



HOTS-BASED FORMATIVE ASSESSMENT: THE KEY TO IMPROVING THE QUALITY OF LEARNING

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Abstract

This study aims to explain *higher-order thinking Skills* (HOTS)-based formative assessment in learning and reveal the principle of constructivism in comprehensively building students' high-level thinking skills. Literature studies are used as a research method. Relevant literature derived from books and articles in scientific e-journals was collected through documentation techniques. Furthermore, the data obtained was analyzed for content. The results show that HOTS-based formative assessment is the key to improving the quality of learning. This assessment trains students to think critically, analyze, and solve problems independently. In addition, teachers can also get more accurate feedback on student learning development so that they can provide appropriate interventions. The theory of constructivism offers a solid foundation for developing HOTS-based formative assessments. These assessments measure students' learning achievements but also encourage students to think critically, creatively, and independently. By consistently implementing HOTS-based formative assessments, it can create graduates with the competencies needed to face the challenges of the 21st century.

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INTRODUCTION

The rapid change of the times requires individuals to have higher-order thinking skills (HOTS). Skills such as analysis, evaluation, and problem-solving are crucial in facing the complexity of challenges in the modern era (Binkley et

al., 2012). Education, as the main pillar in human resource development, is required to produce graduates who not only master factual knowledge but also can think critically and creatively (Nurkhin & Pramusinto, 2020; Pithers & Soden, 2000). In this context, educational assessment plays a very important role. Assessment serves as a measuring tool for learning achievement and provides feedback to students and teachers to improve the learning process (Clark, 2012). One form of assessment that is considered effective in developing HOTS is HOT-based formative assessment.

Various studies have shown that students who engage in learning activities that emphasize HOTS tend to have a deeper understanding of concepts, higher motivation to learn, and better problem-solving abilities (Anderson & Krathwohl, 2001). However, in practice, assessments still often carried out in schools tend to focus more on measuring memory and low-level comprehension, such as remembering facts and memorizing formulas (Suhady & Maimunah, 2020). Previous research has underlined the importance of formative assessment in improving the quality of learning. Formative assessments conducted on an ongoing basis can provide students with quick and specific feedback to correct mistakes and improve their understanding (Johansson et al., 2023; Andersson & Palm, 2017). However, to develop HOTS, formative assessments must be carefully designed to stimulate students to think critically and creatively.

HOTS-based formative assessment can be a solution to improve the quality of learning (Eka Mahendra, 2020). By designing questions that require students to analyze information, evaluate arguments, and create new solutions, formative assessments can encourage students to think deeper and more complexly. In addition, HOTS-based formative assessments can also help teachers identify learning difficulties experienced by students so that they can provide more appropriate assistance (Wiyaka et al., 2020).

This study aims to explain HOTS-based formative assessment in learning. Referring to the theory of constructivism that emphasizes the active role of students in building their knowledge, this research will also comprehensively reveal the principles of constructivism in building students' higher-level thinking skills. This study is expected to be a reference for scholars interested in further studying HOTS-based assessments in designing meaningful learning activities and encouraging students to think critically.

METHOD

The research method used in this study is a literature research method. This research aims to collect data and information with the help of various materials in the library room, such as books, magazines, documents, records, historical stories, and others. The literature method is a series of activities for collecting library data, reading, recording, and processing research materials (Zed, 2008).

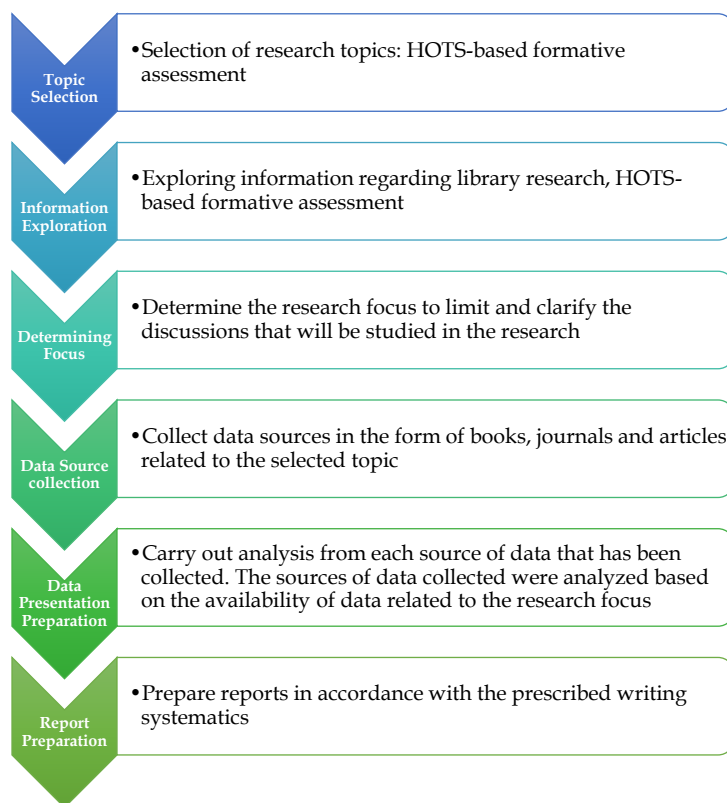


Figure 1. Literature Research Procedure (Kuhlthau, 2002), modified

Research data is obtained from relevant literature from books and articles in scientific e-journals collected through documentation techniques. The research instruments in this study are a checklist of classification of research materials, writing schemes/maps, and research record formats. Furthermore, the data obtained was analyzed for content analysis. This analysis obtains valid and re-examined inferences based on the context (Krippendorff, 1993). This analysis is carried out by selecting, comparing, combining, and sorting various meanings until relevant ones are found.

RESULTS AND DISCUSSION

Assessment in learning

Assessment is one of the activities carried out by teachers and students from a series of learning activities. Teachers must know the extent to which students have understood the material that has been taught or the extent to which the objectives/competencies of the learning activities managed can be achieved. According to Anderson, this assessment must meet the principles: 1) Meaningfulness: Anyone interested in the student assessment results can see the meaning behind the results of the assessment that has been carried out. 2)

Transparency or openness (explicitness): Every party needing information on student learning outcomes can determine how teachers conduct student learning assessment activities and the assessment results. 3) Fairness: Every student gets the same opportunity in the learning assessment system carried out by teachers and schools. Fair does not mean that every student gets the same score, but gets the score that should be obtained according to each student's learning skills and meets the criteria of validity and reliability (Anderson, 2003).

Assessment has two implementation methods, namely formative and summative evaluation (Gulikers et al., 2013). Formative assessment is used to diagnose the abilities of students who have mastered competencies and deficiencies (cognitive, affective, and psychomotor aspects) before being given instruction. Efforts are needed to prepare the instructional strategy to be suitable. Summative assessments are conducted after instruction to evaluate student achievement and the overall quality of the instructional process (Dixson & Worrell, 2016). Assessment should be carried out through three approaches: Assessment of learning, Assessment for learning, and assessment as learning (Schellekens et al., 2021).

1. Assessment of learning This assessment is carried out after the learning process is completed. The learning process is not always completed at the end of the year or at the end of students completing education at a certain level. Each teacher conducts an assessment intended to recognize the achievement of learning outcomes after the learning process is completed, which means that the teacher assesses learning.
2. Assessment for learning This Assessment is carried out during the learning process and is usually used to improve the teaching and learning process. In this assessment, teachers provide feedback on the student's learning process, monitor their progress, and determine their learning progress. Teachers can also use this assessment to improve student performance. Assignments, presentations, and projects, including quizzes, are examples of forms of assessment for learning.
3. Assessment as learning. This assessment is similar to an assessment for learning, which functions as formative and is carried out during the learning process. The difference is that assessment as learning involves students actively in these assessment activities. Students are given the experience to learn to be an assessment for themselves. Self-assessment and peer assessment are examples of assessment as learning.

Table 1. Difference Between Formative and Summative Assessment

Formative Assessment	Summative Assessment
<ul style="list-style-type: none"> • It is carried out during the learning process of certain units/chapters/competencies. • It aims to determine the development of students' mastery of the unit/chapter/competency being studied. • The results are used as a basis for improving the learning process of the unit/chapter/competency being studied (so that students achieve optimal mastery) • The formative assessment results are not used to determine the report card score. 	<ul style="list-style-type: none"> • It is carried out after learning certain units/chapters/competencies. • Aims to find out the learning achievements of students from learning that has ended • Results are evidence of what students master. • The summative assessment results determine the report card score, promotion or stay in class, and pass or not pass.

Formative assessment in learning

One type of assessment used is formative assessment. Formative assessment is intended to monitor student learning progress during the learning process to provide feedback for the improvement of the learning program, as well as to find out the weaknesses that need improvement so that student learning outcomes and teacher learning processes become better (Clark, 2012; Johansson, 2023). The main purpose of formative assessment is to improve the learning process, not to determine students' ability levels (Andersson & Palm, 2017). Formative assessment is not aimed at determining student graduation but rather stimulates students to be more diligent in learning, as well as knowing which parts of the material taught to them cannot be mastered properly, then improvements and repetitions are carried out in learning (Waruwu, 2021).

Formative assessments are carried out during teaching and learning activities. In one face-to-face meeting, formative assessments can be done more than once. For example, at the beginning of learning, use a response technique with the teacher to check students' mastery of the knowledge learned in the previous meeting. In the middle of the lesson, the teacher checks the student's understanding of what he is learning until the middle of the lesson by asking questions. Furthermore, at the end of the lesson, the teacher uses exit slips to check the student's mastery of the competencies learned until the end. The exit slips technique is a technique to assess students' understanding of the material given that has just taken place. The information that the teacher will process is in the form of written answers by students to the questions given (Kobett & Wray, 2016).

Table 2. Aspects, Forms, and Instruments of Formative Assessment

Aspects	shape	Instruments
Affective Assessment	<ul style="list-style-type: none"> • Observation • Self-assessment • Peer-to-peer assessments • Journal 	A checklist or assessment scale accompanied by rubrics, teachers' notes
Cognitive Assessment	<ul style="list-style-type: none"> • Written test • Oral test • Assignment 	Multiple choice questions, filling, short answer, true-false, matchmaking, and description. Description instrument with scoring guidelines Questionnaire Homework or projects that are done individually or in groups according to the characteristics of the task.
Psychomotor Assessment	<ul style="list-style-type: none"> • Practice • Project • Portfolio 	A checklist accompanied by a rubric.

HOTS in Formative Assessment

The cognitive domain is the ability to think about specific facts, procedural patterns, and concepts in developing intellectual knowledge and skills. Bloom, in 1964, formulated a taxonomy of learning, especially in the domain of cognition, ranging from low-level thinking skills (level of knowledge, understanding, application, and analysis) to high-level thinking skills (Synthesis and Evaluation). Nevertheless, the widely referenced taxonomy of thought processes was revised by Anderson and Krathwohl in 2001. In the revised taxonomy, 6 levels of thinking processes are formulated, as shown in Figures 2 and 3 below.

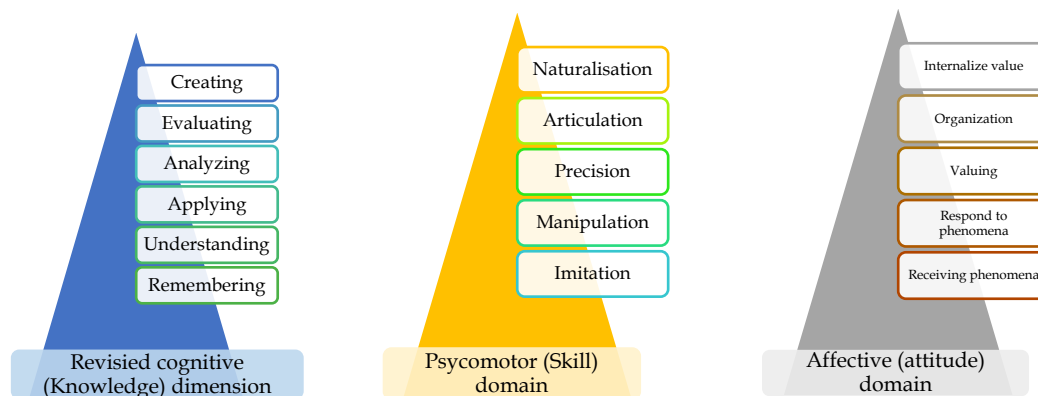


Figure 2. Three Domain Knowledge, Skill, and Attitude (KSA) (Anderson & Krathwohl, 2001)

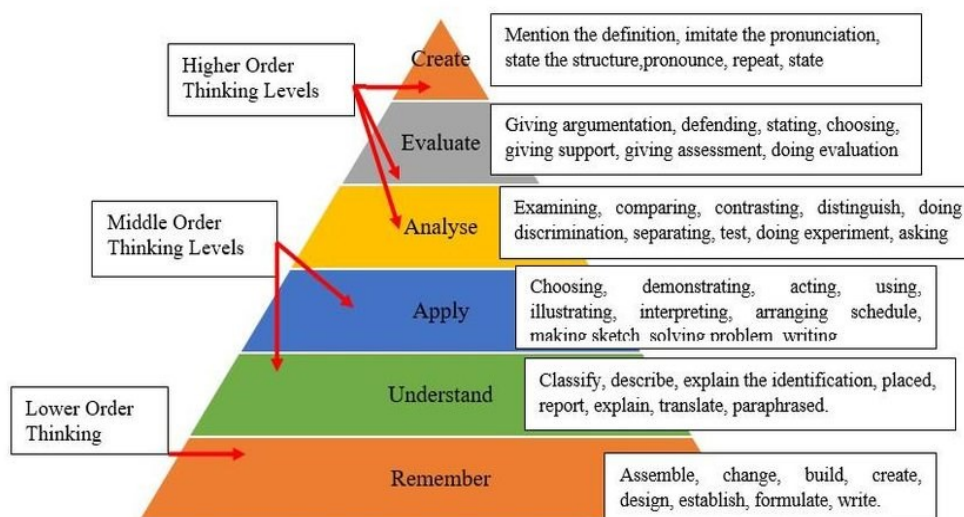


Figure 3. Taxonomy of Bloom HOTS -LOTS (Anderson & Krathwohl, 2001)

Anderson and Krathwohl categorized the ability to analyze, evaluate, and create processes, including high-level thinking. Analyzing is deciphering something into small parts to obtain a deeper meaning. When the ability to analyze leads to the process of critical thinking skills, a person can reach the level of evaluating thinking. From evaluating activities, a person can generally find advantages and disadvantages. New ideas or ideas will emerge after knowing the existing advantages and disadvantages. If a person can find new ideas, his thinking process has reached the creative thinking process. Thus, a person with sharp analytical skills who can evaluate and make decisions quickly and generate new ideas is a great opportunity to solve his problems.

Higher Order Thinking Skill (HOTS) is a high-level thinking skill that requires critical, creative, analytical thinking and using information and data to solve problems (Marta Dhewa et al., 2017). High-level thinking is a type of thinking that tries to explore questions regarding knowledge of related issues that are not clearly defined and do not have a definite answer (Panggabean et al., 2021). High-level thinking skills are divided into four groups: problem-solving, decision-making, critical, and creative thinking. Essential skills of thinking are divided into five groups, namely: a) providing simple explanations, b) building basic skills, c) summarizing, d) providing further explanations, and e) building strategies and tactics (Hikmawati et al., 2020). Furthermore, HOTS-based assessments have the following instrument characteristics:

1. Measure high-level thinking skills. The ability to think at a higher level is not the ability to remember, know, or repeat. Thus, the stimulus does not explicitly state the answers to HOTS questions. The ability to think at a higher level is the ability to solve problems, critical thinking, creative thinking, and decision-making skills.

2. Divergent. The assessment should allow students to give varied answers according to their thinking skills and points of view. Because it is divergent, the HOTS assessment instrument will be easier to create in the form of open-ended questions or essays. Whether multiple-choice questions cannot be used in HOTS-based assessments, the answer is yes, as long as the thought process to obtain the answer is not just memorization or memorization.
3. They are using Instrument Multirepresentation. HOTS assessments generally present all the information explicitly but direct learners to dig into the implicit information. Therefore, it is better for HOTS-based assessment instruments to use representations, including verbal (in the form of sentences), visual (images, graphs, tables), symbolic (symbols, icons, initials, signals), and mathematical (numbers, formulas, and equations).
4. Based on contextual problems. HOTS questions are assessments based on real situations in daily life. In this sense, students must have the skills to relate, interpret, apply, and integrate the knowledge gained through classroom learning to solve real-life problems.
5. They are using various question forms. The test set (HOTS questions) must be composed of multiple forms of questions, as used in PISA. This aims to provide more detailed and comprehensive information about test takers' abilities, in this case, students. Teachers need to pay attention to the use of various questions so that the assessment can ensure objective principles. Evaluations carried out objectively can guarantee assessment accountability.

Constructivism Theory: HOTS-Based Formative Reasoning

Constructivist theory views knowledge as being actively built by individuals through interaction with the environment (Fosnot, 2013). HOTS-based formative assessment aligns with constructivism theory because it encourages students to develop their understanding through an active thought process (Susyla & Jaya, 2024; Zain et al., 2022). Constructivism theory emphasizes the active role of individuals in building their knowledge, becoming a strong foundation for the development of HOTS-based formative assessments. The view that knowledge is not just the transfer of information from teachers to students but the result of individual construction through experience and interaction has significant implications for assessment practices in education. According to the constructivist view, learning is an active process in which students build their understanding through hands-on experience and reflection (Bada & Olusegun, 2015). Students do not just receive information passively but are involved in organizing, connecting, and transforming new information with the knowledge they already have.

Higher-order thinking Skills (HOTS) are complex cognitive abilities that involve analyzing, synthesizing, and evaluating information (Singh & Marappan, 2020; Mohamed & Lebar2017). HOTS-oriented learning is in line with the principles of constructivism. When students are asked to analyze

problems, evaluate evidence, and formulate solutions, they actively build a deeper understanding of the concepts learned. HOTS-based formative assessment is carried out continuously throughout the learning process to provide feedback to students and teachers to improve the learning process (Moyo et al., 2022). This assessment measures students' ability to apply HOTS, such as: 1) Analysis: Breaking down information into smaller parts, identifying relationships between parts, and interpreting the information. 2) Synthesis: Combining various pieces of information to form a new conclusion or idea. 3) Evaluation: Assessing the truth or usefulness of information or ideas. 4) Creativity: Generate original ideas and innovative solutions.

HOTS-based formative assessment is very relevant to constructivism theory because: 1) Process-Focused: Both HOTS-based constructivism and HOTS-based formative assessment emphasize the learning process rather than the outcome. Assessment not only measures what students already know but also how students arrive at that understanding. 2) Active Learning: HOTS-based formative assessments encourage students to participate actively in the learning process. The questions presented challenge students to think critically and creatively to build a deeper understanding. 3) Feedback: Formative assessments provide students with immediate feedback so they can correct mistakes and improve their understanding. This feedback helps students to reconstruct their knowledge continuously. 4) Learning Context: HOTS-based formative assessments are often placed in an authentic context so students can relate their learning knowledge to real-life situations.

The theory of constructivism provides a solid foundation for developing HOTS-based formative assessments. These assessments measure students' learning achievements but also encourage students to think critically, creatively, and independently. By consistently implementing HOTS-based formative assessments, we can create graduates with the competencies needed to meet the challenges of the 21st century.

CONCLUSION

HOTS-based formative assessments have proven to be key in improving the quality of learning. This assessment trains students to think critically, analyze, and solve problems independently. In addition, teachers can also get more accurate feedback on student learning development so that they can provide appropriate interventions. However, further research is still needed to optimize the use of HOTS-based formative assessment in various learning contexts. For additional research, it is necessary to conduct further studies on developing HOTS assessment instruments that are more varied and easy to apply to multiple subjects. In addition, a comparative analysis is required to compare the effectiveness of various HOTS-based formative assessment models. Thus, it is hoped that a more comprehensive understanding of implementing HOTS-based formative assessment in quality-oriented learning can be obtained.

REFERENCES

- Anderson, L. W. (2003). *Classroom assessment: Enhancing the quality of teacher decision making*. Routledge.
- Anderson, L. W., & Krathwohl, D. R. (2001). *A taxonomy for learning, teaching, and assessing: A revision of Bloom's taxonomy of educational objectives: complete edition*. Addison Wesley Longman, Inc.
- Andersson, C., & Palm, T. (2017). The impact of formative assessment on student achievement: A study of the effects of changes to classroom practice after a comprehensive professional development programme. *Learning and instruction*, 49, 92-102.
- Bada, S. O., & Olusegun, S. (2015). Constructivism learning theory: A paradigm for teaching and learning. *Journal of Research & Method in Education*, 5(6), 66-70.
- Binkley, M., Erstad, O., Herman, J., Raizen, S., Ripley, M., Miller-Ricci, M., & Rumble, M. (2012). Defining twenty-first century skills. *Assessment and teaching of 21st century skills*, 17-66.
- Clark, I. (2012). Formative Assessment: Assessment is for self-regulated learning. *Educational psychology review*, 24, 205-249.
- Dixson, D. D., & Worrell, F. C. (2016). Formative and summative assessment in the classroom. *Theory into practice*, 55(2), 153-159.
- Eka Mahendra, I. W. (2020). Teachers' Formative Assessment: Accessing Students' High Order Thinking Skills (HOTS)?. *International Journal of Innovation, Creativity and Change*, 12(12), 180-202.
- Fosnot, C. T. (2013). *Constructivism: Theory, perspectives, and practice*. Teachers College Press.
- Gulikers, J. T., Biemans, H. J., Wesselink, R., & van der Wel, M. (2013). Aligning formative and summative assessments: A collaborative action research challenging teacher conceptions. *Studies in Educational Evaluation*, 39(2), 116-124.
- Hikmawati, H., Suastra, I. W., & Pujani, N. M. (2020). Ethnoscience-Based Science Learning Model to Develop Critical Thinking Ability and Local Cultural Concern for Junior High School Students in Lombok. *Jurnal Penelitian Pendidikan IPA*, 7(1), 60-66.
- Johansson, E., Kanapathippillai, S., Khan, A., & Dellaportas, S. (2023). Formative assessment in accounting: student perceptions and implications of continuous assessment. *Accounting Education*, 32(6), 597-625.
- Kobett, B. M., & Wray, J. A. (2016). *The formative 5: Everyday assessment techniques for every math classroom*. Corwin Press.

- Krippendorff, K. (1993). Content Analysis: Introduction to its Theory and Methodology Terj. *Analisis Isi: Pengantar Teori dan Metodologi*. Jakarta: Rajawali Pers.
- Kuhltau, C. C. 2002. *Teaching The Library Research*. USA: Scarecrow Press Inc.
- Merta Dhewa, K., Rosidin, U., Abdurrahman, A., & Suyatna, A. (2017). The development of Higher Order Thinking Skill (Hots) instrument assessment in physics study. *IOSR Journal of Research & Method in Education (IOSR-JRME)*, 7(1), 26-32.
- Mohamed, R., & Lebar, O. (2017). Authentic assessment in assessing higher order thinking skills. *International Journal of Academic Research in Business and Social Sciences*, 7(2), 466-476.
- Moyo, S. E., Combrinck, C., & Van Staden, S. (2022, February). Evaluating the impact of formative assessment intervention and experiences of the standard 4 teachers in teaching higher-order-thinking skills in mathematics. In *Frontiers in Education* (Vol. 7, p. 771437). Frontiers Media SA.
- Nurkhin, A., & Pramusinto, H. (2020). Problem-Based Learning Strategy: Its Impact on Students' Critical and Creative Thinking Skills. *European Journal of Educational Research*, 9(3), 1141-1150.
- Panggabean, F. T. M., Pardede, P. O., Sitorus, R. M. D., Situmorang, Y. K., Naibaho, E. S., & Simanjuntak, J. S. (2021). Application of 21st century learning skills oriented digital-age literacy to improve student literacy HOTS in science learning in class IX SMP. *Jurnal Mantik*, 5(3), 1992-1930.
- Pithers, R. T., & Soden, R. (2000). Critical thinking in education: A review. *Educational research*, 42(3), 237-249.
- Schellekens, L. H., Bok, H. G., de Jong, L. H., van der Schaaf, M. F., Kremer, W. D., & van der Vleuten, C. P. (2021). A scoping review on the notions of Assessment as Learning (AaL), Assessment for Learning (AfL), and Assessment of Learning (AoL). *Studies in Educational Evaluation*, 71, 101094.
- Setiawati, W., Asmira, O., Ariyana, Y., Bestary, R., & Pudjiastuti, A. (2019). *Buku penilaian berorientasi higher order thinking skills*.
- Singh, C. K. S., & Marappan, P. (2020). A review of research on the importance of higher order thinking skills (HOTS) in teaching english language. *Journal of Critical Reviews*, 7(8), 740-747.
- Suhady, W., Roza, Y., & Maimunah, M. (2020). Pengembangan soal untuk mengukur higher order thinking skill (hots) siswa. *Jurnal Gantang*, 5(2), 143-150.
- Susyla, D., & Jaya, S. (2024). Integrating Critical Thinking Skills in English Language Teaching Assessment: A Theoretical Framework. *Edu-Ling: Journal of English Education and Linguistics*, 7(2), 273-291.

Sutikno, Y. (2019). The Importance of Assessing Formative Assessment of Students of Buddhist Religious Education. *Jurnal Pencerahan*, 12(1), 45-53.

Waruwu, Yaredi. (2021). *Evaluasi Pembelajaran: Teori dan Implementasi*. Malang: Penerbit Litnus.

Wiyaka, W., Prastikawati, E. F., & Adi, A. B. P. K. (2020). Higher-order thinking skills (hots)-based formative Assessment: A proposed model for language learning assessment. *Vision: Journal for Language and Foreign Language Learning*, 9(2), 115-130.

Zain, F. M., Sailin, S. N., & Mahmor, N. A. (2022). Promoting higher order thinking skills among pre-service teachers through group-based flipped learning. *International Journal of Instruction*, 15(3), 519-542.

Zed, M. (2008). *Metode penelitian kepustakaan*. Yayasan Pustaka Obor Indonesia.