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Low-Stakes Quizzing as a Predictor of Academic Outcomes: The Role of Motivation in Undergraduate Health Sciences Education.

Cuestionarios de bajo riesgo como predictores de resultados académicos: el papel de la motivación en la educación universitaria en ciencias de la salud.

Miguel A. Pérez[1]*, Gabriela Urrejola-Contreras[2] and Paula Tiemann[1]

[1] Facultad de Ciencias de la Vida, Carrera de Kinesiología, Universidad Viña del Mar, Viña del Mar, Chile. miguel.perez@uvm.cl , orcid: 0000-0002-7257-1713
[2] Facultad de Ciencias de la Vida, Unidad de Ciencias Aplicadas, Universidad Viña del Mar, Viña del Mar, Chile. gabriela.urrejola@uvm.cl . orcid: 0000-0002-8370-4550
[3] Facultad de Ciencias de la Vida, Carrera de Kinesiología, Universidad Viña del Mar, Viña del Mar, Chile., ptieman@uvm.cl orcid: 0000-0001-8293-9182

* Correspondencia: miguel.perez@uvm.cl

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Abstract: *Introduction:* Improving academic performance remains a central challenge in higher education. Test-enhanced learning (TEL) has been shown to improve knowledge retention and support long-term consolidation. However, the role of motivation in TEL contexts, particularly in low-stakes assessments, remains less well understood. This study examined the relationship between quiz performance, academic motivation, and subsequent outcomes in undergraduate health sciences students. **Methods**: A quasi-experimental design was conducted with 181 kinesiology students enrolled in Biology, Neurophysiology, and Pathophysiology courses. Over 16 weeks, students completed cumulative quizzes, mid-unit tests, and a final exam. Academic motivation was assessed using the Academic Motivation Scale (AMS). Data were analyzed using descriptive statistics and Pearson correlations. **Results:** Significant positive correlations were observed between early quiz performance and first exam scores ($r = 0.50–0.70$, $p < 0.0001$). Strong correlations also emerged between average quiz performance and final course grades across all courses ($r = 0.71–0.82$, $p < 0.0001$), confirming the predictive value of low-stakes assessments. Motivation profiles indicated high levels of intrinsic ($M = 6.1$) and extrinsic motivation ($M = 6.2$), alongside low but variable levels of lack of motivation ($M = 1.8$). Elevated intrinsic and extrinsic motivation likely fostered quiz engagement, consistent with self-determination theory. A minority of students reported high lack of motivation, suggesting potential risk for disengagement and academic failure. **Conclusion:** These findings suggest that TEL is effective both as a learning enhancer and as an early diagnostic tool. Integrating motivational assessments with structured low-stakes testing may help optimize teaching strategies, provide timely support for at-risk students, and improve academic success in higher education.

Keywords: Enhanced learning, low-stakes assessment, academic motivation, undergraduate students, academic performance,

Resumen: Introducción: Mejorar el rendimiento académico sigue siendo un desafío central en la educación superior. Se ha demostrado que el aprendizaje mejorado por pruebas (TEL) mejora la retención de conocimientos y apoya la consolidación a largo plazo. Sin embargo, el papel de la motivación en contextos de TEL, particularmente en evaluaciones de bajo riesgo, sigue siendo menos comprendido. Este estudio examinó la relación entre el rendimiento en cuestionarios, la motivación académica y los resultados posteriores en estudiantes de ciencias de la salud de pregrado. **Métodos:** Se realizó un diseño cuasiexperimental con 181 estudiantes de kinesiología matriculados en cursos de Biología, Neurofisiología y Fisiopatología. Durante 16 semanas, los estudiantes completaron cuestionarios acumulativos, exámenes de mitad de unidad y un examen final. La motivación académica se evaluó utilizando la Escala de Motivación Académica (AMS). Los

datos se analizaron utilizando estadística descriptiva y correlaciones de Pearson. **Resultados:** Se observaron correlaciones positivas significativas entre el rendimiento temprano en cuestionarios y las calificaciones del primer examen (r = 0,50-0,70, p < 0,0001). También surgieron fuertes correlaciones entre el desempeño promedio en los cuestionarios y las calificaciones finales del curso en todos los cursos (r = 0,71–0,82, p < 0,0001), lo que confirma el valor predictivo de las evaluaciones de bajo riesgo. Los perfiles de motivación indicaron altos niveles de motivación intrínseca (M = 6,1) y extrínseca (M = 6,2), junto con niveles bajos pero variables de desmotivación (M = 1,8). La motivación intrínseca y extrínseca elevada probablemente fomentó la participación en los cuestionarios, lo que es coherente con la teoría de la autodeterminación. Una minoría de estudiantes informó una alta desmotivación, lo que sugiere un riesgo potencial de desconexión y fracaso académico. **Conclusión:** Estos hallazgos sugieren que TEL es eficaz tanto como potenciador del aprendizaje como herramienta de diagnóstico temprano. La integración de evaluaciones motivacionales con pruebas estructuradas de bajo riesgo puede ayudar a optimizar las estrategias de enseñanza, brindar apoyo oportuno a los estudiantes en riesgo y mejorar el éxito académico en la educación superior.

Palabras clave: Aprendizaje mejorado con pruebas, evaluación de bajo riesgo, motivación académica, estudiantes universitarios, rendimiento académico,

1. Introduction

In higher education, one of the most persistent challenges for educators and institutions is achieving sustained improvements in student academic performance (1). The ongoing search for pedagogical strategies that foster deep and lasting learning has led to renewed interest in active, student-centered methodologies among which test-enhanced learning (TEL) stands out (2). This approach is grounded in the cognitive principle that the active retrieval of information through repeated testing not only assesses knowledge but also strengthens memory traces and facilitates long-term consolidation (3).

TEL has been shown to improve retention more effectively than additional studying, even when tests are administered without feedback (4). Unlike traditional summative assessments, TEL emphasizes retrieval practice, enabling learners to identify conceptual gaps and adjust their study strategies accordingly (5). Among the most commonly used tools within this approach are low-stakes testing (quizzing), that can be easily integrated into course structures (6). These quizzes provide immediate feedback and promote key metacognitive processes such as self-regulated learning (7-8). Furthermore, their applicability in both face-to-face and online settings enhances their versatility and scalability across diverse educational environments (9). A growing body of evidence supports the positive impact of TEL on long-term knowledge retention, student engagement, and academic achievement (3, 10).

However, important gaps remain in literature particularly regarding the role of motivation in TEL contexts and its relationship with academic performance (11). The international literature provides substantial evidence on TEL and motivation; however, there is a marked scarcity of studies conducted in Latin American contexts. Existing research in the region has largely focused on broad descriptions of educational challenges, with limited attention to the empirical evaluation of specific pedagogical strategies such as TEL (1). Furthermore, within the Latin American educational context, studies have been identified that reinforce the regional relevance of formative feedback and meaningful learning. Authors such as Rebaza (12) in Peru and Mendoza (13) in Lima, have addressed the relationship between these variables in university settings, evidencing positive and moderate correlations. These works underline the need to implement effective and contextualized feedback strategies, particularly in health sciences programs, where competent training is crucial. Accordingly, this study not only aims to replicate international findings but also to generate contextualized evidence on the feasibility and value of integrating motivational assessment with TEL in a Latin American undergraduate health education setting. Prior research has shown that factors beyond cognitive ability such as fatigue, anxiety, motivation, test format, and test length can significantly influence performance on cognitive assessments (11). One major concern in low-stakes testing environments (i.e., tests with no direct consequences for test-takers) is a lack of test-taking motivation. Numerous studies have demonstrated that motivated test-takers

consistently outperform their unmotivated peers, even when controlling for cognitive ability (14–16). In high-stakes assessments, test-taking motivation is typically driven by the associated consequences, with the assumption that students will exert maximum effort throughout the process. In contrast, low-stakes assessments often elicit more variable levels of effort, due to the absence of personal or academic consequences (14,17). It is therefore reasonable to assume that not all students are equally motivated to perform at their best in low-stakes assessments such as quizzes. This raises an important question: To what extent might low motivation or poor performance during low-stakes assessments be associated with lower performance in partial and final exams?

Motivation for academic achievement plays a particularly crucial role in student populations. When individuals are academically motivated, they are more likely to persist in completing tasks, reach academic goals, and attaining professional credentials (18). Motivation underlies human behavior, guiding actions that are energizing, goal-directed, and sustained over time. In educational contexts, it has a multifaceted structure and is closely linked to learning processes and academic engagement (18). Academic motivation and sustained engagement are among the most influential predictors of student success. Consequently, fostering motivation and engagement is a central responsibility for educators (19).

The present study aims to examine whether the performance of summative quizzes correlates with partial and final academic performance in undergraduate students. We hypothesize that low quiz performance possibly reflecting low motivation may be associated with poor outcomes on higher-stakes assessments.

2. Methods

Study Design and Participants

This study employed a quasi-experimental design involving three courses from the School of Health Sciences to evaluate the effects of low-stakes assessments (quizzes) on academic performance. The research was conducted during the first academic semester of 2025 with students from the Kinesiology program at the University of Viña del Mar (UVM), a private university in Chile.

The sample included one first-year course and two second-year courses, all of which incorporated accumulative quizzes as part of their assessment structure. Participants were undergraduate students enrolled in these courses. A total of 181 students participated in the study. All participants provided informed consent prior to enrollment, and the study was approved by the university's institutional ethics committee, in accordance with established research guidelines and protocols.

Each course was structured into three instructional units, with each unit evaluated through one mid-unit test and two accumulative quizzes. In total, each course included three-unit tests, six quizzes, and a final exam. The inclusion of lab and workshop sessions varied between courses. It is important to contextualize that, unlike many educational settings where formative quizzes are typically optional and not linked to grading, in our institutional context these quizzes were incorporated as mandatory components of summative assessment. This decision was based on preliminary observations indicating that voluntary formative activities on our institutional platform had a very low participation rate (below 10%), suggesting limited intrinsic motivation to engage in such practices independently. Therefore, the implemented design reflects a pragmatic adaptation to the specific characteristics of our student population. The final grade was calculated based on a weighted combination of assessment components, as detailed in table 1.

Test-Enhanced Learning

The TEL intervention consisted of the systematic implementation of accumulative quizzes throughout the 16-week course. Quizzes were administered biweekly, at the beginning of each session, and covered content from the previous class. Each quiz consisted of 3 to 5 questions, either

multiple-choice or short-answer format. Immediate feedback was provided both verbally and digitally upon completion, reinforcing learning and clarifying misconceptions. Quizzes were graded and accounted for 10–15% of the final course grade, depending on the course (table 1).

Table 1. Weighted percentage by Course.

Course	Test-1	Test-2	Test-3	Quizzes	Laboratory	Workshops	Final exam
A	20	20	25	10	15	10	30
B	20	20	25	15	none	20	30
C	25	25	25	10	15	none	30

Note. Course A refers to Biology, Course B refers to Neurobiology, and Course C refers to Pathophysiology.

Academic Motivation Scale (AMS)

Academic motivation was assessed using the Academic Motivation Scale (AMS) developed by Vallerand et al. (1992). The scale consists of 28 items designed to measure three types of academic motivation: intrinsic motivation, extrinsic motivation, and lack of motivation. Participants responded to each item on a 7-point Likert scale, ranging from 1 ("Does not correspond at all") to 7 ("Corresponds exactly"), indicating the extent to which each statement reflected their personal reasons for engaging in academic activities. The survey was administered prior to the feedback process of the first test, ensuring that students' responses reflected their authentic motivational state during the initial stages of the course, unaffected by any performance-related feedback. Participation was voluntary, and students were informed that their responses would be used exclusively for research purposes and would remain strictly confidential.

Data collection procedures

Academic performance was assessed using multiple indicators: (1) the individual scores of the first two summative quizzes, (2) the average score of all quizzes throughout the course, (3) the scores obtained in each major test, and (4) the final course grade. These metrics provided both partial and cumulative measures of student achievement across the semester. Academic motivation was measured using the Academic Motivation Scale, a validated instrument that assesses three distinct dimensions: intrinsic motivation, extrinsic motivation, and lack of motivation. The AMS allows for a multidimensional analysis of students' motivational profiles in the academic context. To explore the relationship between early low-stakes assessment performance and later academic outcomes, Pearson correlation analyses were conducted. Specifically, correlations were calculated between the average score of the first two quizzes and the score on Test 1, and the overall quiz average and the final course grade. In Chile, the grading scale ranges from 1.0 to 7.0, where a minimum of 4.0 is required to pass. Typically, in higher education, around 80% of passing grades fall within the 4.5–5.4 range. Grades between 4.0 and 4.9 are considered sufficient, 5.0–5.4 are considered good, 5.5–5.9 are very good, and grades of 6.0 or higher reflect high academic excellence.

Data Analysis

All data were analyzed using GraphPad version 8.01 for Windows. Descriptive statistics were computed to summarize academic performance indicators (quiz scores, exam scores, and final course grade) as well as academic motivation dimensions (intrinsic motivation, extrinsic motivation, and lack of motivation). Pearson correlation analyses were conducted to explore the relationships between the average score of the first two formative quizzes and the score obtained on the first exam, and the overall quiz average and the final course grade. Pearson correlation coefficient of 0.00–0.10 was interpreted as indicating very weak or no correlation, 0.10–0.39 as weak correlation, 0.40–0.69 as moderate correlation, 0.70–0.89 as high correlation, and 0.90–1.00 as very strong correlation (19). A significant level of $p < .05$ was adopted for all statistical tests.

3. Results

Table 2 presents the demographic distribution of the 181 undergraduate students who participated in the study. These students were enrolled in three different courses: Biology (n = 60,

33.2%), Neurophysiology (n = 56, 30.9%), and Pathophysiology (n = 65, 35.9%). Across all courses, male students were predominant: Biology (58.3% male, 41.7% female), Neurophysiology (57.1% male, 42.9% female), and Pathophysiology (60.0% male, 40.0% female). Overall, 58.6% of participants were male and 41.4% were female (Table 2). According to the grading scale, final grades ranging from 4.0 to 4.9 are considered sufficient for passing all courses.

Table 2. Descriptive Statistics by Course.

Course	n	%	Test 1	Test 2	Test 3	Quiz 1–2 Mean	Quiz average
A	60	33.2	3.5 ± 1.2	3.8 ± 1.4	3.9 ± 1.5	4.1 ± 1.4	4.7 ± 1.5
B	56	30.9	3.9 ± 1.2	4.3 ± 1.3	3.6 ± 1.4	4.3 ± 1.0	5.0 ± 1.3
C	65	35.9	3.6 ± 1.2	3.3 ± 1.3	4.0 ± 1.4	3.8 ± 1.0	4.0 ± 1.4
Total	**181**	**100**					

A Pearson correlation analysis revealed a statistically significant positive association between students' average scores on the first two quizzes and their performance on the first exam. As shown in Figure 1A, the scatter plot demonstrates a clear linear trend for biology course ($r = 0.7$, $p < 0.0001$), indicating that students who performed better on early summative quizzes tended to achieve higher scores on the first high-stakes evaluation. In addition, we found a moderate correlation between students' average scores on the first two quizzes and their performance on the first exam for Neurobiology and Pathophysiology course (r=0.54 and r=0.50, respectively) (Figure 1B-C). This finding supports the predictive value of low-stakes quizzes in anticipating academic performance in summative contexts.

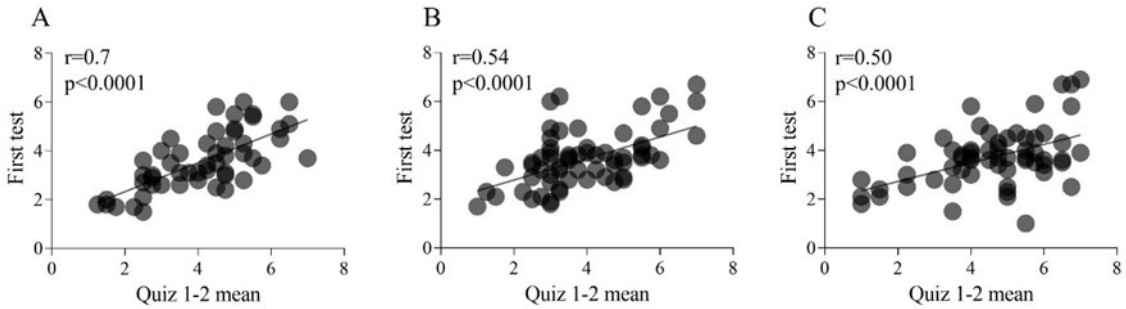

Figure 1. Scatter plots illustrating the relationship between the average score of the first two quizzes and performance on the first test. A. Among first-year students. a significant positive high correlation was observed (r = 0.70). suggesting that higher quiz averages are associated with better test performance. B–C. Among second-year students. significant positive correlations are also observed (r = 0.54 and r = 0.50. respectively). indicating similar patterns. Each point represents an individual student.

Low-stakes quizzes as predictive performance of final grade.

Figure 2 shows a scatter plot displaying the relationship between average quiz performance and final course grade. There was a strong correlation between quiz average (low-stakes assessments) and the final grade average in students of first-year course ($r = 0.71$, $p < 0.0001$) (Figure 2A). Similarly, we found a strong correlation between quiz average and the final grade average in students of second-year course. Indeed, we found in students of pathophysiology course a strong correlation between quiz average and the final grade average in students of first-year course ($r = 0.82$, $p < 0.0001$) (Figure 2B). Furthermore, we found in students of the neurophysiology course a strong correlation between quiz average and the final grade average ($r = 0.76$, $p < 0.0001$) (Figure 2C).

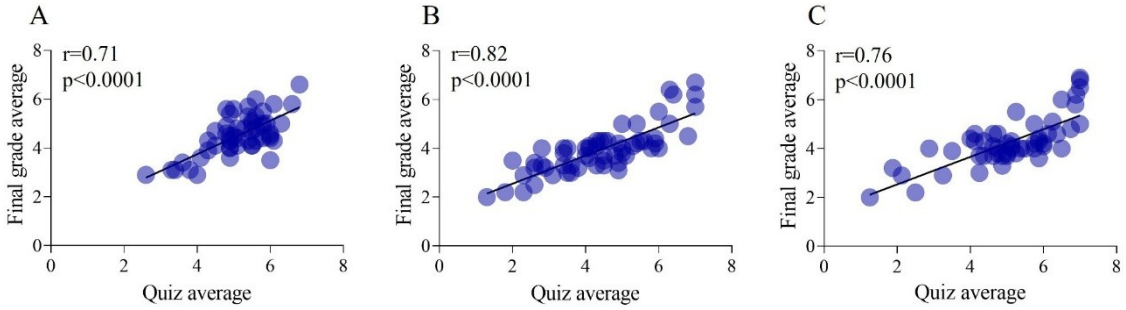

Figure 2. Scatter plots illustrating the relationship between average quiz performance and the final course grade. A. Among first-year students. a strong positive correlation was observed (r = 0.71). suggesting that higher quiz averages are associated with better final grades. B–C. Among second-year students. strong positive correlations are also observed (r = 0.82 and r = 0.76. respectively). indicating similar patterns. Each point represents an individual student.

Academic Motivation Scale

Figure 3 presents the distribution of responses across the three AMS motivation subscales: intrinsic motivation (A), extrinsic motivation (B), and lack of motivation (C). A clear pattern emerged where responses for both intrinsic and extrinsic motivation were concentrated at the higher end of the Likert scale, while lack of motivation scores were predominantly low. As detailed in table 3, students reported high levels of intrinsic and extrinsic motivation across all subdimensions. Notably, the subdimensions "to know" (intrinsic) and "identified regulation" (extrinsic) showed the highest mean scores. In contrast, lack of motivation was characterized by a low mean score but high variability, as indicated by its substantial coefficient of variation.

The distribution shapes further elucidate these patterns. All intrinsic and extrinsic motivation subscales showed negative skewness, reflecting a concentration of responses at the high end of the scale. The kurtosis values varied, indicating differences in the peakedness of the distributions for these subdimensions. lack of motivation presented a starkly different profile, with a strong positive skew and high kurtosis, signifying that while most students reported very low lack of motivation, a small subset reported substantially higher levels, creating a heavy-tailed distribution (table 3). Overall, these findings indicate a student cohort with pronounced intrinsic and extrinsic motivational drives, coupled with generally low but highly variable lack of motivation, where a minority of students displayed markedly elevated disengagement levels.

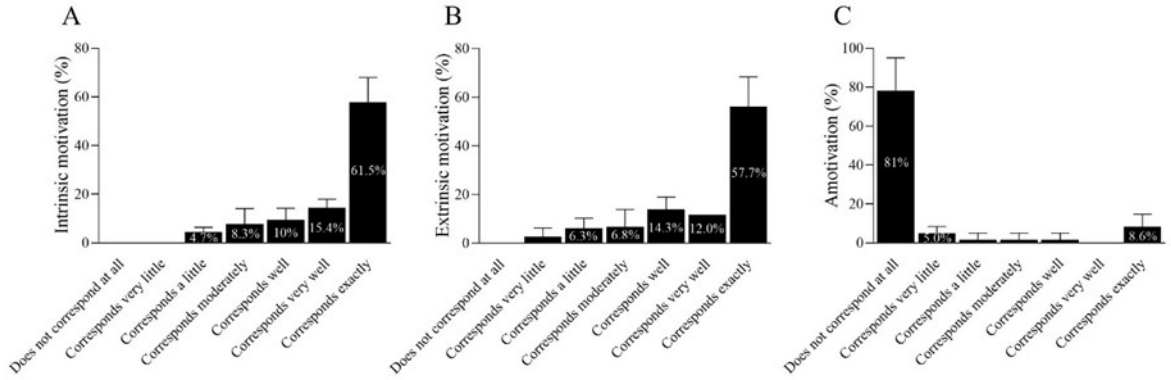

Figure 3. Stacked bar charts illustrating the distribution of responses on the Academic Motivation Scale (AMS) across the seven-point Likert scale for each motivation type. (A) Intrinsic motivation, (B) Extrinsic motivation, and (C) lack of motivation

Table 3. Summary of Descriptive and Shape Indicators for Academic Motivation Dimensions.

Dimension	Mean	SD	CV	Skewness	Kurtosis
Intrinsic motivation – to know	6.3	1.11	17.97	-1.65	1.60
Intrinsic motivation – towards accomplishment	6.2	1.15	19.20	-1.34	0.55
Intrinsic motivation – to experience stimulation	5.7	1.36	24.31	-0.59	-1.15
Extrinsic motivation –identified	6.4	1.01	16.10	-1.55	1.56
Extrinsic motivation – introjected	6.4	1.13	18.28	-1.97	3.40
Extrinsic motivation – external regulation	5.7	1.58	28.70	-1.09	-0.08

4. Discussion

This study aimed to explore the predictive value of low-stakes quizzes on academic performance and the role of academic motivation in undergraduate students enrolled in health sciences courses. Consistent with previous research on test-enhanced learning (TEL), our findings confirm that students who performed better on summative quizzes tended to achieve higher scores on both partial exams and final course grades. Previous studies on formative assessment in science education have recognized their positive impact not only in consolidating knowledge, but also in transforming the student experience of assessment through feedback and engagement (22).

Our results reinforce the usefulness of TEL not only as a cognitive enhancer, but also as a practical tool for monitoring student progress during the semester. This aligns with the "forward testing effect" which helps sustain attention, reduce distraction, and ultimately improve learning and performance (23). The significant correlations between quiz performance, exam grades, and final course outcomes support the idea that retrieval practice in the form of quizzes strengthens long-term retention, even in the absence of feedback (24). This is consistent with evidence showing that TEL fosters knowledge consolidation and metacognitive awareness (8). Moreover, low-stakes assessments have been shown to reduce test anxiety (25) and promote students' self-perception of competence (26). In this sense, our findings provide empirical support for the integration of TEL as a formative strategy in the Latin American context, where empirical evidence remains limited. However, it is noteworthy that in our setting formative quizzes were seldom used voluntarily: platform data indicated that only about 10% of students engaged with optional quizzes. This highlights the need for structured, embedded TEL activities rather than leaving them as optional, since voluntary participation may not sufficiently motivate students.

A distinctive contribution of this study is the integration of motivational assessment using the Academic Motivation Scale (AMS). Students demonstrated high levels of both intrinsic and extrinsic motivation, particularly in the dimensions of "to know" and "identified regulation," which clustered at the upper end of the scale. These motivational profiles may help explain the effectiveness of TEL in our sample, as suggested by Self-Determination Theory (SDT), which highlights the importance of autonomy, competence, and relatedness in sustaining motivation and performance (25). From this perspective, low-stakes quizzes with immediate feedback may fulfill the psychological need for competence by enabling students to track their progress and identify areas for improvement in a non-punitive manner. In addition, the repetitive and predictable structure of these quizzes may reinforce students' sense of autonomy by affording them greater control over their preparation and learning strategies. Prior research has underscored that motivation is particularly critical in low-stakes contexts, where external incentives are minimal (15,28). Our findings extend this view by suggesting that in highly motivated cohorts, even low-stakes quizzes can promote strong engagement and serve as reliable indicators of academic potential.

Although lack of motivation was generally low, its variability was high, and a small subgroup of students showed disproportionately elevated levels. This pattern is relevant, as lack of motivation is linked to disengagement and dropout risk (18,19). Monitoring these students and offering tailored interventions could help prevent academic failure and improve retention (29). Therefore, the combined use of TEL and early motivational assessments may serve not only as pedagogical strategies, but also as preventive tools to identify and support students at risk.

The implications for teaching practice are clear. TEL, when systematically implemented and supported with feedback, can function as both a learning enhancer and a diagnostic resource (30). Integrating motivational screening at the beginning of the semester could further optimize its impact, allowing educators to adjust interventions to student profiles. Given its simplicity and scalability, TEL is suitable for both in-person and online formats, increasing its applicability across diverse educational contexts (31).

Several limitations must be acknowledged. First, this study was conducted within a single institution and program, which limits the generalizability of the findings. Nevertheless, the consistency of the patterns observed across three different academic years provides support for their internal robustness. Second, the quasi-experimental and correlational design precludes drawing causal inferences; although better quiz performance was associated with higher final achievement, it cannot be concluded that quizzes directly caused the improvement. Third, motivation was measured only once—at the beginning of the semester—thereby overlooking its potential fluctuations throughout the academic year. Fourth, possible confounding variables, such as prior academic performance or sociodemographic characteristics, were not statistically controlled through multivariate analyses. Future research should address these limitations by: (a) replicating the study in other institutions and health programs; (b) adopting longitudinal designs with repeated measures of motivation; (c) implementing experimental approaches with control groups; and (d) incorporating potential confounders into regression models to better isolate the unique effects of SLI and motivation.

5. Conclusion

- This study provides evidence that low-stakes quizzes can enhance learning and predict academic performance, particularly when students exhibit strong motivational profiles.
- Enhanced Learning emerges as a promising strategy not only to reinforce learning but also to detect early academic risks, thus offering educators a dual tool for teaching and student support.

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