

From Assessment to Achievement: The Predictive Role of Continuous Assessment in Business Mathematics Performance

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ABSTRACT

This study examines the relationship between continuous assessment performance and final examination performance among diploma students enrolled in a Business Mathematics course. The dataset comprises 244 students from multiple classes. Pearson's correlation analysis was conducted to determine the strength and direction of the relationships between the continuous assessment components and final examination performance, while regression analysis was employed to evaluate the predictive role of continuous assessment in explaining students' final examination performance. The findings indicate positive correlations between final examination performance and all continuous assessment components, with the test showing the strongest relationship, followed by the quiz and project assessment. Multiple linear regression analysis indicated that the overall model was statistically significant and explained 64.7% of the variance in final examination scores. Quiz and test scores were significant predictors of final examination performance, whereas the project did not significantly predict final examination performance. These results highlight the importance of continuous assessment in supporting student learning and improving academic outcomes, particularly in mathematics education.

Keywords: Business Mathematics, continuous assessment, final examination performance, mathematics education, regression analysis

INTRODUCTION

Assessment plays a crucial role in higher education, serving as a primary mechanism for evaluating students' understanding, skills, and overall academic performance. In recent years, there has been increasing emphasis on continuous assessment as an integral component of the teaching and learning process. Unlike traditional assessment methods that rely heavily on final examinations, continuous assessment provides ongoing evaluation and allows educators to monitor students' progress throughout the semester.

Continuous assessment typically includes quizzes, assignments, tests, and other formative activities designed to enhance students' engagement and learning. In mathematics education, particularly in courses such as Business Mathematics, continuous assessment is essential in helping students develop problem-solving skills, conceptual understanding, and analytical thinking. It also provides opportunities for students to receive feedback and improve their performance before the final examination.

Previous studies have highlighted the importance of continuous assessment in improving academic achievement. Continuous assessment not only encourages consistent study habits but also reduces students' reliance on high-stakes final examinations. Furthermore, it allows instructors to identify students who are at risk of poor performance and implement early intervention strategies. As a result, continuous assessment is often considered a reliable indicator of students' academic success.

Despite its importance, the relationship between continuous assessment and final examination performance remains an area of interest in educational research. Understanding this relationship is particularly important for educators, as it can inform teaching strategies, assessment design, and student support mechanisms. In the context of the Business Mathematics course, where students often face challenges in mastering mathematical concepts, it is essential to determine whether continuous assessment can effectively predict students' performance in the final examination.

Therefore, this study aims to examine the relationship between continuous assessment and final examination performance among diploma students enrolled in the Business Mathematics course. Specifically, the study seeks to determine whether continuous assessment can serve as a significant predictor of students' final examination outcomes. The findings of this study are expected to provide valuable insights for educators in improving assessment practices and enhancing students' academic performance.

Objectives of the Study

- i. To examine the relationship between continuous assessment and final examination performance among the Business Mathematics course students.
- ii. To determine which continuous assessment components significantly predict final examination performance.

LITERATURE REVIEW

Previous studies have consistently highlighted the importance of formative assessment in improving student learning outcomes. Continuous assessment enhances student achievement by providing timely feedback and supporting learning during the instructional process (Black & Wiliam, 1998). Similarly, formative assessment plays a critical role in helping students understand the gap between their current performance and desired learning outcomes (Sadler, 1989).

The concept of constructive alignment highlights the importance of ensuring that teaching approaches, assessment methods, and learning outcomes are well-connected to support effective learning (Biggs, 1996). In this sense, continuous assessment goes beyond simply measuring students' performance; it also plays an important role in guiding and enhancing their learning throughout the course.

Furthermore, effective feedback from continuous assessment promotes self-regulated learning, enabling students to take control of their own learning process (Nicol & Macfarlane-Dick, 2006). Research also indicates that feedback is one of the most powerful influences on student achievement (Hattie, 2009), further reinforcing the value of continuous assessment.

Recent studies have demonstrated that continuous assessment can serve as a strong predictor of academic performance. Students who perform well in formative assessments are more likely to achieve higher scores in final examinations. Continuous assessment also encourages consistent engagement with course materials and reduces over-reliance on high-stakes examinations (Yorke, 2003).

Recent studies continue to support the importance of continuous assessment in higher education. Evidence shows that continuous assessment not only helps predict students' academic performance but also improves their engagement in the learning process (Wu, 2025; Parmigiani et al., 2024). Students who perform well in continuous assessment are generally more likely to achieve better results in their final examinations (Clayson & Chiwala, 2026).

In addition, the way continuous assessment is designed and implemented, including how often it is conducted, can influence student outcomes (Bulut, 2025). When combined with active learning approaches, continuous assessment can further enhance students' understanding and knowledge retention (Nasirpour-Osgoei, 2025). Students' perceptions of the feedback they receive also play an important role, as meaningful feedback can shape their learning experience and overall performance (Kwan, 2024). In mathematics education, continuous assessment is particularly important due to the cumulative nature of the subject. Regular assessment helps

reinforce understanding and identify misconceptions early, thereby improving students' problem-solving skills and conceptual understanding.

While previous studies show that continuous assessment generally helps student learning (Black & Wiliam, 1998; Yorke, 2003), little research has focused specifically on introductory applied subjects such as Business Mathematics at the diploma level. Business Mathematics is unique because it requires students to understand basic concepts, remember formulas, and solve step-by-step problems under time limits (Sujatha & Vinayakan, 2023; Wardana et al., 2024).

In addition, many courses now use projects to encourage real-world problem-solving, but it is unclear whether these projects can really predict how well an individual student will do in a formal written exam (Segers et al., 1999). Therefore, studying Business Mathematics students specifically helps us understand how different types of assessment, such as individual quizzes, tests, and projects, affect final exam results in a calculation-heavy subject.

Despite the strong support for continuous assessment in the literature, there is still a need to further examine its relationship with final examination performance, particularly at the diploma level. Therefore, this study aims to address this gap by analysing the predictive role of continuous assessment in the Business Mathematics course.

METHODOLOGY

This study employed a quantitative research approach to examine students' performance in the Business Mathematics course. The participants comprised students from the Diploma in Public Administration Studies, Diploma in Business Studies, and Diploma in Banking Studies at a public institution in Malaysia. All students enrolled in the Business Mathematics course during the October 2025 to February 2026 semester were included in the study.

The Business Mathematics course covers eight major topics that are fundamental to financial and business calculations. Table 1 provides an overview of the topics covered throughout the course and their alignment with the respective assessment components. The course begins with Simple Interest, which covers basic interest calculation methods. Bank Discount and Promissory Notes focuses on financial documents and business-related calculations. Compound Interest discusses interest calculations on principal and accumulated interest. Annuities involve present and future value calculations for regular payments. Trade and Cash Discounts explain discount strategies for sales and payments. Markup and Markdown explore pricing strategies and profit-loss calculations. Instalment Purchase addresses interest and repayment methods for instalment plans. Lastly, Depreciation covers asset value reduction over time and common calculation methods.

Table 1. Alignment of Course Topics with Assessment Components

Topic No	Topic Title	Quiz	Test	Project	Final Examination
1	Simple Interest	✓			✓
2	Bank Discount and Promissory Note	✓			✓
3	Compound Interest			✓	✓
4	Annuities			✓	✓
5	Trade and Cash Discount		✓		✓
6	Markup and Markdown		✓		✓
7	Instalment Purchased		✓		✓
8	Depreciation				✓

Data for this study were obtained from students' course assessment records, which included quiz, test, project, and final examination, with continuous assessment constituting 50% of the overall course grade (10% for the quiz, 25% for the test, and 15% for the project). The final examination is 50%, and all assessment components

are systematically aligned with the relevant course learning outcomes (CLOs) and course topics to accurately measure student achievement. The quiz was designed to assess CLO1, which is related to differentiating between simple and compound interest calculations in solving business mathematics problems. Accordingly, Topics 1 and 2 were assessed through the quiz, which comprised a total of 30 marks. The test focused on CLO2 related to determining appropriate solutions to business mathematics problems and covered Topics 5 to 7, with a total of 45 marks. Meanwhile, the project was designed to assess the CLO3 related to demonstrating entrepreneurial skills in addressing real-life business mathematics problems. Topics 3 and 4 were incorporated into the project through case studies and video presentations, providing students with opportunities to apply mathematical knowledge in real world business contexts. Performance on all assessment components was measured individually for each student. No student records were excluded, as complete assessment data were available for all 244 students. Consequently, there were no missing observations, and no missing-data treatment or imputation was required.

The systematic alignment of CLOs, course topics, and assessments ensures a comprehensive evaluation of students' learning outcomes. This diverse assessment strategy gauges conceptual understanding, problem-solving abilities, and practical application of business mathematics, while the final examination evaluates overall mastery of the course content across all syllabus topics with a total of 100 marks. The assessment records for each student were then analysed using appropriate statistical methods. Descriptive statistics were employed to summarise students' performance across the various assessment components. In addition, inferential analysis was conducted to examine the relationships between each component of the continuous assessment and students' final examination performance. Specifically, correlation analysis was used to determine the strength and direction of the relationship between each continuous assessment component and the final examination. This analysis provides an empirical basis for identifying which assessment components are most strongly associated with students' achievement in the final examination. Furthermore, multiple linear regression analysis was conducted to examine the combined contribution of the continuous assessment components to students' final examination performance. The regression model was used to determine the extent to which quiz, test, and project scores could explain the variation in final examination scores. The results of these analyses provide a more comprehensive understanding of students' performance and the effectiveness of the different assessment components in supporting the achievement of the intended learning outcomes. All statistical analyses were performed using R statistical software.

RESULTS AND DISCUSSIONS

A total of 244 students participated in the study, of which 32% were from the Diploma in Public Administration Studies, 36% were from the Diploma in Business Studies, and the remaining students were from the Diploma in Banking Studies. All the participants of the study were students enrolled in the Business Mathematics course for the October 2025 to February 2026 semester at a public university in Malaysia.

The descriptive statistics for the scores of all students across various assessments, including quiz, test, project and the final examination, are presented in Table 2. The results indicate that the project recorded the highest mean score among all assessment components and showed the lowest variation, indicating that students generally performed well and consistently in this assessment. In contrast, the final examination recorded the lowest mean score (71.66), suggesting that students found the final examination more challenging compared to the other assessments. Meanwhile, quiz and test components obtained mean scores of 74.44 and 74.90, respectively, indicating moderate student performance in both assessments. Overall, the results suggest that students performed better in continuous assessments, particularly the projects, than in the final examination.

Table 2. Descriptive Statistics of Students' Performance by Assessment Component

Assessment	Mean	Standard Deviation	Minimum	Maximum
Quiz	74.44	18.25	20.00	100.00
Test	74.90	17.96	27.00	100.00
Project	82.03	7.31	35.00	100.00
Final Examination	71.66	20.74	13.00	100.00

A one-way analysis of variance (ANOVA) was conducted to examine whether students' performance differed according to their programme of study. The results indicated that there were no statistically significant differences in students' scores across the three programmes for the quiz ($F(2, 241) = 0.131, p = .877$), test ($F(2, 241) = 0.664, p = .516$), project ($F(2, 241) = 1.768, p = .173$) and final examination ($F(2, 241) = 1.138, p = .322$). These findings suggest that students' performance did not significantly differ by programme of study across any of the assessment components.

Table 3. One-Way ANOVA Results by Programme of Study

Assessment	F	P
Quiz	0.131	.877
Test	0.664	.516
Project	1.768	.173
Final Examination	1.138	.322

The analysis is continued with a correlation analysis to examine the relationship between continuous assessment components and final examination performance among students, with the results presented in Table 4. The findings show that all components of continuous assessment are positively related to final examination. Among them, the test exhibits the strongest relationship with final examination performance, followed by the quiz, suggesting that students who performed well in these assessments were more likely to achieve higher final examination results. In contrast, the project shows only a weak relationship with final examination performance, indicating that high achievement in the project assessment did not necessarily reflect strong performance in the final examination.

Table 4. Pearson Correlation Matrix of Assessment Scores

	Quiz	Test	Project	Final Examination
Quiz	1			
Test	.567**	1		
Project	.104	.179**	1	
Final Examination	.661**	.750**	.184**	1

**Correlation is significant at the 0.01 level (2-tailed)

A multiple linear regression model is then fitted to the data to determine whether continuous assessment components (quiz, test, and project) can significantly predict students' final examination performance. According to the results in Table 5, the regression model is statistically significant ($F = 146.774, p = 0.000$), indicating that the model provides a good fit for the data. As indicated by the R-squared, the three continuous assessment components explain 64.7% of the variation in final examination scores, with the remaining 35.3% associated with other factors not included in the model.

Table 5. Summary of Regression Model Fit

Model	R-squared	Adjusted R-squared	F	P
Quiz, Test, Project	.647	.643	146.774	.000

The assumptions underlying the Pearson correlation and multiple linear regression analyses were examined before interpreting the results. As shown in Figure 1, the Q-Q plot indicated that the residuals were approximately normally distributed, with most points lying close to the diagonal line. The residuals were also randomly scattered around zero with a relatively consistent spread across the predicted values, supporting the assumptions of linearity and constant variance. The independence of observations was considered based on the study design, as each student contributed one set of assessment scores. In addition, Cook's Distance values

ranged from 0.00 to 0.08, indicating that no observation had an excessively large influence on the regression model. Furthermore, the variance inflation factor (VIF) values for all predictors, as presented in Table 6, were below 5, indicating no evidence of multicollinearity among the independent variables.

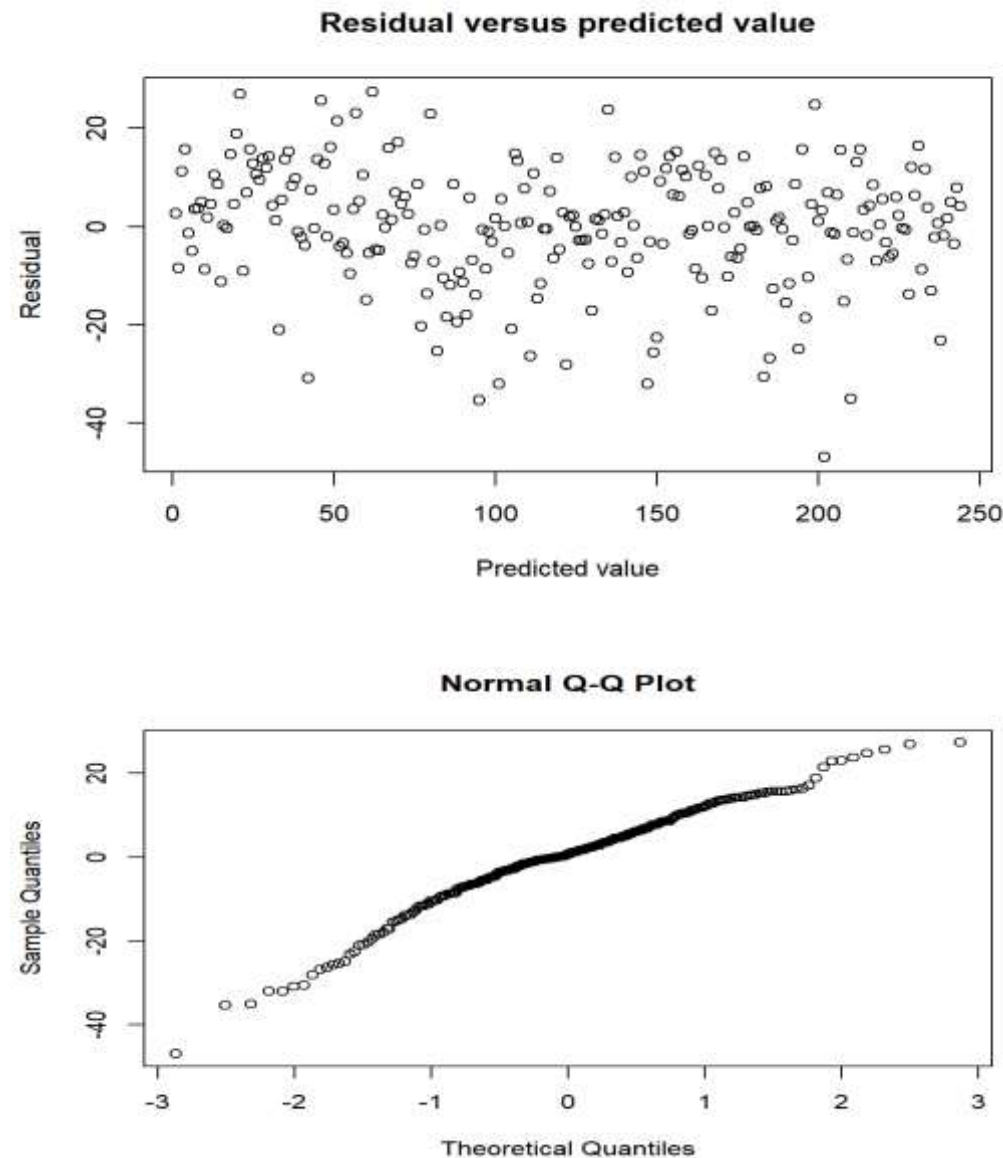


Figure 1. Diagnostic Plots: Normal Q–Q Plot and Residuals versus Predicted Values

At the individual predictor level, quiz ($p < 0.001$) and test ($p < 0.001$) are statistically significant contributors to final examination performance, while the project is not statistically significant ($p = 0.191$). Among the significant predictors, the test demonstrated the largest standardised regression coefficient, indicating that it made the strongest unique contribution to the prediction of final examination performance, after controlling for the other assessment components.

Table 6. Multiple Linear Regression Coefficients for Predicting Final Examination Scores

Predictor	B	Standard error	β	t	P	VIF
Constant	-16.674	9.276		-1.797	.074	
Quiz	.394	.053	.347	7.448	.000	1.474
Test	.629	.054	.545	11.575	.000	1.506
Project	.145	.111	.051	1.310	.191	1.033

Overall, this finding suggests quizzes and tests are significantly associated with and can predict students' final examination performance. The quiz which assesses CLO1 indicates that students capable of distinguishing between simple and compound interest calculations tend to perform better in final examinations. This suggests that the quiz provides opportunities for students to strengthen their understanding of fundamental mathematical concepts and the procedures required to apply them. In addition, the test that assesses CLO2 requires higher cognitive processing, demonstrating the application of mathematical procedures, which correlates well with the final examination. In contrast, the project focuses on CLO3, which evaluates students' entrepreneurial approaches to real-world situations. This lack of statistical significance does not necessarily indicate that the project is ineffective, but rather, it may reflect differences in the dimensions of learning assessed by the project and the final examination. According to Sujatha and Vinayakan (2023), the integration of mathematics with real-world applications significantly enhances student engagement and understanding. Students who engage with real-world applications demonstrate greater motivation to learn and a stronger ability to recognise the relevance and importance of mathematics in their daily lives (Wardana et. al, 2024). The project provides opportunities for practical application of business mathematics in real-life contexts, whereas the final examination primarily assesses students' individual cognitive knowledge and problem-solving abilities (Segers et. al, 1999).

CONCLUSION

This study examined the relationship between continuous assessment performance and final examination performance among diploma students. The findings revealed significant positive relationships between continuous assessment components and final examination performance, although the strength of these relationships varied across the different assessment components. Multiple linear regression analysis further demonstrated that the assessment components collectively provided significant predictive value for final examination performance, with some components showing stronger predictive effects than others.

These findings highlight the importance of using a variety of assessment methods to monitor students' learning progress and provide insights into their academic performance, particularly in mathematics courses. Continuous assessment not only serves to evaluate students' learning throughout the course but can also provide an indication of their potential performance in the final examination. This information may assist instructors in refining assessment strategies, monitoring students' progress and providing timely instructional interventions where appropriate. Future research could extend this study by examining additional factors that may influence students' examination performance, such as prior academic achievement, study habits, learning engagement and attendance.

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