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# The Effect of Using Rubrics in Improving the Quality of Assessment of Mathematics Learning

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**Abstract:** This study constitutes a systematic review of the available literature from 2015 to 2024, obtained through indexing from Google Scholar, DOAJ, and Scopus. The aim of this research is to evaluate the impact of using assessment rubrics in mathematics learning on the quality of student learning outcomes assessment. Research findings indicate that the implementation of assessment rubrics has a significant positive impact on students' learning achievement in mathematics. The utilization of assessment rubrics not only aids in enhancing students' academic performance but also improves the effectiveness of the learning process, enriching their ability to comprehend mathematical concepts. The implications of these findings underscore the importance of integrating assessment rubrics into mathematics learning practices to enhance the quality of assessment and student learning outcomes. Further research is warranted to delve into this matter more extensively.

**Keywords:** The Application of Rubrics, Mathematics Learning Outcomes

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## A. INTRODUCTION

In the process of mathematics learning, evaluation plays a crucial role in gauging students' understanding and performance concerning the taught material (Rakhmasari et al. 2019). Evaluation serves not only as a tool to assess students' success in grasping concepts but also as a means to evaluate their ability to apply these concepts in various real-world contexts. Through effective evaluation, teachers can identify students' strengths and weaknesses and provide comprehensive feedback to aid in enhancing their understanding. Furthermore, evaluation also serves to motivate students by offering them the opportunity to track their progress and achievements over time. Hence, evaluation serves not only as an assessment tool but also as a continuous learning mechanism to improve the overall quality of mathematics education (Aulia et al. 2020).

Rubrics play a significant role as structured and transparent assessment instruments in enhancing the quality of assessment regarding mathematics learning outcomes. With the presence of rubrics, the assessment process becomes more focused and systematic as they provide clear guidelines for both teachers and students regarding the applied assessment criteria (Fajarini, Sabtiawan, and Widodo 2021). Teachers can utilize rubrics to objectively assess students' achievements according to pre-established criteria (Setiadi 2016). Additionally,

rubrics aid students in understanding the expected outcomes in a mathematics task or project, enabling them to concentrate and direct their efforts more effectively in the learning process. Thus, the implementation of rubrics can enhance transparency in assessment, ensure consistency across assessments conducted by teachers, and offer more constructive feedback to students for the development of a deeper understanding of mathematical concepts (Sholeh, Efendi, and Junaris 2023). Therefore, in the context of mathematics education, the use of rubrics as assessment tools plays a crucial role in improving the quality of teaching and students' learning outcomes.

The application of rubrics in evaluating mathematics learning achievements offers substantial advantages (N. R. Dewi 2022). Firstly, rubrics enhance the objectivity aspect in the assessment process by providing concrete and measurable evaluation parameters for educators. This implies that student assessment can be carried out more fairly and objectively, without being influenced by subjective opinions. Secondly, the use of rubrics can also strengthen consistency in assessment across teachers. With pre-established rubrics, the assessment of mathematics learning outcomes can be conducted uniformly, thus reducing the possibility of variation in assessment outcomes among educators (L. U. Dewi 2020). Additionally, rubrics provide meaningful feedback to students. By knowing the assessment criteria used, students can identify areas where they need to enhance their understanding and skills in mathematics (Soniveriyus Lahagu and Andarweni Astuti 2023). This gives them the opportunity for corrections and further improvements to achieve better learning achievements. Therefore, the use of rubrics in evaluating mathematics learning outcomes not only enhances objectivity and consistency in assessment but also provides meaningful feedback for student learning development.

Research from several articles demonstrates the success of using rubrics in enhancing the evaluation of mathematics learning outcomes. Bhattamisra and Ho found that rubrics make assessment easier, more precise, fairer, and consistent, while also helping to identify students' strengths and weaknesses (Dimos et al. 2023). Adorni et al. developed a Computational Thinking assessment model using rubrics, which increased result coherence without reducing its simplicity (Gan and Gan 2023). Toalongo et al. designed rubrics for assessing the mathematical modeling process, beneficial for researchers and teachers across various educational levels (Adorni et al. 2023). This reinforces the positive impact of rubrics in evaluating mathematics learning outcomes.

To address challenges and optimize the utility of rubrics, several strategies can be implemented. Firstly, effective rubrics should be developed considering learning objectives, measurable outcomes, and the type of assessment utilized. Rubrics should be formulated to assess higher-order thinking skills and provide valid assessment instruments in digital contexts (Ayudia et al. 2023). Additionally, rubrics need to be structured to meet the specific goals and attributes of the field or program being assessed. Another crucial aspect is considering the limitations and parameters of rubrics, such as weight distribution, to ensure consistency and validity in the assessment process. Rubrics also serve the purpose of providing qualitative feedback to students and instructors, enhancing interaction in the learning process (Mahardika n.d.). Lastly, the use of learning management systems can

facilitate the collection and review of rubric data, supporting program evaluation and accreditation processes.

Various studies indicate theoretical implications in designing and implementing rubrics in mathematics learning. Arafah and Samsuddin (2023) assert the relevance of constructivist learning theory, emphasizing students' active participation in the mathematics learning process. This can be reflected in rubrics by adding criteria to evaluate students' abilities to investigate and apply mathematical concepts independently. Ariawan and Nufus (2017) underline the role of cooperative learning methods in addressing students' anxiety towards mathematics, which can be considered in designing rubrics to create an inclusive learning environment. Lastly, Abi (2017) suggests integrating ethnomathematics into the curriculum, which can be reflected in rubrics by adding criteria to assess students' abilities to relate mathematical concepts to reality and cultural contexts.

This study aims to investigate the impact of using rubrics in enhancing the evaluation of mathematics learning outcomes. The researchers seek to assess the effectiveness of rubrics as assessment instruments in mathematics education, considering their accuracy, consistency, and objectivity. They also aim to evaluate whether the use of rubrics can provide more detailed feedback to students to understand assessment standards and improve the quality of their work. Thus, the research objective is to provide a deeper understanding of the role and impact of using rubrics in enhancing the evaluation of mathematics learning outcomes in educational settings.

## B. METHOD

This research aims to investigate the impact of using rubrics on enhancing the quality of assessing mathematics learning outcomes, particularly in evaluating the effectiveness of rubrics as assessment instruments within the context of mathematics education. Additionally, the study will examine challenges and disparities that may arise when rubrics are applied in mathematics assessment. The subsequent step involves developing comprehensive guidelines for educators to optimize the use of rubrics in evaluating mathematics learning outcomes effectively, with the hope of making a positive contribution to the improvement of teaching and assessment quality in mathematics classrooms. This research is expected to provide educators and mathematics education practitioners with a deep understanding of the significance of using rubrics and strategies they can employ to overcome potential implementation barriers.

In an effort to support this research, the initial step involves utilizing various academic information sources such as Google Scholar, Scopus, and DOAJ, encompassing publications from 2015 to 2024, selected for investigation. Keywords utilized include "rubric," "mathematics assessment," "mathematics learning," and their variations. The purpose of employing these keywords is to locate relevant articles pertaining to the research topic, particularly those discussing the use of rubrics in assessing mathematics learning outcomes and their effectiveness in education. Emphasis is also placed on articles that have undergone the peer-review process and were published within the relevant timeframe. It is anticipated that this thorough literature search will provide a solid foundation for the research, furnish a robust

theoretical framework, and offer comprehensive insights into the role of rubrics in evaluating mathematics learning outcomes.

In establishing inclusion and exclusion criteria for literature search, it is essential to consider factors that support the alignment of articles with the research objectives. Inclusion criteria encompass articles specifically addressing the use of rubrics in assessing mathematics learning outcomes, accompanied by detailed research methodology and findings relevant to the research focus. This step aims to verify that selected articles contribute significantly to understanding the use of rubrics in evaluating mathematics learning outcomes. Conversely, exclusion criteria are employed to eliminate articles not pertinent to the research topic, such as those not discussing the use of rubrics in mathematics assessment, lacking clear research methodology exposition, or whose findings do not support the research objectives. Thus, determining these criteria helps ensure that selected articles for the research possess relevant quality pertinent to the ongoing research needs.

In the stage of selection and data extraction, the initial step involves evaluating the abstracts and keywords of each identified article according to the established inclusion criteria. Articles meeting the inclusion criteria are then selected for further analysis to gain a comprehensive understanding of their content. Subsequently, relevant data regarding the use of rubrics in assessing mathematics learning outcomes are collected from the selected articles. The gathered information encompasses the effectiveness of rubric utilization, challenges that may arise in its implementation, and other key findings that can provide valuable insights. All collected data are then recorded in a structured format for thorough analysis and synthesis in article writing. This is crucial to ensure that the conclusions drawn are based on strong and relevant evidence from the available literature.

## C. RESULTS AND DISCUSSION

### 1. Definition and Basic Concepts of Rubrics in the Context of Assessing Mathematics Learning Outcomes

Rubrics are assessment instruments used to evaluate mathematics learning outcomes. They provide a framework for assessing student achievements based on specific criteria. Rubrics can be applied across various educational levels, from preschool to secondary education (Toalongo, Trelles, and Alsina 2022). Designed to evaluate various aspects of mathematics learning, rubrics encompass high-level thinking skills such as critical thinking, problem-solving, and mathematical modeling (Prayitno and Masduki 2017). Moreover, rubrics can assess the quality of mathematics lesson plans by considering the appropriateness of didactics and instructional strategies (Toalongo, Trelles, and Alsina 2022). They also play a crucial role as learning tools, aiding students in improving their understanding of mathematical concepts and developing procedural skills (Auxtero and Callaman 2020). In the context of automated assessment, rubrics can be utilized to obtain learning models, implement individualized education, and evaluate competencies accurately (Krebs, Rothstein, and Roelle 2022).

Rubrics serve as essential principles in assessing mathematics learning achievements by providing clear and consistent structures for evaluating student performance (Seto and Bantas 2020). However, despite this, many students encounter difficulties in understanding mathematics and fail to achieve the expected learning outcomes (Prayitno and Masduki 2017). Factors such as motivation, classroom layout, and discipline can influence these conditions. Therefore, the use of rubrics in assessing mathematics learning needs to be accompanied by strategies to enhance learning motivation, create a supportive learning environment, and improve student discipline.

Rubrics are vital tools in the context of assessing mathematics learning outcomes as they provide clear and consistent structures. They assist teachers in evaluating student achievements based on predefined criteria. By employing rubrics, teachers can identify students' strengths and weaknesses and provide appropriate feedback to enhance their understanding of mathematical concepts. The use of rubrics in assessing mathematics learning offers the advantage of providing consistent and objective guidelines for teachers to assess students. However, the main challenge lies in designing rubrics that align with learning objectives and relevant assessment criteria. Additionally, implementing rubrics also requires a profound understanding of mathematical concepts and the ability to provide constructive feedback to students.

**2. The use of rubrics can influence the quality of assessing mathematics learning outcomes**

The implementation of rubrics has the potential to influence the quality of evaluating mathematics learning outcomes. Rubrics are designed to provide guidelines to learners regarding assessment standards and achievement levels, assisting them in self-assessing their performance (Krebs, Rothstein, and Roelle 2022). Additionally, rubrics can enhance the productivity and accuracy of assessment by offering clearer understanding to learners about their achievement levels. The use of rubrics can also reduce cognitive load in self-assessment (Toalongo, Trelles, and Alsina 2022). In the field of mathematics learning, rubrics have been developed and validated to assess the mathematical modeling process across the curriculum (Miknis, Davies, and Johnson 2020). These rubrics encompass elements and performance criteria aligned with different stages of the modeling cycle and can be utilized by researchers and educators at various educational levels to evaluate group work outcomes produced by students. Thus, the use of rubrics can positively impact the quality of assessing mathematics learning outcomes by providing clear criteria and supporting accurate self-assessment.

The use of rubrics can have a significant impact on the quality of mathematics learning outcomes (Seto and Bantas 2020). This finding is supported by Rusmawati (2017), demonstrating that the use of direct learning tools in the context of mathematics education can enhance student learning achievements. Furthermore, Jusnani (2019) underscores the importance of discipline in improving mathematics learning achievements. Somakim (2018) highlight the vital role of mathematical modeling in facilitating students' understanding of algebraic concepts, which has the potential to contribute to academic achievement improvement.

This indicates that the use of rubrics provides a clear and structured foundation in the evaluation process, allowing for more objective and accurate assessment of mathematics learning outcomes. Learners can gain a better understanding of assessment expectations, enabling them to reflect on their own performance. These findings affirm that the use of rubrics contributes positively to enhancing the quality of evaluating mathematics learning outcomes. This is evidenced by the supportive research results showing improvements in student learning achievements and the vital role of mathematical modeling in facilitating understanding of algebraic concepts.

### 3. The Benefits of Using Rubrics in Improving the Quality of Mathematics Learning Outcome Assessments

Utilizing rubrics in evaluating mathematics learning outcomes offers several advantages. Firstly, rubrics provide valid and reliable assessments of Higher-Order Thinking Skills (HOTS) in mathematics learning (Saraswati and Agustika 2020). These rubrics encompass various aspects of HOTS such as critical thinking, problem-solving, mathematical understanding, and communication (Adorni et al. 2023). Secondly, rubrics are practical and useful tools for evaluating students' HOTS abilities in mathematics (Miknis, Davies, and Johnson 2020). The effectiveness of these rubrics has been tested and validated by experts in measuring students' higher-order thinking skills (Auxtero and Callaman 2020). Moreover, rubrics can serve as learning aids that support the improvement of students' academic achievements in mathematics (Krebs, Rothstein, and Roelle 2022). Rubrics help students deepen their understanding of mathematical concepts and enhance their ability to apply knowledge, such as in the application of derivatives in basic calculus. Overall, the utilization of rubrics in evaluating mathematics learning outcomes can enhance assessment quality by providing valid, reliable, and practical standards for higher-order thinking skills, as well as facilitating the learning process and students' achievements in mathematics.

The use of rubrics in the context of mathematics education has been shown to enhance students' academic achievement (Rusmawati 2017). However, negative perceptions towards mathematics as a challenging subject can pose obstacles to improving the quality of learning (Alyusfitri and Wahyuni 2017). To address these challenges, it is recommended to utilize direct teaching methods and diverse learning approaches, including the use of manipulative aids (Fernandez and Fernandez 2018). Furthermore, the importance of creating a pleasant and conducive learning environment to enhance student achievement is emphasized, particularly in bridging students' initial mathematics abilities with their learning outcomes (Pioke et al. 2022).

The use of rubrics assists teachers in objectively evaluating students' Higher-Order Thinking Skills (HOTS) and providing detailed feedback. This facilitates effective learning and helps students understand learning expectations. Studies indicate that employing rubrics in mathematics education can enhance students' academic achievement. However, challenges such as negative perceptions towards mathematics need to be addressed through diverse learning approaches and supportive learning environments.

**4. The Challenges or Obstacles Faced in Implementing Rubrics in Assessing Mathematics Learning Outcomes**

The implementation of rubrics in assessing mathematics learning outcomes faces several challenges. These include limited guidance from curriculum documents, teachers' understanding of reasoning, attention and interpretation of students' reasoning by teachers, students' difficulty in expressing their reasoning, assessment of reasoning development, lack of examples of work, and difficulties in monitoring and reporting students' reasoning progress (Adorni et al. 2023). Additionally, the development and implementation of assessment rubrics for digital marking systems in higher education pose challenges, including technical limitations of digital platforms (Herbert 2021).. Rubrics as formative assessment tools in mathematics learning are difficult to design tasks that support both learning and assessment simultaneously and adapt rubrics to various contexts (Boudamoussi 2022). The use of rubrics in middle school mathematics classrooms has the potential to enhance student learning and teacher workload but requires time, effort, and adaptation in using mathematical language to solve problems (Gallego-arrufat and Dandis 2014).

The implementation of rubrics in evaluating mathematical learning achievement encounters various challenges. Students often perceive this subject as difficult and uninteresting, resulting in a negative attitude towards it (Abidin 2020). This impacts their performance and participation in the evaluation process. The solution lies in devising more engaging and practical mathematics learning strategies, such as integrating activities in outdoor settings and applying concepts in real-world contexts (Abidin 2020; Ulfa 2020). These approaches can help create a more positive learning environment and enhance students' understanding and application of mathematical concepts.

These challenges indicate that the use of rubrics in assessing mathematical learning outcomes requires significant effort and adaptation from both teachers and curriculum developers. These constraints can also affect the quality of assessment and the overall effectiveness of mathematics teaching and learning. These challenges highlight the complexity of implementing rubrics in the context of assessing mathematical learning outcomes. Although rubrics have the potential to enhance student learning and reduce subjectivity in assessment, the challenges faced require careful and planned solutions.

**5. Strategies That Can Be Used to Optimize the Use of Rubrics in Improving the Quality of Mathematics Learning Outcomes Assessment**

Rubrics can be enhanced to improve the evaluation of mathematics learning outcomes through diverse approaches. One approach is to design rubrics that incorporate high-order thinking skills (HOTS) in mathematics, such as critical thinking, problem-solving, and mathematical modeling (Adorni et al. 2023). Another strategy includes using rubrics that assess process skills, such as critical thinking and information processing, particularly in STEM undergraduate classrooms (Rahayu, Suryana, and Pranata 2020). Rubrics are also beneficial for evaluating students' understanding and application of concepts and problem-solving strategies in mathematics, thereby reflecting a more substantial representation of their mathematical thinking (Lee et al. 2025). Additionally, the use of rubrics can enhance consistency between learning objectives, instructional tasks, and assessment methods, which

helps establish shared understanding of process skills between teachers and students (Reynders et al. 2020). By implementing rubrics that consider specific skills and align with learning objectives, the process of evaluating mathematics learning outcomes can be significantly improved.

The utilization of rubrics in evaluating students' performance in mathematics subjects can be enhanced through various approaches. Vani Rahmayani (2020) recommends employing motivational strategies to increase students' interest and engagement in mathematics learning. This is expected to trigger self-assessment among students and enable more accurate use of rubrics. Meanwhile, Ramadhana (2018) and Nurdyansyah and Toyiba (2016) emphasize the effectiveness of active learning strategies in improving students' achievement. These approaches can be integrated into rubric-based assessments to encourage student engagement and understanding.

Developing rubrics that incorporate aspects of critical thinking, problem-solving, and mathematical modeling can help evaluate students' abilities holistically. Rubrics also need to assess process skills such as critical thinking and information processing, particularly in the context of STEM undergraduate classrooms. Rubrics can be used to evaluate students' understanding and their ability to apply mathematical concepts and problem-solving strategies. The use of rubrics can enhance alignment between learning objectives, instructional tasks, and assessment methods, fostering shared understanding between teachers and students. The proposed strategies depict a comprehensive approach to enhancing the use of rubrics in assessing mathematical learning outcomes. Integrating high-order thinking skills and problem-solving processes, along with assessing students' understanding, can provide a more accurate picture of students' mathematical achievements.

## D. CONCLUSIONS AND SUGGESTIONS

From the evaluation conducted, it is concluded that the utilization of rubrics in assessing mathematical learning outcomes plays a crucial role in enhancing the quality of assessment, facilitating effective learning, and supporting student achievement improvement. However, the challenges in implementing rubrics emphasize the need for a holistic and integrated approach. One emerging gap is the necessity for the development of rubrics that can address negative perceptions of mathematics and create a conducive learning environment. A pressing research topic for the future is the development of rubrics that consider students' psychological aspects in mathematical learning, which becomes a relevant focus. This topic can delve deeper into the design of rubrics that foster students' interest and motivation in learning, as well as effective strategies for using rubrics to transform negative perceptions of mathematics into positive ones. This research is expected to make a significant contribution to creating a more conducive mathematics learning environment and supporting overall student achievement improvement.

**REFERENCES**

Abi, Alfonsa M. 2017. "Integrasi Etnomatematika Dalam Kurikulum Matematika Sekolah." *Jurnal Pendidikan Matematika Indonesia*: 1–6.

Abidin, Zainal. 2020. "Belajar Matematika Asyik Dan Menyenangkan." *jaurnal pendidikan dan pembelajaran matematika* (January).

Adorni, Giorgia et al. 2023. "Rubric-Based Learner Modelling via Noisy Gates Bayesian Networks for Computational Thinking Skills Assessment." *Journal of Communications Software and Systems* 19(1): 52–64.

Alyusfitri, Rieke, and Yusri Wahyuni. 2017. "Analisis Diagnostik Kesulitan Belajar Mahasiswa PGSD Pada Mata Kuliah Konsep Dasar Matematika II." *Al-Jabar : Jurnal Pendidikan Matematika* 8(2): 145.

Arafah, Andi Asrafiani, and Auliaul Fitrah Samsuddin. 2023. "Implikasi Teori Belajar Konstruktivisme Pada Pembelajaran Matematika." *Jurnal Pendidikan MIPA* 13(2000): 358–66.

Ariawan, Rezi, and Hayatun Nufus. 2017. "Profil Kemampuan Koneksi Matematis Mahasiswa Dalam Menyelesaikan Masalah Pada Mata Kuliah Kalkulus 1 Ditinjau Berdasarkan Gaya Kognitif." *Journal of Mathematics Education* 3(2): 102–10.

Aulia, Raida Namira et al. 2020. "Peranan Penting Evaluasi Pembelajaran Bahasa Di Sekolah Dasar." *Jurnal BELAINDIKA* 01: 1–9.

Auxtero, Leah Conejos, and Roar Abalos Callaman. 2020. "Rubric as a Learning Tool in Teaching Application of Derivatives in Basic Calculus." *JRAMathEdu (Journal of Research and Advances in Mathematics Education)* 6(1): 46–58.

Ayudia, Inge et al. 2023. *Pengembangan Kurikulum PT. MIFANDI MANDIRI DIGITAL*.

Boudamoussi, Samira El. 2022. "Using Criteria-Based Assessment Rubrics for Online Marking : Technological and Pedagogical Challenges." *Journal of Higher Education Theory and Practice Vol. 22(8) 2022* 22(Figure 1): 58–72.

Dewi, Lathifa Utami. 2020. "Pengaruh Quizizz Sebagai Media Penilaian Formatif Berbasis Web 2.0 Terhadap Hasil Belajar Siswa Pada Materi Sistem Periodik Unsur." *skripsi*.

Dewi, Nila Ratna. 2022. "Penerapan Desain Pembelajaran Addie E-Learning Materi Bahasa Inggris Pada Siswa Sma." *Jurnal Ilmiah Mandala Education* 8(4): 2774–84.

Dimos, Ioannis, Chrysoula Velaora, Konstantinos Louvaris, and Athanasios Kakarountas. 2023. "How a Rubric Score Application Empowers Teachers ' Attitudes over Computational Thinking Leverage." : 1–20.

Fajarini, Mei Wulan, Wahyu Budi Sabtiawan, and Wahono Widodo. 2021. "Studi Kasus Penerapan Penilaian Pembelajaran IPA Pada Masa Pandemi Covid-19." *Pensa E-Jurnal : Pendidikan Sains* 9(3): 336–55. https://ejournal.unesa.ac.id/index.php/pensa.

Fernandez, Michael, and Aloysius Joakim Fernandez. 2018. "Pendampingan Belajar Matematika Dan Pemanfaatan Alat Peraga Di Komunitas Anak Makanan Babi Kolhua." 2(1): 32–36.

Gallego-arrufat, Maria Jesus, and Maha Dandis. 2014. "Rubrics in a Secondary Mathematics Class." *International Electronic Journal of Mathematics Education, 2014, 9(1), 73-82* 9(1): 73–82.

Gan, Sook Yee, and Sook Yee Gan. 2023. "Pharmacy Students ' and Supervisors ' Perceptions of the Effectiveness of Assessment Rubrics for Undergraduate Research Performance Review." *Pharmacy Education* 23: 193–204.

Herbert, Sandra. 2021. "Overcoming Challenges in Assessing Mathematical Reasoning." *This Journal Article is posted at Research Online. https://ro.ecu.edu.au/ajte/vol46/iss8/2* 46(8).

Jusnani, Jusnani. 2019. "Pengaruh Kedisiplinan Terhadap Hasil Belajar Matematika Siswa Kelas Viii Smp Negeri 35 Makassar." *Klasikal : Journal of Education, Language Teaching and*

*Science* 1(3): 53–63.

Krebs, Rebecca, Björn Rothstein, and Julian Roelle. 2022. "Rubrics Enhance Accuracy and Reduce Cognitive Load in Self-Assessment." *Metacognition and Learning* 17(2): 627–50. https://doi.org/10.1007/s11409-022-09302-1.

Lee, Betsy et al. 2025. "A Marking Scheme Rubric : To Assess Students ' Mathematical Knowledge for Applied Algebra Test." 11(24): 18–25.

Mahardika, Bagus. "Penerapan Metode Penilaian Berbasis Portofolio Dalam Meningkatkan Pembelajaran Bahasa Indonesia." : 33–46.

Miknis, Marius, Ross Davies, and Clare S. Johnson. 2020. "Using Rubrics to Improve the Assessment Lifecycle: A Case Study." *Higher Education Pedagogies* 5(1): 200–209. https://doi.org/10.1080/23752696.2020.1816843.

Nurdyansyah, and Fitriyani Toyiba. 2016. "Pengaruh Strategi Pembelajaran Aktif Terhadap Hasil Belajar Pada Madrasah Ibtidaiyah." *Jurnal TEKPEN, Jilid 1, Terbitan 2, 929-930*: 929–30.

Pioke, Ismail, Samsiar Rivai, Widi Candika Pakaya, and Nurliyanti Abdullatif. 2022. "Hubungan Antara Kemampuan Awal Matematika Dengan Hasil Belajar Siswa Kelas 5 SDN 08 Paguyaman." *Aksara: Jurnal Ilmu Pendidikan Nonformal* 8(2): 803.

Prayitno, Edi, and Lusi Rachmiazasi Masduki. 2017. "Pengembangan Media Blended Learning Dengan Model Flipped Classroom Pada Mata Kuliah Pendidikan Matematika Ii." *JIPMat* 1(2): 121–26.

Rahayu, Sri, Yusuf Suryana, and Oyon Haki Pranata. 2020. "Pedadidaktika : Jurnal Ilmiah Pendidikan Guru Sekolah Dasar Pengembangan Soal High Order Thinking Skill Untuk Meningkatkan Kemampuan Berpikir Tingkat Tinggi Matematika Siswa Sekolah Dasar Dibangun Sejak Dini Pada Peserta Didik." 7(2): 127–37.

Rakhmasari, Rifa et al. 2019. "Pengaruh Model Pembelajaran Berbasis TIK Terhadap Hasil Belajar Matematika Dan Motivasi Belajar Matematika Siswa." *Jurnal Analisa* 5(1): 41–50.

Ramadhana. 2018. "Penerapan Strategi Pembelajaran Inkuiri Untuk Meningkatkan Aktivitas Dan Hasil Belajar Biologi Siswa Kelas Xii Ipa 2 Sman 1 Makassar." *JURNAL SAINTIFIK* 1(1): 20–25.

Reynders, Gil et al. 2020. "Rubrics to Assess Critical Thinking and Information Processing in Undergraduate STEM Courses." *International Journal of STEM Education* 5.

Rusmawati. 2017. "Penggunaan Alat Peraga Langsung Pada Pembelajaran Matematika Dengan Materi Pecahan Sederhana Untuk Meningkatkan Hasil Belajar Siswa." *Jurnal Ilmu Pendidikan Sosial, sains, dan Humaniora* 3(2): 307–14. http://103.193.19.206/index.php/suaraguru/article/view/3607/2128.

Santri, Diah Dwi, Yusuf Hartono, and Somakim Somakim. 2018. "Pemodelan Matematika Untuk Belajar Aljabar." *UNION: Jurnal Ilmiah Pendidikan Matematika* 6(3): 297–306.

Saraswati, Putu Manik Sugiari, and Gusti Ngurah Sastra Agustika. 2020. "Kemampuan Berpikir Tingkat Tinggi Dalam Menyelesaikan Soal HOTS Mata Pelajaran Matematika." *Jurnal Ilmiah Sekolah Dasar* 4(2): 257.

Setiadi, Hari. 2016. "Pelaksanaan Penilaian Pada Kurikulum 2013." *Jurnal Penelitian dan Evaluasi Pendidikan* 20(2): 166–78.

Seto, Stefania Baptis, and Maria Goretty D. Bantas. 2020. "Pengaruh Motivasi Belajar Dan Formasi Duduk Terhadap Hasil Belajar Mata Kuliah Asessmen Pembelajaran Matematika." *Jurnal Cendekia : Jurnal Pendidikan Matematika* 4(2): 526–33.

Sholeh, Muh Ibnu, Nur Efendi, and Imam Junaris. 2023. "Evaluasi Dan Monitoring Manajemen Pembelajaran Pendidikan Islam Dalam Upaya Peningkatan Kualitas Penddikan." *Refresh: Manajemen Pendidikan Islam* 1(3): 48–73.

Soniveriyus Lahagu, and Andarweni Astuti. 2023. "Peningkatan Hasil Belajar Siswa Dan Sikap Bernalar Kritis Dalam Pak Dengan Model PBL Fase A Kelas Dua." *Prosiding Seminar Nasional Pendidikan Dan Agama* 4(2): 1483–1503.

Toalongo, Ximena, César Trelles, and Ángel Alsina. 2022. "Design, Construction and Validation of a Rubric to Evaluate Mathematical Modelling in School Education." *Mathematics* 10(24): 1–19.

Ulfa, Nanik. 2020. "Pengembangan Bahan Ajar Matematika Berwawasan Lingkungan Untuk Meningkatkan Hasil Belajar Materi KPK Dan FPB." *Elementary, Jurnal* 3(1): 21–25.

Vani Rahmayani, R.Amalia. 2020. "Journal On Teacher Education Research & Learning In Faculty Of Education Strategi Peningkatan Motivasi Siswa Dalam." *Journal On Teacher Education Research & Learning in Faculty of Education* 2: 18–24.