Using MCQ-Based Assessments to Evaluate Students' Comprehensive Understanding of Course Content

Vithusia Prashanth[*], Arulnesan Priscilah Nivetha

Trincomalee Campus, Eastern University, Sri Lanka.

[*]Corresponding Author

ABSTRACT

Assessment methods play an important role in evaluating students' understanding of course content and in supporting effective learning. In the Software Quality Assurance (SQA) course, the syllabus primarily comprises theoretical concepts covering a broad range of topics, including quality models, testing strategies, standards, and process improvement techniques. Traditionally, essay-type questions have been used as the primary method of assessment. However, this approach was found to evaluate only limited portions of the syllabus, as students often concentrated on selected topics based on anticipated examination questions. As a result, students' overall understanding of the complete course content was not adequately assessed, despite their exposure to all chapters of the syllabus. To address this limitation, the existing essay-based assessment format was restructured into a multiple-choice question (MCQ)-based approach. The redesigned MCQs were systematically developed to cover nearly all sections of each chapter, thereby enabling broader representation of course content within a single assessment. This approach facilitated the evaluation of students' factual knowledge, conceptual understanding, and basic application of key principles across the entire curriculum. The adoption of MCQ-based assessments was also intended to promote consistent engagement with all topics rather than selective learning. An analysis of student feedback and assessment outcomes indicates that the MCQ-based approach enhanced comprehensive syllabus coverage, improved objectivity through standardized grading, and increased consistency in evaluation. Furthermore, students reported increased motivation to study the entire course content due to the broader scope of assessment. Nevertheless, it was acknowledged that MCQs alone may be limited in assessing higher-order cognitive skills, such as critical thinking, synthesis, and in-depth analysis. Therefore, the continued use of MCQs is proposed to ensure comprehensive content coverage while effectively assessing students' understanding of key concepts. This approach supports efficient and consistent evaluation of learning outcomes in theory-intensive courses such as Software Quality Assurance.

Keywords: Multiple-Choice Questions (MCQs), Assessment Strategies, Software Quality Assurance, Comprehensive Content Coverage, Outcome-Based Education, Student Learning Evaluation

INTRODUCTION

Assessment plays a central role in higher education, not only measuring students' knowledge but also shaping learning behaviours and engagement (Gibbs & Simpson, 2004). In theory-intensive courses such as Software Quality Assurance (SQA), students must master a wide range of topics, including quality models, standards, testing strategies, and process improvement techniques. Traditionally, essay-type questions have been used to evaluate learning outcomes. While essays support critical thinking and analytical skills, they often assess only selected portions of the course contents, which may lead students to focus on certain topics while neglecting others. This can limit comprehensive understanding of the entire course content.

Recent approaches to assessment emphasize the importance of aligning evaluation methods with intended learning outcomes and promoting broader student engagement. Multiple-choice questions (MCQs) have emerged as a practical alternative to essays for covering a wide curriculum. Well-designed MCQs can assess factual knowledge, conceptual understanding, and application skills while providing objective and consistent grading. When combined with active learning principles, such assessments encourage students to engage with all components of the course and develop consistent study habits.

Kolb's Experiential Learning Theory and learning styles further support the use of varied assessment strategies to address diverse learner needs (Honey & Mumford, 1986). Incorporating MCQs alongside complementary formative methods, such as short-answer questions or case-based exercises, provides opportunities for immediate feedback, reinforces learning, and ensures broader coverage of course content. This approach aligns with Outcome-Based Education (OBE) principles, emphasizing comprehensive attainment of learning objectives across the entire syllabus.

LITERATURE REVIEW

Active learning, which involves students in the learning process through activities such as discussions, problem solving, and peer collaboration, has been shown to significantly enhance student engagement and participation (Prince, 2004); this effectiveness is further strengthened when it is supported by well-designed MCQs that promote active thinking, application of knowledge, and provide immediate feedback.

Research in higher education indicates that students' learning is strongly influenced by the assessment system. What is formally assessed is perceived as the most important aspect of a course, and students tend to focus their efforts accordingly. Tasks that contribute to a qualification, such as graded assignments or exams, receive considerable attention, while unassessed activities such as optional essays or lab exercises, are often neglected. This pattern has been observed across multiple disciplines, where students submit the minimum required reports or, in some cases, skip activities entirely once assessment requirements are fulfilled (Gibbs & Simpson, 2004).

Gibbs and Simpson (2004) identify four broad strategies that students adopt in response to assessment-driven learning. One approach is to engage minimally, particularly in courses where assessment is limited or poorly aligned with learning objectives. In such cases, students may "cruise" through the course, devoting little effort to unassessed learning, and experience difficulties when high-stakes assessments are finally administered. Another common strategy is to focus exclusively on assessed tasks. Instructors can capture student attention by formally assessing specific activities, ensuring engagement with content deemed important. However, this approach can lead to a heavy marking workload for instructors, reduce students' flexibility and intrinsic motivation, and encourage an instrumentalist mindset, where learning is viewed primarily as a means to earn marks rather than to gain understanding.

These insights highlight the critical role of assessment design in shaping learning behaviours. For theory-intensive courses such as Software Quality Assurance, relying specifically on essay-based assessments may lead students to concentrate narrowly on anticipated topics, potentially neglecting large portions of the syllabus. Incorporating broader assessment strategies, such as carefully constructed multiple-choice questions (MCQs), can mitigate this effect by encouraging students to engage with the full range of course content, promoting both comprehensive understanding and consistent study habits.

METHODOLOGY

Data collection

MCQ data were collected from a group of 15 students enrolled in the Special Degree Programme. This group was selected due to the strong industry relevance of Software Quality Assurance (SQA), which was identified as a key area through classroom observations. The MCQ-based assessment facilitated a systematic evaluation of students' conceptual understanding while promoting application-oriented thinking aligned with industry expectations.

After conducting an MCQ assessment based on a single chapter, a follow-up survey was administered using Google Forms to gather students' reflections on the assessment approach. This survey focused on students' perceptions of the MCQs, including their clarity, relevance to real-world applications, and usefulness in reinforcing conceptual understanding. The responses provided valuable insights into how MCQs supported students' learning processes, confidence levels, and ability to apply theoretical knowledge in an industry oriented context.

The integration of survey findings, MCQ performance data, and classroom observations provided comprehensive evidence of the effectiveness of MCQs as both a learning and assessment tool. This approach enabled a deeper

understanding of student engagement and learning outcomes while also identifying specific areas for further improvement in MCQ design and implementation.

Implementation

For the assessment implementation, students were first provided with the essay examination paper, and the total content coverage within each essay question was clearly explained. Students were informed about the specific topics and learning outcomes assessed through the essay questions, along with the allocated time for completion. Although the essay assessment required students to select and study particular topics in depth, the evaluation did not cover all content within each chapter. As a result, students tended to focus only on the selected areas relevant to the essay questions rather than engaging with the full chapter content.

To address this limitation and ensure broader content coverage, MCQs were introduced as a complementary assessment method. Unlike essay-based assessments, MCQs require students to understand the content of each chapter, as questions can be drawn from any part of the syllabus. For the initial implementation, MCQs were constructed based on a single chapter to familiarize students with the format and expectations. A total of 30

MCQs were administered within a one-hour time frame, which was extended compared to typical MCQ assessments to allow students sufficient time during their first exposure to this assessment type.

Both the essay and MCQ assessments were evaluated, and detailed feedback was provided to students. The corrected scripts were discussed in class, with explanations given for correct answers, common misconceptions, and areas requiring further improvement. In addition, student feedback on the MCQ assessment was collected using a Google Form to understand their perceptions of the assessment method, level of difficulty, time adequacy, and its effectiveness in supporting learning. This feedback was used to reflect on the implementation process and to inform improvements in future MCQ design and assessment strategies.

Data Analysis

Feedback was collected from 15 Special Degree students regarding the clarity and effectiveness of MCQs, with students comparing them to traditional essay questions in terms of assessing understanding of chapter content, and this feedback, together with classroom observations conducted during the assessment, highlights students' perceptions of how MCQs support conceptual understanding and provide clearer assessment.

Analysis of Student Feedback Survey: After implementing the MCQ-based assessment, a follow-up survey was conducted to assess its effectiveness in supporting student learning and engagement. The survey aimed to evaluate how the use of MCQs influenced students' understanding of chapter content, clarity of assessment expectations, and confidence in applying concepts during assessments, as well as their overall learning experience.

How clear were the MCQs in assessing your understanding of the material compared to the original essay questions?

15 responses

- Much Clearer
- Clearer
- About the Same
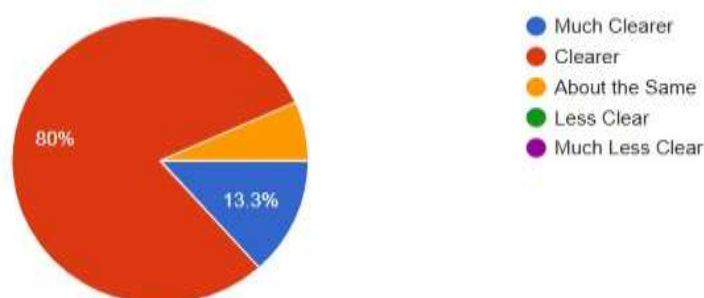- Less Clear
- Much Less Clear

Figure 1: Students' Perceptions of MCQ Clarity Compared to Essay-Based Assessment

The Figure 1 displays the distribution of responses to the question: "How clear were the MCQs in assessing your understanding of the material compared to the original essay questions?" The chart illustrates students' perceptions of the clarity of MCQs relative to essay-based assessments. A substantial majority of students indicated positive responses, with 80% selecting "Clearer" and 13.3% selecting "Much Clearer",

demonstrating that most students found MCQs to provide clearer assessment of their understanding. Only a small proportion of students (6.7%) selected "About the Same", and no students reported MCQs as less clear. These results suggest that MCQs offer greater clarity and transparency in assessment, supporting more effective evaluation of students' understanding of chapter content.
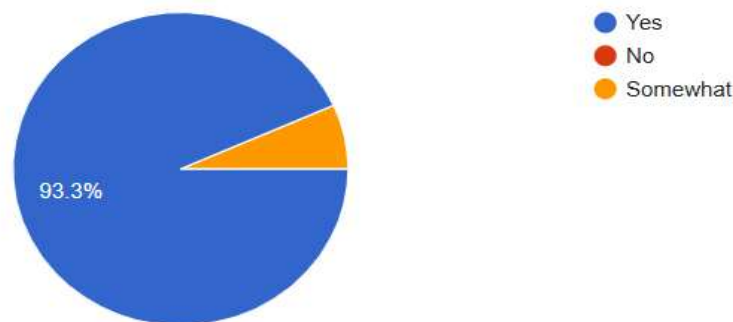

Figure 2: Student Feedback on the Alignment of MCQs with Course Concepts

This figure illustrates the responses of 15 Special Degree students to the question, "Did the MCQs accurately reflect the key concepts covered in the course?" The chart shows that an overwhelming majority of students (93.3%) responded "Yes," indicating that they believed the MCQs effectively represented the key concepts addressed in the course content. A small proportion of students (6.7%) selected "Somewhat," suggesting partial alignment, while no students responded "No." These results demonstrate that the MCQs were largely successful in capturing the essential concepts of the course, supporting their effectiveness as an assessment tool aligned with learning objectives.
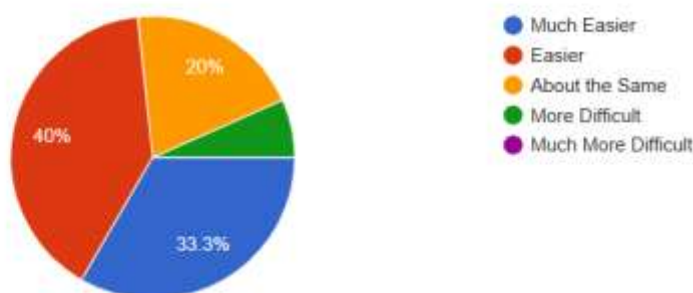

Figure 3: Comparison of Perceived Difficulty Between MCQs and Essay Questions

This figure presents the responses to the question, "How would you rate the difficulty level of the MCQs compared to the essay questions?" The chart shows that 40% of students perceived the MCQs as easier, while 33.3% indicated that they were much easier. Additionally, 20% of students felt that the difficulty level was about the same as that of essay questions. Only a small proportion of students (6.7%) considered MCQs to be more difficult, and none reported them as much more difficult. These results suggest that most students perceived MCQs as less challenging than essay-based assessments, while still maintaining an appropriate level of difficulty for evaluating understanding.

Do you think the MCQs provided a fair assessment of your knowledge and understanding?

15 responses

Figure 4: Students' Perceptions of the Fairness of MCQs

The figure shows the responses to the question, "Do you think the MCQs provided a fair assessment of your knowledge and understanding?" According to the chart, 40% of students strongly agreed that the MCQs were fair, while 60% agreed. No students indicated disagreement. These findings suggest that all students considered the MCQs to be a fair and appropriate means of assessing their knowledge and understanding, highlighting the effectiveness of the assessment.

Did you find the MCQs to be an effective way to test your knowledge of the subject matter?
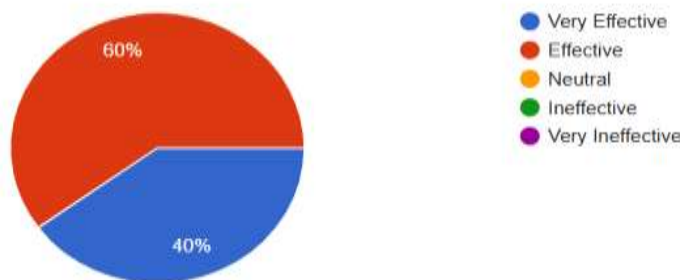
15 responses

Figure 5: Students' Feedback on the Effectiveness of MCQs

The figure indicates the responses to the question, "Did you find the MCQs to be an effective way to test your knowledge of the subject matter?" The chart indicates that 40% of students considered the MCQs very effective, while 60% found them effective. No students rated the MCQs as ineffective. These results suggest that all students regarded MCQs as an effective method for assessing their understanding of the subject matter, highlighting the value of this assessment approach.

How well did the MCQs help you in identifying areas where you need further study or improvement?
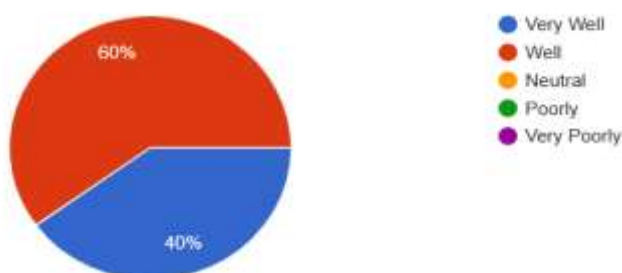
15 responses

Figure 6: Students' Responses on the Effectiveness of MCQs in Identifying Areas for Further Improvement

The figure illustrates the responses to the question, "How well did the MCQs help you in identifying areas where you need further study or improvement?" The results show that 60% of students reported that MCQs helped them well in identifying areas requiring further attention, while 40% indicated that MCQs were very well in supporting this process. Importantly, no students selected lower levels of effectiveness. These findings suggest that MCQs were highly effective in helping students recognize gaps in their understanding, thereby supporting self-directed learning and targeted revision of chapter content.
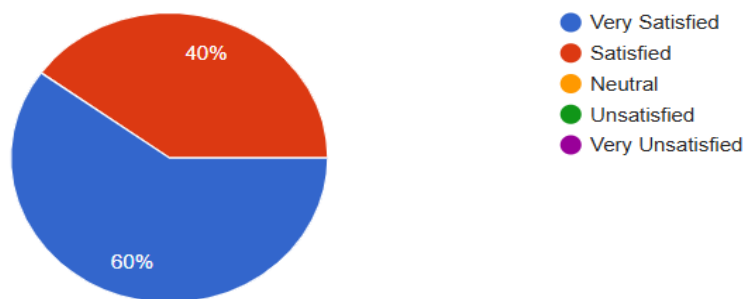

Figure 7: Students' Views on Overall Satisfaction with the Conversion of Essay Questions to MCQs

The figure presents the responses to the question, "Overall, how satisfied are you with the conversion of essay questions to MCQs in this assessment?" The results indicate a high level of student satisfaction, with 60% of respondents reporting that they were very satisfied and the remaining 40% indicating that they were satisfied. Significantly, no students expressed dissatisfaction. These findings suggest that the conversion of essay questions into MCQs was well received and perceived as an effective assessment approach that supports clarity, fairness, and improved evaluation of chapter content.
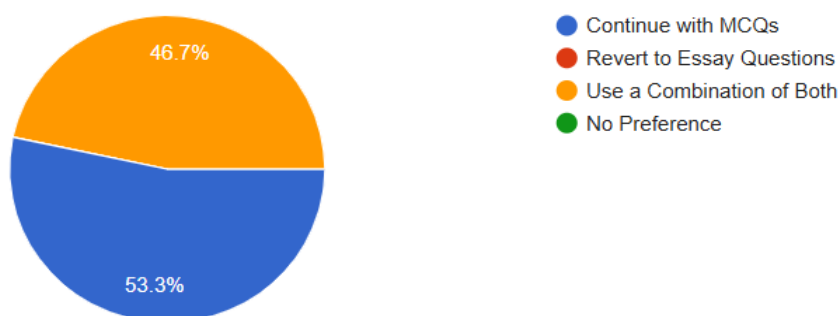

Figure 8: Students' Preferences for Assessment Format in Future Evaluations

The figure illustrates the responses of 15 Special Degree students to the question, "Would you prefer to continue with MCQs, revert to essay questions, or use a combination of both in future assessments?" The results indicate that 53.3% of students preferred to continue with MCQs, reflecting a strong inclination towards this assessment format. Meanwhile, 46.7% of students expressed a preference for using a combination of both MCQs and essay questions, suggesting recognition of the complementary strengths of both methods. Notably, no students preferred reverting solely to essay questions or reported having no preference. These findings suggest that

students largely favour MCQs, either independently or in combination with essays, highlighting the perceived effectiveness, clarity, and balance offered by MCQ-based or mixed assessment approaches.

Classroom Observations: These observations offered meaningful insights into the effectiveness of monitoring MCQ-based assessments in evaluating student learning. Students remained attentive throughout the assessment process, as the MCQs required them to actively engage with the content and apply their knowledge. This approach motivated students to prepare in advance and respond confidently to the questions. In addition, the MCQ assessment process was time-efficient for both students and instructors, allowing effective evaluation within a limited timeframe. Ongoing monitoring revealed noticeable improvements in student engagement and overall participation, demonstrating the effectiveness of MCQ assessments as a supportive and engaging evaluation method.

RESULT AND DISCUSSION

In the Software Quality Assurance (SQA) course, essay-type assessments were traditionally used; however, they assessed only limited portions of the syllabus despite students studying the entire content. To address this limitation, essay questions were converted into multiple-choice questions (MCQs), enabling broader coverage of course topics and improving overall content comprehension.

This change was informed by experiences gained as both a student and an educator, during which essay-based assessments were observed to encourage selective learning. The implementation of MCQs enabled assessment across a broader range of topics, thereby promoting a more comprehensive and balanced understanding of the subject matter.

The decision was further supported by the need to assess multiple learning objectives efficiently. MCQs allow objective, consistent, and time-efficient evaluation of factual knowledge, conceptual understanding, and basic application skills across the full curriculum.

Based on positive student feedback, MCQs will continue to be used for theory-oriented subjects like SQA. However, to address limitations in assessing higher-order thinking, MCQs will be complemented with short answer questions or case-based assessments to achieve a balanced and effective assessment strategy.

CONCLUSIONS AND RECOMMENDATIONS

The implementation of multiple-choice questions (MCQs) in the Software Quality Assurance course demonstrated positive outcomes in terms of assessment fairness, effectiveness, and comprehensive syllabus coverage. Student feedback indicated that MCQs were perceived as fair, effective, and appropriately challenging, while enabling assessment across a wider range of course content. This approach encouraged consistent student engagement and preparation, and provided an efficient and objective method for evaluating theoretical understanding in a theory-intensive course.

Based on these outcomes, it is recommended that MCQs continue to be used as a primary assessment method for evaluating theoretical knowledge in Software Quality Assurance. However, to address the limitations of MCQs in assessing higher-order cognitive skills, it is further recommended that MCQs be complemented with short-answer questions. This combination would allow for both broad content coverage and deeper evaluation of analytical and critical thinking skills, thereby supporting a more balanced and effective assessment of learning outcomes.

REFERENCES

1. Gibbs, G. & Habeshaw, T. (1989). Preparing to Teach: An Introduction to Effective Teaching in Higher Education. Bristol: Technical and Educational Services.
2. Honey, P. & Mumford, A. (1986). The Manual of Learning Styles. Maidenhead: Peter Honey Publications.
3. Biggs, J. & Tang, C. (2011). Teaching for Quality Learning at University. 4th ed. Maidenhead: McGraw Hill Education.
4. Sri Lanka Qualifications Framework (SLQF), 2015. Ministry of Higher Education, Sri Lanka.

5. Barkley, E. F. (2010). Student engagement techniques: A handbook for college faculty. Jossey-Bass.
6. Prince, M. (2004). Does active learning work? A review of the research. Journal of Engineering Education, 93(3), 223-231.
7. Hidi, S., & Anderson, V. (1986). Producing written summaries: Task demands, cognitive operations, and implications for instruction. Review of Educational Research, 56(4), 473-493.
8. Wiggins, G. (2012). Seven Keys to Effective Feedback. Educational Leadership, 70(1), pp.10-16.
9. Carter, M., & S. Kramp (2011). Enhancing communication skills through active learning in higher education. Journal of Educational Research, 15(2), 200-208.