

Article

Differentiated Assessment through Quizizz to Evaluate Learning of the Logarithmic Function in Upper Secondary Education



Evaluación diferenciada mediante Quizizz para valorar el aprendizaje de la función logarítmica en Bachillerato

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Abstract

This study aimed to design and validate a differentiated assessment instrument mediated by Quizizz to assess competency M.5.1.75 related to the logarithmic function among second-year upper-secondary students. An applied, descriptive-propositional design was used. The diagnostic phase combined a survey of 120 students, an interview with a mathematics teacher, classroom observation, and a diagnostic assessment. Written tests predominated (100%), technological resources were not used for assessment (100%), and 58.33% of students perceived learning logarithmic functions as very difficult. The main difficulties concerned mathematical procedures (48.33%) and graphs/problems (42.50%). Based on these needs, a 12-item Quizizz instrument was structured into basic, intermediate,

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and advanced performance levels. Three experts validated the proposal, yielding an overall mean of 3.77/4. Curriculum relevance, methodological coherence, mathematical relevance, mathematical representation, item distribution, and feedback reached 4.00/4. The instrument therefore shows adequate curricular and methodological coherence for pilot implementation; however, its effectiveness on student learning remains to be tested empirically.

Keywords: differentiated assessment; formative assessment; Quizizz; logarithmic function; secondary education; educational technology.

Resumen

El estudio tuvo como objetivo diseñar y validar un instrumento de evaluación diferenciada, mediado por Quizizz, para valorar la destreza M.5.1.75 vinculada con la función logarítmica en estudiantes de segundo año de Bachillerato General Unificado. Se desarrolló una investigación aplicada de alcance descriptivo-propositivo. El diagnóstico integró una encuesta a 120 estudiantes, entrevista a un docente de Matemática, observación de aula y una evaluación diagnóstica. Los hallazgos mostraron predominio de pruebas escritas (100 %), ausencia de recursos tecnológicos en la evaluación (100 %) y elevada dificultad percibida en la función logarítmica: 58,33 % la calificó como muy alta; las principales dificultades se concentraron en procedimientos (48,33 %) y gráficas/problemas (42,50 %). Con base en estas necesidades se diseñó un instrumento de 12 reactivos en Quizizz, organizado en tres niveles: básico, intermedio y avanzado. La validación mediante tres expertos alcanzó una media global de 3,77/4. Los criterios de pertinencia curricular, coherencia metodológica, pertinencia matemática, representación matemática, distribución de reactivos y retroalimentación obtuvieron 4,00/4. Se concluye que el instrumento presenta coherencia curricular y metodológica suficiente para su implementación piloto, aunque su efectividad sobre el aprendizaje deberá comprobarse en una aplicación posterior.

Palabras clave: evaluación diferenciada; evaluación formativa; Quizizz; función logarítmica; Bachillerato; tecnología educativa.

Introduction

Contemporary educational assessment is conceived as a process of gathering and interpreting evidence to guide pedagogical decisions, beyond the assignment of a grade. Formative assessment takes on special importance when the evidence gathered allows for providing feedback to students and adjusting instruction (Black & Wiliam, 1998; Cruzado Saldaña, 2022; Boström & Palm, 2023). Within this framework, differentiated assessment seeks to recognize different paces and levels of performance through instruments capable of offering equivalent opportunities to demonstrate learning (Díaz, 2021).

In mathematics, this need is particularly acute in content that requires integration among symbolic, graphical, and contextualized representations. The logarithmic function requires linking prior knowledge of exponents and exponential functions to properties, domain, graphical representation, and modeling. Studies on learning functions have documented difficulties in connecting different forms of representation and solving modeling tasks, while also highlighting the value of strategies that promote understanding and contextualization (Araújo et al., 2022; Viseu et al., 2022; Hernández Martínez et al., 2022).

Digital platforms can complement formative assessment by facilitating interaction, response tracking, and immediate feedback. In particular, Quizizz has been studied as a resource for strengthening participation, motivation, and assessment in mathematics, although its usefulness depends on the pedagogical purpose and the quality of the items (Farfán-Pimentel et al., 2023; Hernanz et al., 2024; Balbi et al., 2024; Muchuweni et al., 2025).

At the “Ciudad de Caracas” Educational Unit, the preliminary assessment revealed a predominance of written exams, limited use of technology, and difficulties with procedures, graphing, and problem-solving related to the logarithmic function. Therefore, the objective of this study was to design and validate a differentiated assessment instrument using Quizizz, structured by performance levels, to evaluate curricular skill M.5.1.75 in second-year students of the Unified General High School program.

Materials and methods

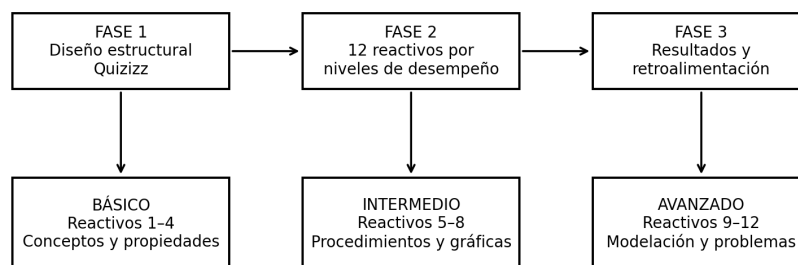
An applied research study with a descriptive-propositional scope was conducted. The diagnostic phase was carried out with second-year students in the Unified General High School program at the “Ciudad de Caracas” Educational Unit in Ecuador. A total of 120 students participated. Complementary sources included an interview with a mathematics teacher, a classroom observation, and the results of a diagnostic assessment.

Four sources of information were used: (a) a 10-question student survey on assessment practices, difficulties with logarithmic functions, feedback, and attitudes toward digital platforms; (b) a semi-structured interview with the teacher; (c) a classroom observation form with 10 indicators; and (d) a pre-test diagnostic assessment. The analysis was descriptive, using frequencies and percentages. The triangulation of these sources allowed for the construction of a needs matrix that guided the design of the assessment instrument.

The instrument was aligned with skill M.5.1.75 and indicator I.M.5.3.5 (I.3). Twelve items were designed in Quizizz and distributed progressively: four at the basic level, four at the intermediate level, and four at the advanced level. Content validation was conducted through expert judgment by three experts, who rated ten criteria on a scale from 1 (not relevant) to 4 (very relevant). Averages were calculated for each criterion and an overall average was determined. Qualitative observations were used to adjust time limits and instructions.

Figure 1. Methodological structure of the differentiated assessment instrument. Developed based on the thesis project.

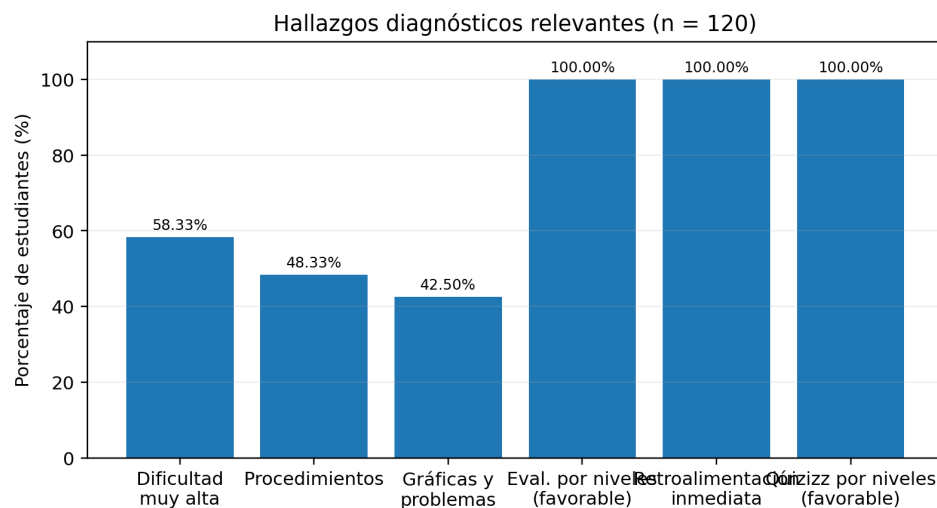
Instrumento de evaluación diferenciada de la función logarítmica mediante Quizizz



Results

The survey revealed a predominantly traditional assessment practice: all 120 students indicated that math assessments are always conducted through written tests and that technological resources are never used for assessment. Furthermore, 89.17% noted that exercises with varying levels of difficulty appear only occasionally, and 10.83% indicated that they are never included. Classroom observations were consistent with this pattern: written tests predominated, the use of technology for assessment was nonexistent, and contextualized problems appeared rarely.

Figure 2. Selected diagnostic findings. The percentages correspond to different indicators and are not mutually exclusive categories.



The perceived difficulty was high: 58.33% rated the difficulty of learning the logarithmic function as very high, 20.83% as high, and 20.83% as moderate. Regarding the type of difficulty, 48.33% identified mathematical procedures and 42.50% identified graphs and problems; only 9.17% cited properties as the main difficulty. These results are consistent with the literature describing difficulties in articulating representations and developing modeling processes when learning functions (Araújo et al., 2022; Viseu et al., 2022).

There was broad acceptance of differentiated assessment: 83.33% strongly agreed and 16.67% agreed with organizing assessment by levels; 100% considered immediate feedback useful. Furthermore, all students reported not having previously used Quizizz or any other digital platform for assessment, but expressed a favorable view of interactive platforms and of Quizizz for level-based assessment. This contrast between limited technological experience and high

willingness reinforces the importance of guided implementation, without assuming that the digital tool alone will lead to improvements. This caution aligns with Balbi et al. (2024), who emphasize that technology must be integrated into a coherent instructional design.

Table 2. *Technical organization of the 12 items by performance levels.*

Nivel	Reactivos	Desempeño esperado	Tipo / tiempo
Básico	1–4	Reconocimiento de la función logarítmica, base, dominio, restricciones y propiedades básicas.	Opción múltiple; 45 s por ítem
Intermedio	5–8	Aplicación de propiedades, procedimientos, dominio, ceros e interpretación gráfica.	Selección múltiple / respuesta matemática; 120–180 s
Avanzado	9–12	Análisis, resolución y modelación de situaciones contextualizadas.	Problemas contextualizados / respuesta numérica; hasta 5 min

The progressive structure integrates conceptual understanding, procedural application, and interpretation/modeling. The use of Quizizz is intended as a means to digitize the items, record responses, and support feedback—not as a substitute for teacher judgment. The proposal also includes a matrix showing the alignment between skills, curriculum indicators, assessment criteria, performance levels, and evidence generated by the platform.

Discussion

The assessment identified a gap between current assessment practices and the needs expressed by students. Written tests predominated, and technology was largely absent from assessment, while the greatest difficulties with logarithmic functions were concentrated in procedures, graphical interpretation, and problem-solving.

The methodological response was a 12-item assessment tool aligned with skill M.5.1.75 and organized into basic, intermediate, and advanced levels. This structure allows for linking types of evidence to different degrees of cognitive complexity and provides a basis for differentiated feedback.

The evaluation by three experts yielded an overall average of 3.77/4 and allowed for specific adjustments to clarity and completion time. Consequently, the instrument provides preliminary evidence of curricular, mathematical, methodological, and technological relevance for a pilot application.

The main limitation is that the instrument has not yet been used as an intervention to measure changes in learning. Future research should examine its reliability, item performance, performance by level, and potential effects on learning through pretest–posttest or comparative designs, in addition to considering connectivity conditions and access to devices.

References

- Araújo, S., Viseu, F., Soares, A. J., & Leite, I. (2022). El aprendizaje de las funciones logarítmicas por parte de estudiantes de 12.º grado basado en tareas de modelización. *Alteridad*, 17(2), 224–243. <https://doi.org/10.17163/alt.v17n2.2022.05>
- Balbi, A., Berrutti, S., Tejera, M., Gonzalez, E., & Bonilla, M. (2024). Tecnologías digitales y evaluación formativa en clases de matemática: una revisión de la literatura. *Bolema*, 38, e230045. <https://doi.org/10.1590/1980-4415v38a230045>
- Black, P., & Wiliam, D. (1998). Assessment and classroom learning. *Assessment in Education: Principles, Policy & Practice*, 5
- Boström, E., & Palm, T. (2023). The effect of a formative assessment practice on student achievement in mathematics. *Frontiers in Education*, 8, 1101192. <https://doi.org/10.3389/educ.2023.1101192>
- Cruzado Saldaña, J. J. (2022). La evaluación formativa en la educación. *Comuni@cción*, 13(2), 149–160. <https://doi.org/10.33595/2226-1478.13.2.672>
- Díaz, C. D. (2021). Evaluación de conocimientos de evaluación diferenciada y diversificada a docentes de educación media: propuesta preliminar de cuestionario EV.CEDDI. Pontificia Universidad Católica de Chile.
- Farfán-Pimentel, J. F., Valdez-Asto, J. L., & Serveleon-Quincho, F. (2023). Quizizz en el desarrollo de competencias matemáticas en estudiantes de secundaria: una revisión teórica. *Ciencia Latina Revista Científica Multidisciplinar*, 7(2), 2987–3005. https://doi.org/10.37811/cl_rcm.v7i2.5541
- Fernández, J. R. D., & Taquire, C. D. C. (2022). Gamificación y herramientas tecnológicas en la enseñanza-aprendizaje de las

- matemáticas. *Ciencia Latina Revista Científica Multidisciplinar*, 6(6), 262–285. https://doi.org/10.37811/cl_rcm.v6i6.3485
- Hernández Martínez, M. A., Molina Patiño, E. K., Minayo Echeverría, N. A., Morales Gramal, L. J., & Mayanquer Barreto, J. C. (2022). Aprendizaje basado en problemas como estrategia didáctica en la enseñanza de funciones exponenciales y logarítmicas. *Ecos de la Academia*, 8(16), 141–152. <https://doi.org/10.53358/ecosacademia.v8i16.766>
- Hernanz, V., Latorre-Coscolluela, C., Suárez, C., & Lanchares-Sancho, E. (2024). Revitalising learning in three university contexts: Unleashing the power of the Quizizz app to increase self-efficacy, intrinsic motivation, satisfaction and performance. *Education and Information Technologies*, 29, 23917–23935. <https://doi.org/10.1007/s10639-024-12779-9>
- Ministerio de Educación del Ecuador. (2023). Lineamientos para la evaluación de los aprendizajes. Ministerio de Educación del Ecuador.
- Moreira, H., & Freire, M. L. L. (2024). Promoviendo la evaluación formativa con Quizizz: un estudio de investigación acción en el aula. *Ciencia Latina*, 8(2), 590–604. https://doi.org/10.37811/cl_rcm.v8i2.10511
- Muchuweni, T., Jojo, Z., & Kariyana, I. (2025). Mejora de la enseñanza de las matemáticas mediante Quizizz: una revisión sistemática de la literatura. *International Journal of Learning, Teaching and Educational Research*, 24(10), 106–124. <https://doi.org/10.26803/ijlter.24.10.5>
- Valdez Valdez, L. S., Sánchez Uscamayta, J. O., & Lescano López, G. S. (2023). Evaluación formativa: retroalimentación, estrategias e instrumentos. *Revista Educación*, 47(2), 794–812.
- Viseu, F., Silva, A., Rocha, H., & Martins, P. M. (2022). A representação gráfica na aprendizagem de funções por alunos do 10.º ano de escolaridade. *Educación Matemática*, 34(1), 186–213. <https://doi.org/10.24844/EM3401.07>