

Learning to assess: analytic rubrics in formative assessment¹

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ABSTRACT

This study examines how assessment practices mediated by analytic rubrics are appropriated in pre-service mathematics teacher education grounded in formative assessment and the Assessment for Learning framework. The objective was to investigate how the design and use of rubrics impact evaluative, self-regulatory, and reflective competencies among preservice teachers. This mixed-methods study was conducted with twelve students from a Brazilian public university within a didactic intervention that involved lesson planning and the collaborative construction of rubrics. Quantitative data were analyzed using descriptive statistics and organized into three analytical axes, while qualitative data were examined through Descending Hierarchical Classification with the support of IRaMuTeQ software. The results indicate that rubrics enhanced criteria clarity, transparency, formative feedback, and learning self-regulation, while also revealing challenges related to the time required for rubric construction and the complexity of evaluative judgment. It is

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concluded that the formative use of rubrics strengthens evaluative thinking in teacher education within higher education.

KEYWORDS: Formative assessment. Analytic rubrics. Feedback. Self-regulation.

Aprender a avaliar: rubricas analíticas en la evaluación formativa

RESUMEN

Este estudio analiza la apropiación de prácticas evaluativas mediadas por rúbricas analíticas en la formación inicial de profesores de Matemáticas, desde la perspectiva de la evaluación formativa y de la Evaluación para el Aprendizaje. El objetivo fue investigar cómo la elaboración y el uso de rúbricas impactan las competencias evaluativas, autorregulatorias y reflexivas de los estudiantes de licenciatura. Se trata de una investigación de enfoque mixto, realizada con doce estudiantes de una universidad pública brasileña, en el contexto de una intervención didáctica que involucró la planificación de clases y la construcción colaborativa de rúbricas. Los datos cuantitativos fueron analizados mediante estadística descriptiva y organizados en tres ejes analíticos, mientras que los datos cualitativos se examinaron a través de la Clasificación Jerárquica Descendente, con el apoyo del software IRaMuTeQ. Los resultados indican que las rúbricas favorecen la claridad criterial, la transparencia, la retroalimentación formativa y la autorregulación del aprendizaje, al tiempo que evidenciaron desafíos relacionados con el tiempo de elaboración y la complejidad del juicio evaluativo. Se concluye que el uso formativo de rúbricas fortalece el pensamiento evaluativo en la formación docente en la educación superior.

PALABRAS CLAVE: Evaluación formativa. Rúbricas analíticas. Retroalimentación. Autorregulación.

Aprender a avaliar: rubricas analíticas na avaliação formativa

RESUMO

Este estudo analisa a apropriação de práticas avaliativas mediadas por rubricas analíticas na formação inicial de professores de Matemática, à luz da avaliação formativa e do *Assessment for Learning*. O objetivo foi investigar como a elaboração e o uso de rubricas impactam competências

avaliativas, autorregulatórias e reflexivas em licenciandos. Trata-se de pesquisa mista, realizada com doze estudantes de uma universidade pública brasileira, em uma intervenção didática que envolveu planos de aula e construção colaborativa de rubricas. Os dados quantitativos foram analisados por estatística descritiva, organizados em três eixos, e os qualitativos por Classificação Hierárquica Descendente, com apoio do IRaMuTeQ. Os resultados indicam que as rubricas favoreceram clareza criterial, transparência, *feedback* formativo e autorregulação da aprendizagem, e evidenciaram desafios relacionados ao tempo de elaboração e à complexidade do julgamento avaliativo. Conclui-se que o uso formativo de rubricas fortalece o pensamento avaliativo na formação docente, no ensino superior.

PALAVRAS-CHAVE: Avaliação formativa. Rubricas analíticas. *Feedback*. Autorregulação.

Introduction

In international debates, formative assessment has been widely understood within the framework of Assessment for Learning (AfL), a perspective that conceives assessment as an integral part of the teaching and learning process, rather than as a final stage of classification. In this approach, the explicit articulation of criteria, continuous feedback, and the active involvement of students constitute central elements for the self-regulation of learning (Black; Wiliam, 1998). Subsequent theoretical developments reinforce that AfL is not limited to specific techniques or instruments, but rather constitutes a situated evaluative rationality, whose meaning depends on contexts, interactions, and the pedagogical conceptions that guide teaching practices (Black; Wiliam, 2009; Stobart, 2008).

In this context, assessment literacy plays a central role in the development of teaching professionals. A solid foundation of assessment knowledge is essential for teachers to make informed pedagogical decisions,

acting in ways that are fair, coherent, and aligned with learning objectives (Brookhart, 2013; Villas Boas, 2023). Therefore, it is crucial that initial teacher education programs promote formative assessment experiences capable of moving beyond a focus on outcomes and incorporating students' reflective and self-regulatory processes (Panadero, 2017).

Within this framework, rubrics have been discussed in the literature as tools particularly associated with the formative conception of assessment. Studies indicate that rubrics can enhance assessment transparency, communicate expectations, and foster student engagement with quality criteria in proposed tasks. When well designed, they support learning by guiding students' work, improving the quality of feedback, and sustaining processes of self-assessment and self-regulation (Andrade; Du, 2005; Jonsson; Svingby, 2007). From this perspective, rubrics function not only as judgment tools, but also as mediators of the learning process.

Among the different types of rubrics, analytical rubrics stand out, characterized by the explicit articulation of multiple criteria and performance levels. Research suggests that this type of rubric tends to promote a more detailed understanding of assessment expectations, allowing students to identify strengths and areas for improvement in their work (Panadero; Jonsson, 2013). By receiving feedback grounded in specific descriptors, students are better able to monitor their progress, while teachers can support more consistent assessment decisions aligned with previously defined criteria.

Despite recognition of the formative potential of rubrics, studies investigating how the design and use of these instruments by pre-service teachers themselves impact the development of assessment competencies during initial teacher education remain relatively scarce. In particular, there is limited exploration of how such experiences contribute to the development of reflective, self-regulatory, and pedagogical decision-making capacities, core dimensions of the teaching profession.

In light of this context, the present study aims to analyze how the design and use of analytical rubrics impact the development of assessment, self-regulatory, and reflective competencies in pre-service teachers. The research was conducted with students enrolled in an initial teacher education program at a Brazilian public university, within the context of a formative activity involving the design of lesson plans incorporating digital technologies and the construction of four analytical rubrics. By examining this process, the study seeks to contribute to the field of teacher education by expanding understanding of the role of rubrics as formative tools and of how future teachers appropriate assessment practices in higher education.

Theoretical Framework

The theoretical approach of this study is grounded in formative assessment, particularly within the field of Assessment for Learning, and in rubrics as pedagogical tools associated with the explicit articulation of criteria, feedback, and the self-regulation of learning. In the context of initial teacher education, these perspectives are especially relevant as they contribute to the development of assessment knowledge and to reflection on teaching practice.

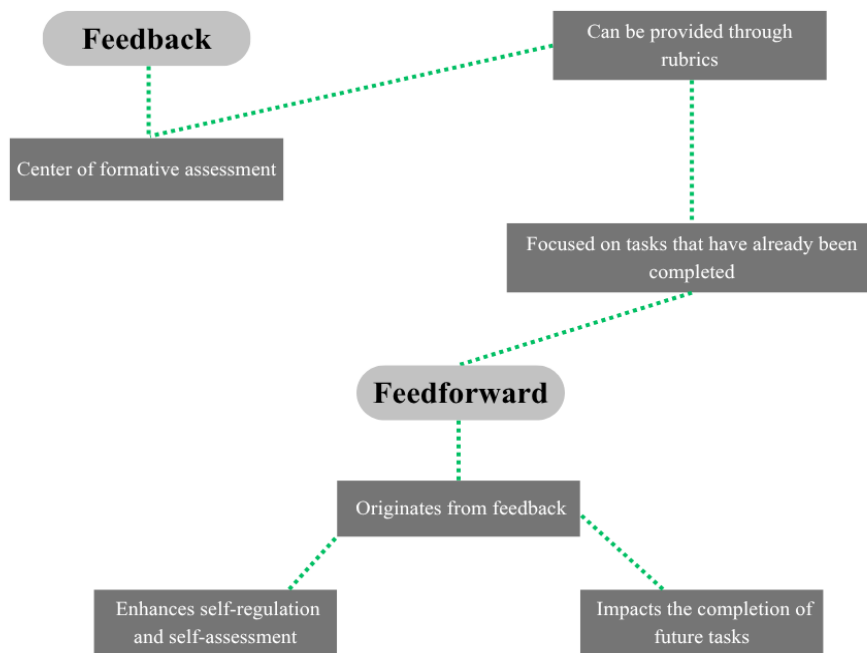
Assessment Rubrics

Within a formative assessment perspective, assessing implies the prior sharing of criteria, which involves the use of rubrics as a way of operationalizing this proposition (Vaz-Rebelo; Barreira; Bidarra, 2026). Formative assessment encompasses process-oriented assumptions, in which diverse instruments are applied continuously, fostering the provision of ongoing feedback. From this perspective, students occupy a central position in the assessment process, as they are invited to reflect on their performance and learning trajectories (Villas Boas, 2023; Andrade, 2007).

According to Fernandes (2006), this assessment perspective is aligned with interactions focused on students' cognitive processes and, although self-regulation and self-assessment are crucial factors, the teacher needs to clearly understand their meaning, which implies a complex teaching–learning relationship.

Thus, as a formative assessment instrument, rubrics are understood as tools that make performance expectations explicit and guide both students' learning and teachers' evaluative judgments (Andrade; Du, 2005; Jonsson; Svingby, 2007). By enabling the assessment of different tasks and actions, they constitute a relevant assessment approach for the analysis of lesson plans, as they make explicit the quality criteria of productions and support the organization of pedagogical work. Moreover, their formative potential is enhanced when they are used throughout the entire assessment process, rather than only at the end of activities (Irala; Ribeiro, 2023).

Figure 1 – The Relationship Between Feedback and Feedforward in Formative Assessment



Source: Authors' own elaboration.

The use of rubrics, especially in their analytical form, is directly related to formative assessment as it enables the monitoring of learning through systematic feedback. This feedback, which does not necessarily take on an evaluative character, is aligned with the established objectives, thereby creating opportunities for revision and further development, with a view to achieving improved outcomes (Vaz-Rebelo; Barreira; Bidarra, 2026).

From this perspective, effective feedback, by addressing both cognitive and motivational dimensions, contributes to student engagement and to the improvement of their work (Brookhart, 2008). Within the scope of formative assessment, feedback and feedforward constitute interdependent processes that support the self-regulation of learning.

While feedback focuses on the analysis of performances already carried out, feedforward guides future actions, enabling strategic adjustments based on previously received information (Zimmerman, 2000; Hattie; Timperley, 2007). Thus, the articulated use of these processes, combined with self-assessment mediated by rubrics, supports the organization of learning and positively impacts students' academic performance (Villas Boas, 2023; Andrade, 2019).

Rubrics in Teacher Education

In the context of higher education, particularly in initial teacher education programs, studies that systematically analyze how the use of rubrics contributes to the development of assessment knowledge and to professional teacher development are still limited, especially in the Brazilian context. Although rubrics are widely recognized as instruments applicable across different educational levels and subject areas, their incorporation into initial teacher education remains underexplored as an object of research.

International studies have indicated that the use of rubrics in higher education can foster relevant formative processes, particularly regarding the development of self-assessment and self-regulation of learning,

competencies aligned with the formative purposes of this educational level (Cockett; Jackson, 2018). These findings suggest that systematic exposure to rubrics during undergraduate studies can enhance pre-service teachers' understanding of quality criteria, performance expectations, and pedagogical decision-making.

In the Brazilian context, studies show that initial teacher education still presents weaknesses in the field of assessment, offering few opportunities for pre-service teachers to critically and consistently appropriate assessment practices (Irala; Blass; Junqueira, 2021). Research conducted in Mathematics teacher education programs highlights the need to expand formative spaces that address assessment beyond its classificatory function, providing instruments, such as rubrics, that can enhance future teaching practice.

Recent advances have also emphasized the potential of rubrics when articulated with dialogic approaches to assessment. Cristofari and Irala (2023), in a study conducted within a Language and Literature teacher education program, found that the development of rubrics, combined with formative monitoring processes, contributed to students' assessment literacy, strengthening their understanding of assessment practices and pedagogical feedback.

In this sense, teacher education requires not only a conceptual understanding of assessment, but also the development of competencies to plan, analyze, and evaluate pedagogical proposals in an autonomous and critical manner. Although curricular policies emphasize the development of critical thinking, there remains a gap in terms of assessment instruments capable of operationalizing this dimension in formative practice (Fonseca *et al.*, 2023).

Thus, rubrics can be understood as formative tools that promote reflection on the act of assessing and the construction of professional knowledge, as they require pre-service teachers to make criteria explicit, analyze levels of performance, and make informed pedagogical decisions.

When incorporated into initial teacher education, they contribute to preparing future teachers to face, in a critical and conscious way, the assessment challenges of their professional practice. The methodological design of the study is presented next.

Methodology

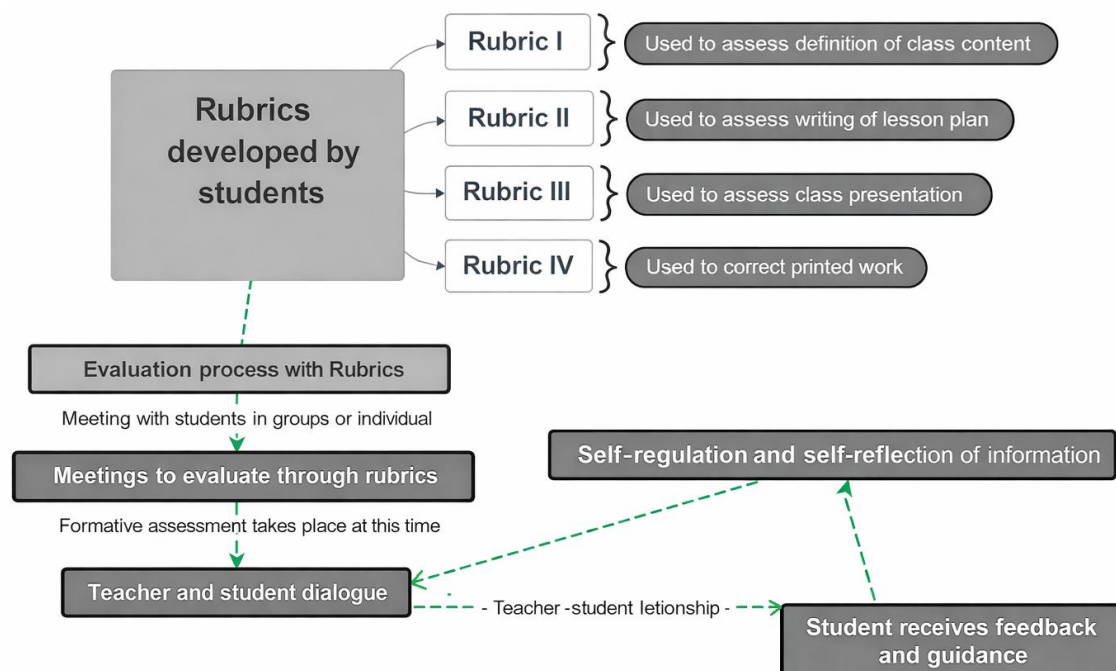
Research Context and Participants

The research data were generated by twelve pre-service teachers enrolled in the course *Technologies Applied to Mathematics Teaching II*, offered in the seventh semester of a Mathematics teacher education program at a Brazilian public university, during the second academic semester of 2023. For the purposes of analysis and to preserve anonymity, participants were identified using alphanumeric codes (E1–E12). Within the course, students developed lesson plans integrating digital technologies and constructed analytical rubrics, which were used across four stages of the activity, from the definition of the topic to the final presentation in a seminar format.

Considering that the instructor responsible for the course also acted as the researcher, the possibility of social desirability bias is acknowledged. To mitigate this risk, methodological strategies were adopted that emphasized the centrality of assessment criteria rather than the figure of the teacher. These strategies included the co-construction of rubrics with the pre-service teachers, the prior and shared definition of criteria and performance levels, as well as the implementation of systematic moments of self-assessment and peer assessment throughout the development of the activities.

Figure 2 summarizes the assessment process mediated by rubrics, highlighting the stages of learning monitoring, the provision of feedback grounded in established criteria, and the moments of students' self-assessment and self-regulation. These procedures were integrated into the formative design of the intervention, constituting the context in which the data analyzed in this study were generated.

Figure 2 – Assessment Process Using Rubrics



Source: Authors' own elaboration.

At the end of the academic semester, participants completed an online evaluative questionnaire, following their agreement to participate and the signing of the Informed Consent Form (ICF), via *Google Forms*. The data obtained through this instrument constituted the empirical basis for the quantitative and qualitative analyses presented in the subsequent sections.

Quantitative Data Analysis

In adopting a quantitative approach, Creswell (2010, p. 41) states that “data are collected using an instrument that measures attitudes, and the information is analyzed through statistical procedures and hypothesis testing.”

The construction of the questionnaire was guided by theoretical frameworks that articulate rubrics, formative assessment, and the regulation of learning. Studies have shown that the use of rubrics contributes to the explicit articulation of assessment criteria, the reduction

of subjectivity, and the strengthening of student participation in processes of self-assessment and self-regulation (Panadero; Jonsson, 2013; Panadero, 2017). Based on these contributions, the items were organized into three interrelated thematic axes: (a) clarity and fairness in assessment criteria; (b) pedagogical advantages and flexibility in the assessment process; and (c) self-regulation, reflection, and feedback. Data analysis was conducted with the support of the Jamovi and R software. The results corresponding to each axis are presented in the Results section.

Qualitative Data Analysis

The qualitative stage of the research aimed to deepen the understanding of pre-service teachers' perceptions regarding the use of rubrics in the assessment process. This is an interpretive approach, in which the researcher seeks to understand the meanings attributed by participants based on their discourse (Creswell, 2010).

The qualitative data were derived from two open-ended questions in the questionnaire, whose responses were submitted to textual analysis with the support of the software *Interface de R pour les Analyses Multidimensionnelles de Textes et de Questionnaires* (IRaMuTeQ).

The technique employed was Descending Hierarchical Classification (DHC), which allows for the grouping of text segments (TSs) into lexically homogeneous classes, highlighting distinct semantic fields within the analyzed corpus. DHC operates through the statistical association between words and classes, with those presenting an association value of χ^2 greater than 3,80 and a significance level of $p < 0,05$ considered representative.

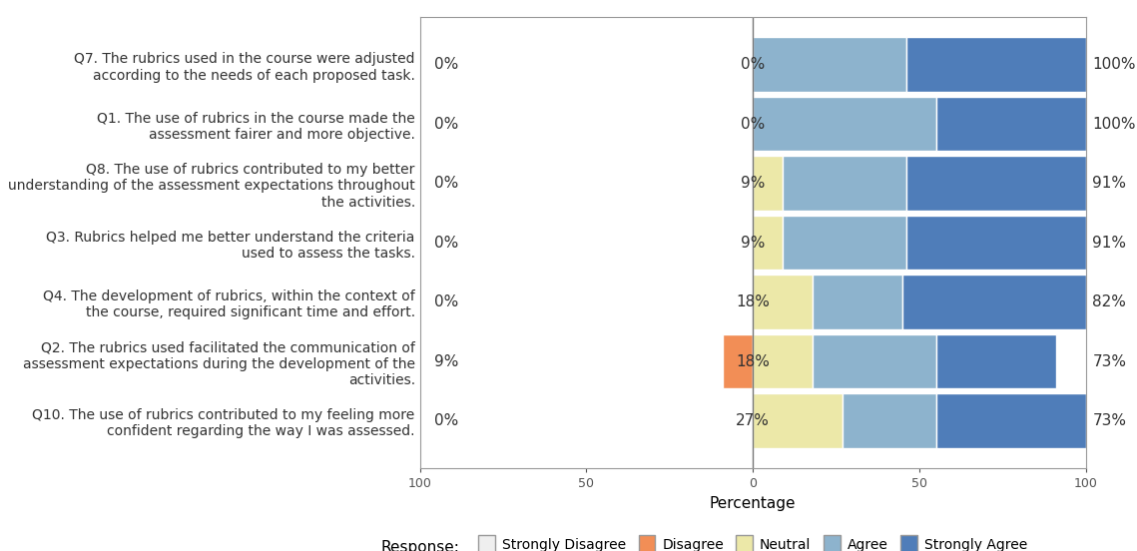
Results and Discussion

In this section, organized according to the research approach, we present the qualitative and quantitative results of the study, as well as their discussion.

Reflections from the Quantitative Dimension of the Research

First, the Cronbach's Alpha coefficient was calculated, which is recommended for assessing the internal consistency of a scale, also referred to as a measure of inter-item homogeneity. According to Maroco and Marques (2006), reliability is considered appropriate when the Cronbach's Alpha value is equal to or greater than 0,70. The Cronbach's Alpha obtained for the research data was 0,96, indicating that the data are highly consistent. The data analyses are organized according to the thematic axes, as presented in Figures 3, 4, and 5.

Figure 3 – Results of the Likert items related to Thematic Axis 1: Clarity and Fairness in Assessment Criteria



Source: Authors' own elaboration.

The results of Thematic Axis 1 indicate that pre-service teachers recognize rubrics as instruments that structure assessment based on explicit

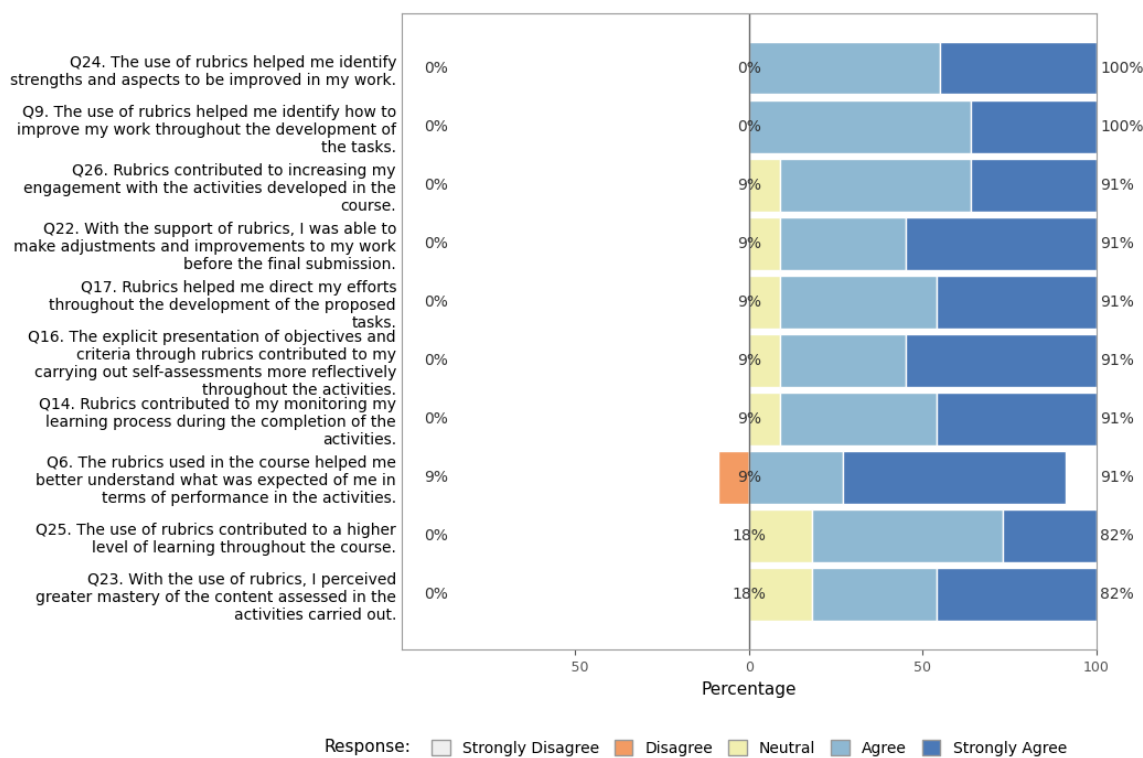
criteria, associated with perceptions of fairness, objectivity, and evaluative coherence. Items Q1 (“fairer and more objective assessment”) and Q7 (“adjustment of rubrics according to the task”) concentrate the interpretive core of this axis, as they show that participants understand rubrics both as criterion-based legitimizing devices and as instruments sensitive to the pedagogical context. This interpretation is particularly relevant for initial teacher education, as it indicates that rubrics were not reduced to a checklist, but rather understood as resources that make evaluative judgment more justifiable and pedagogically grounded, in line with the principles of Assessment for Learning (Black; Wiliam, 1998; 2009).

The convergence observed in items Q3 and Q8, related to the understanding of assessment criteria and expectations, reinforces the role of rubrics as communicative mediators between pedagogical intent and student performance, reducing evaluative ambiguities and supporting processes of self-assessment and self-regulation (Panadero; Jonsson, 2013).

In contrast, item Q4 highlights a recurring trade-off in the implementation of formative assessment practices: although pre-service teachers recognize gains in clarity and fairness, they also identify the time and effort required to develop rubrics as a cost. This finding shifts the analysis to the level of pedagogical and institutional feasibility, an aspect widely discussed in the literature on formative assessment in higher education (Villas Boas, 2023).

Finally, items Q2 and Q10 indicate that the explicit articulation and discussion of criteria tend to strengthen the communication of expectations and students’ trust in the assessment process. Thus, this axis directly supports the objective of the study by showing that the experience with rubrics fostered the development of professional assessment competencies, while also highlighting the conditions and limitations of their implementation. Figure 4 presents the analysis of the items related to Thematic Axis 2.

Figure 4 – Results of the Likert-scale items related to Thematic Axis 2: Pedagogical Advantages and Flexibility in the Assessment Process

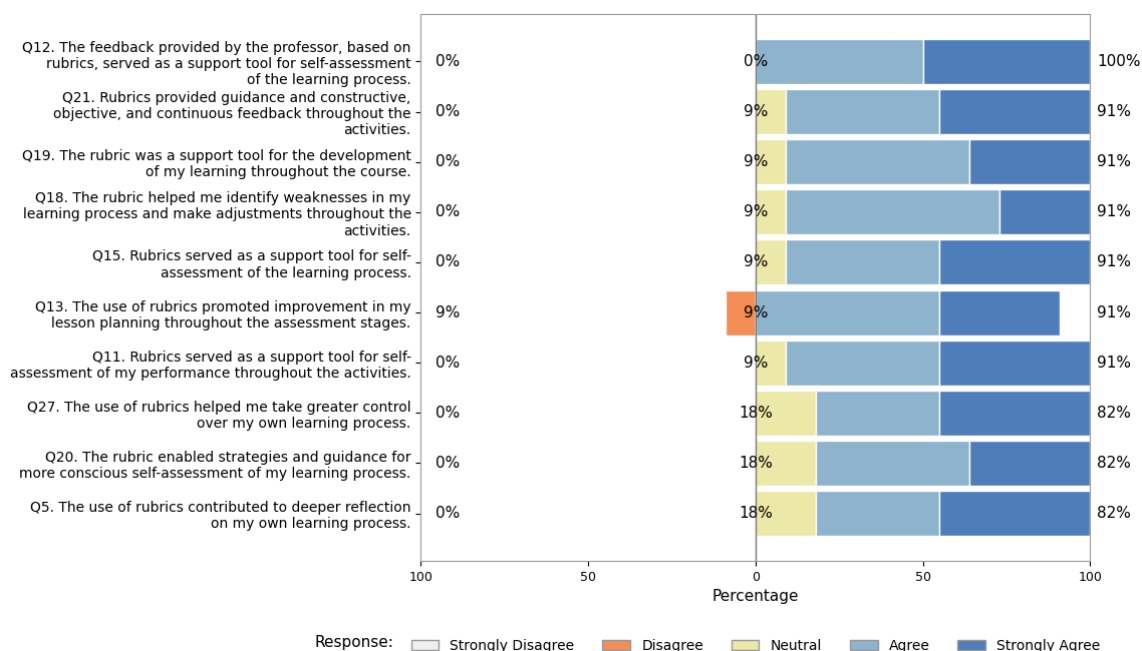


Source: Authors' own elaboration.

Items Q24 and Q26 reinforce this interpretation by indicating that rubrics supported the identification of strengths and weaknesses and promoted greater student engagement. This result aligns with studies that highlight the potential of rubrics to sustain metacognitive practices by making levels of quality visible and enabling comparisons between performance and established criteria (Panadero; Jonsson, 2013; Panadero, 2013).

Finally, items Q25 and Q23 associate the use of rubrics with higher levels of learning and greater mastery of the assessed content. Although these results should be interpreted with caution, they suggest that pre-service teachers perceive rubrics as an integrative tool between assessment and learning. In the context of initial teacher education, Thematic Axis 2 supports the relevance of the study by demonstrating that the experience with rubrics contributed to the development of more reflective and intentionally learning-oriented assessment practices. Figure 5 presents the analysis of the items related to Thematic Axis 3.

Figure 5 – Results of the Likert-scale items related to Thematic Axis 3:
Self-regulation, Reflection, and Feedback



Source: Authors' own elaboration.

The results of Thematic Axis 3, which includes items Q5, Q11, Q12, Q13, Q15, Q18, Q19, Q20, Q21, and Q27, reveal a broadly positive perception among pre-service teachers regarding the role of rubrics as mediators of self-assessment, critical reflection, and formative feedback. Across all items, the combined responses of “Agree” and “Strongly Agree” exceed 80%, with particular emphasis on Q12, which reached 100% agreement, indicating consensus on the role of feedback as support for self-assessment in the learning process.

These findings are directly aligned with the formative feedback model proposed by Hattie and Timperley (2007), according to which feedback impacts learning when it guides both the understanding of current performance (“How am I going?”) and the definition of future actions (“Where to next?”). Responses to items Q18, Q20, and Q27 reinforce this perspective by indicating that rubrics helped students identify weaknesses, reflect on

their own learning, and assume greater management of the learning process, key characteristics of feedback at the self-regulatory level.

The high levels of agreement observed in Q11 and Q15 corroborate studies that identify rubrics as tools that promote metacognitive practices and student autonomy (Panadero; Jonsson, 2013). From this perspective, feedback moves beyond a merely corrective role and becomes a structuring element of self-regulated learning.

Finally, the positive perception expressed in Q21 reinforces the understanding of feedback as a continuous and guiding process, aligned with formative assessment. In summary, Thematic Axis 3 supports the central objective of the study by demonstrating that the use of rubrics, combined with systematic feedback practices, fosters processes of self-regulation, critical reflection, and formative learning in initial teacher education.

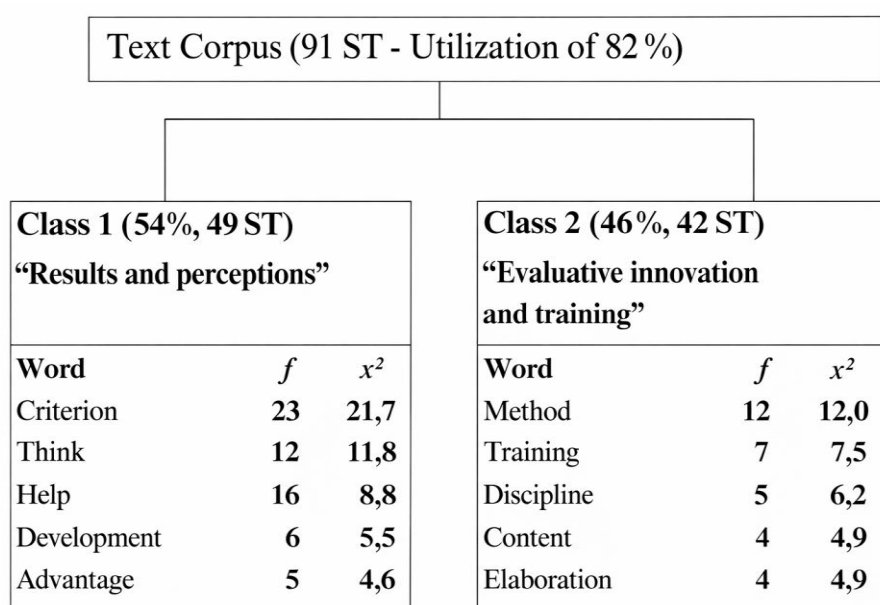
Reflections from the Qualitative Dimension of the Research

The qualitative analysis was conducted using the IRaMuTeQ software, employing Descending Hierarchical Classification (DHC), a method widely used in educational research and one that presents theoretical-methodological affinities with Discursive Textual Analysis (DTA), as it enables the identification of semantic regularities and emergent meaning structures within the corpus (Martins *et al.*, 2022; Magno; Gonçalves, 2023). To ensure the interpretive validity of the classification, a minimum retention criterion of 75% of text segments was adopted, in accordance with methodological recommendations in the specialized literature (Camargo; Justo, 2013; 2016).

The corpus consisted of twelve texts corresponding to responses to the open-ended question: “Write a paragraph evaluating and describing your experience in developing and using rubrics in the assessment process of the course component.” After processing, the material was segmented into 112 text segments (TS), with 91 TS retained, resulting in a retention rate of 82%. A total of 3,851 lexical occurrences were identified,

distributed across 1,036 distinct words, of which 600 occurred only once. The classification of lexical units was performed based on the chi-square (χ^2) test, adopting values greater than 3.80 ($p < 0.05$) as the criterion for significance, as indicated by Lahlou (2012).

Figure 6 – Dendrogram of DHC Classes



Source: Authors’ own elaboration.

The Class 1, responsible for 54% of the textual corpus, reveals a strong convergence with Thematic Axes 1 and 2 of the quantitative analysis, which address objectivity, fairness in assessment, and the pedagogical advantages associated with the use of rubrics. This correspondence between qualitative and quantitative data reinforces the internal consistency of the results and indicates alignment between the discursive perceptions of the pre-service teachers and the trends observed in the questionnaire.

The excerpts show that the clarity of assessment criteria was perceived as a central element for guiding performance and reducing uncertainties in the evaluation process, in line with the results of Thematic Axis 1 (especially Q1–Q3). This understanding appears recurrently when participants highlight that knowing the criteria in advance facilitates planning and improves their

work. E2 states that “knowing what will be required (...) makes it easier to understand what I need to prepare and what I need to improve,” while E3 emphasizes that students need to know “very clearly how they were assessed, what they were able to develop, and where they made mistakes.” These accounts support the interpretation that rubrics functioned as mechanisms for making expectations explicit and for ensuring assessment transparency, an aspect widely discussed in the literature on formative assessment and rubrics (Andrade, 2005; Brookhart, 2013; Stobart, 2008).

At the same time, Class 1 also highlights the cognitive challenges associated with the development of rubrics, particularly with regard to defining intermediate levels of performance. This aspect is made explicit by E1 when stating that “the middle ranges require a much higher level of attention,” indicating that the complexity lies not only in distinguishing extreme performances, but in qualifying learning progressions. In a convergent manner, E6 points out the difficulty of “determining clear and specific criteria for each level of performance,” emphasizing the need for alignment between objectives, language, and assessment criteria. The statement by E11, “throughout my entire undergraduate program, this was the first time we created [rubrics],” suggests that such difficulties also stem from the scarcity of systematic experiences with assessment practices in initial teacher education. This perception directly triangulates with item Q4 of the questionnaire, in which participants acknowledge that developing rubrics requires time and effort, constituting a trade-off between initial complexity and subsequent pedagogical gains, as noted in studies on analytical rubrics in teacher education (Allen; Tanner, 2006).

Another central core of Class 1 concerns the role of feedback and self-assessment. The accounts of E8 and E10 indicate that rubric-mediated feedback promoted the reorganization of work and reflection on one’s own performance, aligning with items Q9, Q22, and Q23 of Thematic Axis 2, which highlight the contribution of rubrics to the progressive

improvement of students' work. E8 emphasizes that immediate feedback helped him identify "the weakest points of my work" and "better reorganize my ideas" for the next stage, while E10 underscores that making the criteria explicit made the assessment process more transparent and comfortable, as it allowed the student to know "all the ways in which [they] will be assessed." These excerpts show that feedback grounded in rubrics goes beyond error correction, supporting processes of self-assessment and decision-making, thereby reinforcing the literature that understands criteria-based feedback as a central element in the self-regulation of learning (Hattie; Timperley, 2007; Panadero, 2017).

Finally, the excerpts indicate that the experience with rubrics fostered an initial reflection on the act of assessment by positioning the pre-service teachers in the role of future educators. This dimension emerges when E9 acknowledges that the use of rubrics led him to "think critically about students' needs," reflecting on how criteria and performance levels can impact fairness in assessment, and when E11 highlights the prior lack of formative experiences focused on the development of assessment instruments. These findings suggest that engaging with rubrics goes beyond the technical mastery of the tool and stimulates reflections on pedagogical judgment and teaching responsibility, pointing to the development of assessment literacy, an aspect frequently identified as a gap in initial teacher education (Irala; Blass; Junqueira, 2021).

The Class 2, entitled "Assessment Innovation and Teacher Education," shifts the analysis from immediate perceptions about assessment outcomes to a broader reflection on the method, course organization, and the formative processes involved in the development and use of rubrics. Unlike Class 1, which is centered on advantages and operational challenges, this class highlights assessment as a structuring component of the pedagogical proposal, articulating content, teaching strategies, and assessment practices.

The triangulation with the quantitative data, particularly with Thematic Axis 3, indicates that the pre-service teachers attributed high relevance to rubrics as tools for organizing pedagogical planning, ensuring methodological clarity, and aligning learning objectives, criteria, and assessment. These quantitative results provide a consistent backdrop for the interpretation of Class 2, in which the excerpts reveal a deeper understanding of assessment as a formative and professionalizing practice.

The accounts indicate that the appropriation of rubrics was initially marked by difficulties associated with defining criteria and performance levels. By stating that “it is extremely complicated to develop the criteria, and separating the levels becomes very difficult” (E_1), the pre-service teacher makes explicit the cognitive complexity of evaluative judgment, especially when faced with the need to move beyond dichotomous forms of assessment. This difficulty is intensified by the recognition that a formative trajectory “based solely on tests” made it harder to change assessment habits (E_1), highlighting the weight of traditional conceptions of assessment in initial teacher education. This finding aligns with the understanding of assessment as a socially situated practice, strongly shaped by prior experiences (Stobart, 2008), and reinforces the importance of intentional formative interventions (Silva; Mendes, 2017).

In contrast, the excerpts from E_2, E_4, and E_7 reveal progressive shifts in the understanding of assessment, particularly with regard to pedagogical planning. By reporting that the construction of rubrics required “precisely articulating educational goals and indicators of success” (E_2), the pre-service teacher demonstrates a more conscious alignment between objectives, strategies, and assessment. This perception converges with the results of Thematic Axis 3, in which students recognize that the experience contributed to the development of teaching competencies related to pedagogical decision-making, corroborating the literature that understands formative assessment as a structuring element of teaching (Black; Wiliam, 2009).

The expansion of assessment understanding is also evident in the accounts that highlight the diversification of assessment practices. By stating that rubrics “increase our range of possibilities” (E_3), the pre-service teacher recognizes assessment as a field of pedagogical choices, breaking away from the idea of a single, fixed model. This reflection is accompanied by a critical review of their own formative trajectory, as they acknowledge limitations in previous assessment experiences, reinforcing the need for formative practices that promote the reconstruction of assessment conceptions in teacher education (Irala; Blass; Junqueira, 2021).

Another relevant aspect of Class 2 relates to the projection of the rubric experience onto future teaching practice. Excerpts such as “I will be able to create my own rubrics one day” (E_9) and “I intend to enrich my assessments with rubrics” (E_12) indicate that the pre-service teachers began to see themselves as agents of change in their assessment practices. This disposition is supported by the data from Thematic Axis 3, which highlight the perceived professional applicability of the experience, in line with studies that emphasize initial teacher education as a privileged space for the development of teachers’ assessment knowledge (Panadero, 2017).

Finally, the mention of the feedforward concept in E_6’s account reflects an emerging understanding of central principles of formative assessment, recognizing feedback as a guide for future actions and the development of competencies. This interpretation aligns with the propositions of Hattie and Timperley (2007) and Panadero (2017), according to which effective feedback supports processes of self-regulation and planning. The convergence between this qualitative understanding and the data from Thematic Axis 3 reinforces that rubrics, when integrated into systematic formative practices, contribute to the formation of teachers who are more reflective and conscious of the act of assessing.

Although the accounts reveal predominantly positive perceptions regarding the use of rubrics, the analysis also highlights tensions related to the time required for development, initial complexity, and the gradual appropriation

of the tool. These dissonances indicate that the formative potential of rubrics does not manifest uniformly, being conditioned by processes of pedagogical mediation, gradual familiarization, and the context of use. These elements underscore that the effectiveness of rubrics depends not solely on their structure, but on the formative practices that accompany their implementation.

Final Considerations

This study analyzed the appropriation of assessment practices mediated by analytic rubrics in the initial training of Mathematics teachers, articulating quantitative and qualitative data in light of formative assessment and Assessment for Learning. The results indicate that the experience of developing and using rubrics fostered the explicit articulation of criteria, assessment transparency, and the organization of pedagogical planning, elements that are central to the development of more fair, coherent, and pedagogically oriented assessment practices.

The quantitative analysis, structured around three thematic axes, revealed broadly positive perceptions regarding the role of rubrics in enhancing assessment objectivity, guiding the learning process, and strengthening feedback, self-assessment, and self-regulation. These findings were corroborated by the qualitative analysis, which revealed shifts in the preservice teachers' conceptions of assessment; they came to understand it not merely as a measurement mechanism, but as a formative practice integrated into teaching and learning.

The qualitative data also showed that the development of rubrics mobilized significant cognitive challenges, especially with regard to defining criteria and intermediate levels of performance. Far from constituting weaknesses of the study, such tensions reveal the formative nature of the experience, as they exposed the preservice teachers to the complexity of evaluative judgment and the need for well-founded pedagogical decisions. This process contributed to the initial development

of assessment competencies, an aspect often identified as lacking in initial teacher education.

Another relevant finding concerns the role of feedback and feedforward mediated by rubrics. The results indicate that the explicit articulation of criteria, combined with systematic feedback, supported the reorganization of work, reflection on one's own performance, and the projection of future actions, thereby sustaining processes of self-regulated learning. In this sense, rubrics functioned as mediating artifacts between assessment, learning, and professional development, reinforcing contemporary conceptions of formative assessment.

Despite the contributions identified, the study presents limitations that should be considered. The investigation focused on a single group with a small number of participants, which limits the generalizability of the results. Moreover, the implementation of rubrics required time, pedagogical mediation, and gradual familiarization, indicating that their formative potential does not manifest uniformly or automatically, but rather depends on the conditions of use and the educational context.

Even so, the main contribution of the study lies in the analysis of the formative process experienced by preservice teachers as they actively engaged in the construction and use of analytic rubrics. By tracing this trajectory, the study provides empirical evidence of how formative assessment practices can be appropriated in initial teacher education, fostering greater reflexivity, pedagogical awareness, and responsibility in the act of assessment. In this way, the study contributes to the field of Mathematics Education by advancing the understanding of how evaluative thinking is developed among future teachers in higher education.

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