on participants' written responses, a few key themes surrounding the benefits of alternative assessment were identified (Table 3). Many participants felt that alternative assessment allowed them to acquire a broader range of knowledge and have more time to understand the concepts. They were given more time to conduct self-study and reflection, which could have contributed to their improved understanding of some important biological concepts. This could also promote long-term memory and make them more likely to apply them to their daily lives. Here are some of the comments:

“Practical makes me understand better than pure examinations”

“Personally, I enjoy the major assessments a lot! As the assessments are spread out over the semester, they assess and challenge my understanding continuously”

“I usually understand the information before doing the assignments. For final exam, I instead memorising and not understand the information”

Conventional assessments such as final examinations normally cause learners to succumb to memorisation without comprehending the content. Due to the time constraint, many students have no choice but to memorise as much information as possible before attempting an examination in the hope that they can recall more. Memorization is the lowest level of knowledge assessment, with low knowledge retention, as learners tend to quickly forget what they have memorized. Learners need to develop deep learning encompassing higher-order thinking skills to better prepare for the complex demands of future life and work (Villarroel et al., 2019). Alternative assessments allow learners to learn at their own pace by doing further study and researching for more information whenever they do not understand certain topics. Learners are knowledge constructors as they take the initiative to search for relevant information, decide and make choices about which information to be included and set goals in order to complete the assessment in time (Janisch et al., 2007). Learners become responsible and engaged with their learning through inquiry and knowledge acquisition.

Table 4. Key themes generated based on participants' responses to an open-ended question

Question	Response key theme	Frequency	Percentage (%)
Why do you feel the major assessments were a better assessment of	Knowledge gain and enhance understanding	78	44

Question	Response key theme	Frequency	Percentage (%)
your understanding of this unit than exams would have been?	Independent learning	28	16
	Application, practical	21	12
	Reduced stress	20	11
	Time management	20	11
	Skills development	12	7

For the past decade, there has been a gap between the skills required by employers and those possessed by graduates (Burrows et al., 2021). Science graduates are expected to master certain essential skills such as problem-solving skills, the ability to search for relevant information and learn new methods, and effective interpersonal and communication skills (Talgar et al., 2015; White et al., 2013). The three major assessments implemented in this unit assessed students in different areas, particularly in presenting scientific findings and information using different methods. This includes writing a typical scientific report and communicating scientific information in writing and orally to the public. The inclusion of authenticity in these assessments supports the development of higher-order thinking skills, knowledge reflection and construction, and innovation in communicating effectively with different groups of audiences. Therefore, many participants expressed that more skills were acquired when completing these assessments, which may not be assessed with the final examination:

“Broader range of knowledge and useful soft skills learned”

“Major assessments tests our knowledge in specific areas, and also allows us to gain other skills such as report writing and searching for relevant information in articles”

“I feel the major assessment were better in testing the critical thinking skills of students, as well as allowing them the opportunity to apply what they have learned throughout the unit.”

“I think that the major assessments covers a broader aspect, and also evaluates more skills rather than just the knowledge alone.”

“It helps to develop some important skills in students. For example, the analysing and writing skills required to write an article or a report. Besides, it also evaluate students’ performance from various perspectives such as writing tasks, presentations and quizzes”

There were approximately 10% of the responses related to alternative assessment with lesser stress and pressure than conventional assessment. The stress caused by the latter is linked to extensive revision workloads, anxiety about completing an examination within a set time, and fear of failure, which ultimately demotivates students from learning. (Roome and Soan, 2019). The perception of success or failure in an examination can significantly influence future

performance and may result in increased stress, self-confidence challenges, and overall well-being issues (Giddens, 1991). Alternative assessment that allows students to complete tasks over an extended period reduces anxiety and time pressure, which leads to improved emotional well-being.

According to Yorke (2003), the main goal of formative assessment is to enhance student learning by providing feedback about their performance, either formally or informally. This is also an important aspect of alternative assessment in providing feedback to help learners to improve. The design of the unit assessment has allowed feedback to be given in time: students could learn from the feedback provided for the first assessment and avoid committing similar mistakes in their third assessment. Students became more aware of the areas in which they did not perform well, and they were given the opportunity to apply what they had learned in the subsequent assessment within the same unit and semester. This helped students to appreciate the standards that are expected of them and better relate to the learning objective or outcomes of the unit. Additionally, the instructions and weekly seminars provided details and guidelines for students to work on their assessments. The assessment rubrics served as preliminary feedback to students about the criteria being assessed. Students were then required to conduct more in-depth research and understanding of the topics related to the assessments. The learning process becomes independent as students are responsible for meeting the assessment requirements and submission due dates.

Challenges with Alternative Assessment

Participants were asked about the main challenges that they faced when completing the major assessments. Most participants identified that a tight schedule (42%) was one of the main challenges. This was likely due to most of the assessments being due within the semester, causing students to feel overwhelmed by the constant deadlines. The challenge could be greater for those enrolled in multiple science units, where weekly practical classes often included lab assessments, such as lab reports, that required submission on a weekly or biweekly basis. Other factors that were raised, such as poor time management (24%) and lack of self-discipline (18%), have been closely associated with the main challenge. To maintain performance, students must be disciplined and consistent in meeting deadlines. Failing to do so could lead to reduced interest and motivation, ultimately affecting their ability to sustain performance throughout the semester. Although the benefits of alternative assessment are reported by many studies (reviewed by Yan et al., 2021), there are other issues that should be addressed to ensure the assessments are designed to promote learning, rather than serving to meet deadlines. Otherwise, alternative assessment risks becoming a hindrance to learning.

Preference for Conventional Assessment

The study recorded a low preference for conventional assessment, accounting for 5.7% of the total participants. Among these participants, six out of seven were local students and they

commented about the limited areas being assessed by major assessments and the preference for being assessed for all learning content through one main assessment:

“Compile and relate all knowledge learnt in the semester”

“Although major assessment can assess other skills like citation, the knowledge itself may not be given much emphasis.”

“Major assessments are not exactly reflecting the content learned, and it is not assessing memory. Also group assessment can be difficult to manage as different students have different ways of thinking and working. Can be really difficult to work in group as per my experience”

One of the participants expressed the importance of having various forms of assessment, which included both forms of assessment:

“While major assessments really help in students understanding due to the hands on experience, I feel like we don't learn as much as having an exam to test how much you've really learnt through the semester. I'd suggest a combinations of both these assessments for optimum performance.”

While alternative assessment fosters a positive learning experience and provides a more comprehensive view of learner performance, it is inadequate for meeting the requirements of certain professional certifications (Williams, 2013). Maclellan (2004) discussed the variability of task specification and marking consistency that leads to difficulty making judgments about achievement, leaving alternative assessment a less convincing form of assessment in higher education.

According to Broadbent et al. (2017), a key feature of assessment and feedback is the intentional and iterative use of various interventions, which gradually enhance student capacity for quality work and include success indicators within them. Conventional and alternative assessments should not be seen as contrary to each other but should be viewed as complementary, integrating the essential aspects of both approaches to achieve their intended purpose. This involves the careful design of assessments to ensure they have a positive impact on learning and are effective in assessing performance.

CONCLUSION

The study showed that students had an overall better performance and positive learning experience with alternative assessment. Alternative assessment provides more flexibility and makes learners feel accountable for their knowledge inquiry. It also motivates students to be self-disciplined in meeting the requirements of the assessments. While the study demonstrated improved student performance and a more positive learning experience associated with the use of alternative assessments, several limitations should be acknowledged. The study was conducted within a specific institutional and disciplinary context, which may limit the generalizability of the findings to other academic disciplines, levels of study, or educational settings. In addition, the short-term nature of the study did not allow for the evaluation of long-term impacts, such as knowledge retention, skill transferability, or sustained academic motivation. While students reported increased self-discipline and a stronger sense of accountability, it remains unclear whether these perceptions can be translated into lasting

improvements in learning behaviour or academic performance. The implementation of alternative assessment requires careful planning, resource allocation, and training for educators, which may pose practical challenges in larger or more resource-constrained institutions. Different forms of assessment are useful in evaluating understanding and determining if learners have gained sufficient knowledge to progress in a course. There is no single assessment format that is perfect and can achieve the goal. It is essential to carefully consider the design of assessments to accommodate learners of diverse backgrounds and learning styles. Therefore, designing and implementing a variety of assessment formats is essential and is an ongoing process to support consistent learning and identify knowledge gaps. Future research could investigate more rigorous experimental or longitudinal designs to evaluate the lasting impact of alternative assessments, particularly on diverse student populations, including those that are underrepresented or at risk, and to explore the varying effects of different assessment modalities. Comparative studies examining the efficacy of multimodal assessment approaches in improving learning outcomes, motivation, and self-regulated learning would also offer valuable insight.

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