



Keselarasan Instrumen Asesmen Kognitif dengan Perkembangan Kognitif Siswa Sekolah Dasar: Tinjauan Pustaka Berdasarkan Teori Piaget

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ABSTRAK

Cognitive assessment in elementary education requires careful alignment between assessment instruments, students' developmental characteristics, and the cognitive levels expected in learning objectives. However, classroom assessment practices often prioritize practicality and curriculum coverage while giving limited attention to the developmental readiness of elementary students. This study aims to analyze the alignment of cognitive assessment instruments with elementary students' cognitive development through a literature-based review grounded in Piagetian theory and Bloom's taxonomy. An integrative literature review design was employed using systematic search, selection, extraction, and thematic synthesis procedures. The reviewed literature focused on cognitive development, classroom assessment, formative assessment, authentic assessment, Bloom's taxonomy, and elementary education. The findings indicate that objective instruments, including multiple-choice, short-answer, and matching tests, are suitable for measuring lower cognitive levels such as remembering, understanding, and simple application, particularly when items are concrete, contextual, and clearly worded. However, these instruments are insufficient for capturing reasoning, conceptual explanation, creativity, and higher-order thinking. Essay tests, portfolios, projects, and product-based assessments provide broader evidence of students' cognitive development because they allow learners to organize ideas, apply concepts, solve contextual problems, and demonstrate progress over time. The study concludes that elementary cognitive assessment should be designed as a progressive and developmentally appropriate process by combining objective, subjective, and authentic assessment instruments. The main contribution of this study lies in integrating Piagetian developmental principles and Bloom's taxonomy into an assessment alignment perspective that supports more meaningful, valid, and pedagogically responsive assessment practices in elementary classrooms.

Keywords: Authentic assessment; Bloom's taxonomy; Cognitive assessment instruments; Cognitive development; Elementary education

A. Introduction

Assessment is a central component of classroom learning because it determines how students' knowledge, reasoning, and learning progress are interpreted by teachers. In elementary education, assessment cannot be separated from students' developmental characteristics because children do not process information in the same way as adolescents or adults. Students at the elementary school level are generally transitioning from intuitive thinking to more logical reasoning, yet their thinking remains strongly connected to concrete objects, familiar situations, and direct learning experiences. This condition makes cognitive assessment more complex than merely preparing questions based on curriculum content. Assessment instruments must be developmentally appropriate, linguistically accessible, and aligned with the level of cognitive demand expected from students. When assessment tasks are too abstract or disconnected from students' cognitive readiness, the results may reflect test difficulty rather than actual learning achievement. Therefore, the design of cognitive assessment instruments in elementary schools requires a careful alignment between developmental psychology, learning objectives, and classroom assessment principles.

The issue becomes more urgent because elementary teachers often rely on conventional paper-based tests, especially multiple-choice, short-answer, and matching items, to measure students' cognitive achievement. These instruments are useful for assessing recall and basic understanding, but they may be insufficient for capturing students' reasoning, conceptual development, problem-solving ability, and creative thinking. Recent studies have emphasized that assessment should not function only as a mechanism for grading, but also as a tool for diagnosing learning needs and supporting further instruction (Sortwell et al., 2024; Yan et al., 2021). In primary education, formative assessment literacy has also been identified as a crucial teacher competence because teachers must interpret students' responses, provide feedback, and adjust instruction according to learners' cognitive and emotional needs (Çibukçiu & Koliqi, 2026; Li et al., 2023). However, in many classroom contexts, the selection of assessment instruments still tends to be practical rather than theoretically grounded. Evidence from mathematics education also indicates that the use of interactive and visual learning technologies can support students' engagement and learning outcomes. Nirfayanti and Setyawan (2018), for example, reported that GeoGebra-assisted learning was effective in supporting students' learning outcomes, activities, and responses, suggesting the potential value of interactive representations in facilitating active cognitive engagement. Although their study was conducted at the higher-education level, the finding reinforces the broader principle that the way learning content is represented may influence how learners engage with and demonstrate their understanding. As a result, a gap often appears between the cognitive processes intended in the curriculum and the cognitive processes actually measured through classroom tests.

The relevance of assessment instruments is closely related to Piagetian cognitive development theory. Piaget's theory suggests that elementary-aged children are commonly situated within the concrete operational stage, where logical thinking develops through concrete materials, observable relationships, classification, sequencing, and cause-and-effect reasoning. Although contemporary research recognizes that children's cognitive development is influenced by social, cultural, linguistic, and instructional factors, Piagetian theory remains useful as a developmental lens for designing age-appropriate learning and assessment tasks. For elementary students, questions that require reasoning should ideally be embedded in familiar contexts, visual representations, real objects, or meaningful classroom experiences. Empirical evidence from mathematics education supports the importance of visual representation in conceptual learning. Aisyah et al. (2025) found that GeoGebra-based learning significantly improved students' understanding of geometric concepts and highlighted the role of dynamic visualization in strengthening the connection between visual representations and formal mathematical reasoning. Although the study was conducted at the junior high school level, its findings provide relevant evidence that visual and manipulable representations can facilitate conceptual understanding of relatively abstract mathematical content. This consideration is particularly relevant to elementary assessment, where students' reasoning may be more effectively elicited through concrete, visual, and contextualized tasks than through decontextualized abstract questions. Abstract questions that demand formal reasoning may not accurately represent students' actual cognitive potential if they are introduced without sufficient scaffolding. This means that cognitive assessment in elementary education should not only ask what students know, but also consider how students at a particular developmental stage are able to show what they know. In this sense, Piagetian theory provides a foundation for ensuring that assessment instruments are not only content-valid, but also developmentally valid.

In addition to Piagetian theory, Bloom's taxonomy offers an important framework for classifying the

level of cognitive demand embedded in assessment instruments. The revised Bloom's taxonomy organizes cognitive processes into remembering, understanding, applying, analyzing, evaluating, and creating, while also recognizing different types of knowledge, such as factual, conceptual, procedural, and metacognitive knowledge (Anderson & Krathwohl, 2001). This framework is widely used to align learning objectives, instructional activities, and assessment tasks. Recent studies have shown that Bloom's taxonomy remains relevant for designing assessment items, formative assessment activities, and higher-level questioning, but its classroom implementation is often superficial when teachers focus only on action verbs without considering the depth of knowledge being assessed (Na et al., 2021; Qadar et al., 2025; Sypré et al., 2025). In elementary education, the use of Bloom's taxonomy must therefore be balanced with developmental appropriateness. Lower-level cognitive tasks such as remembering and understanding may be suitable for younger students, whereas applying, analyzing, evaluating, and creating should be introduced progressively through concrete, contextual, and scaffolded tasks. This balance is necessary so that higher-order thinking skills are developed without ignoring students' cognitive readiness.

Previous literature has provided important insights into classroom assessment, formative assessment, authentic assessment, and Bloom-oriented instructional design. Yan et al. (2021) reviewed factors influencing teachers' formative assessment intentions and implementation, showing that teacher beliefs, assessment knowledge, school context, and professional support shape assessment practices. Sortwell et al. (2024), through an umbrella review of meta-analyses, found that formative assessment can produce positive effects on K-12 student learning, although the magnitude of effects varies depending on assessment type and implementation quality. Li et al. (2023) demonstrated that professional development can strengthen primary teachers' formative assessment literacy, while Çibukçiu and Koliqi (2026) highlighted the conceptual, practical, and socio-emotional dimensions of formative assessment literacy among primary school teachers. In relation to authentic assessment, Vlachopoulos and Makri (2024) showed that real-world tasks can support critical thinking, problem-solving, collaboration, and other twenty-first-century skills. Papanastasiou et al. (2025) also emphasized the need to reposition authentic assessment as a meaningful alternative to traditional assessment practices. Together, these studies indicate that effective assessment requires more than item construction; it requires a coherent understanding of learners, cognitive processes, task design, and feedback.

Studies focusing on Bloom's taxonomy have also shown the importance of aligning assessment with cognitive complexity. Na et al. (2021) demonstrated that Bloom's taxonomy can guide the development of formative assessment items that help students remember, understand, and apply knowledge. Qadar et al. (2025) found that teachers may struggle to integrate both cognitive process and knowledge dimensions when designing assessment tasks based on the revised Bloom's taxonomy. Sypré et al. (2025) further showed that teacher training based on Bloom's taxonomy can support higher-level questioning and student engagement. In elementary contexts, Bloom-oriented learning activities have been reported to improve conceptual knowledge, procedural knowledge, scientific literacy, and creative thinking when they are designed in accordance with students' learning characteristics (Adijaya et al., 2023; Premana et al., 2023; Pujawan et al., 2022). Nevertheless, most previous studies tend to examine formative assessment, authentic assessment, Bloom's taxonomy, or teacher assessment literacy as separate domains. Limited attention has been given to the specific alignment between cognitive assessment instruments, elementary students' developmental stages, and Bloom's cognitive levels within one integrated conceptual discussion. This gap is important because an assessment instrument may be technically valid but still developmentally inappropriate if it demands cognitive operations beyond students' readiness.

Based on this gap, the present study aims to analyze the alignment of cognitive assessment instruments with elementary students' cognitive development through a literature-based review grounded in Piagetian theory and Bloom's taxonomy. Specifically, this study examines how different forms of assessment instruments, including multiple-choice tests, short-answer items, matching tests, essay tests, portfolios, projects, and product-based assessments, correspond to students' developmental characteristics and cognitive levels. The theoretical contribution of this study lies in its attempt to integrate developmental appropriateness and cognitive taxonomy into a single assessment alignment perspective. Practically, the study provides guidance for elementary school teachers in selecting and designing assessment instruments that are not only aligned with learning objectives, but also suitable for students' cognitive readiness. This study also contributes to the discussion on assessment quality by emphasizing that valid assessment in elementary education must consider content, cognition, context, and developmental suitability at the same time. By strengthening this

alignment, classroom assessment can become a more meaningful tool for measuring learning progress, supporting higher-order thinking, and improving the quality of instruction in elementary schools.

B. Method

a. Research Design

This study employed an integrative literature review design with a systematic search and thematic synthesis procedure. This design was selected because the study aimed to analyze, compare, and synthesize theoretical and empirical literature on the alignment between cognitive assessment instruments and elementary students' cognitive development. An integrative review is appropriate when a study seeks to combine conceptual perspectives, empirical findings, and pedagogical implications into a coherent analytical framework. In this study, the review focused on three major conceptual domains: Piagetian cognitive development, Bloom's taxonomy of cognitive learning outcomes, and cognitive assessment instruments used in elementary education. Although the study did not involve direct classroom experimentation or survey data, a systematic procedure was applied to ensure transparency, replicability, and analytical rigor. The review process was informed by contemporary guidelines for systematic review reporting, particularly the principles of clear eligibility criteria, transparent source identification, and documented selection procedures (Page et al., 2021). This design was also considered suitable because recent assessment studies emphasize the importance of synthesizing evidence across K-12 formative assessment, authentic assessment, and cognitive-level assessment frameworks (Sortwell et al., 2024; Yan et al., 2021).

b. Research Context, Location, and Period

The research was conducted as a literature-based study focusing on the context of elementary education, particularly students aged approximately 7–12 years who are generally associated with the concrete operational stage of cognitive development. Since the study did not collect primary data from a specific school, the research location was defined as the academic literature environment covering international and national scholarly publications related to elementary assessment, cognitive development, and classroom evaluation. The literature search and screening process were conducted between December 2025 and January 2026. The reviewed literature was limited mainly to publications from 2021 to 2026 to ensure the relevance of the findings to recent educational assessment discourse. However, seminal theoretical works on Piagetian cognitive development and Bloom's taxonomy were retained as foundational references because these theories remain central to the conceptual structure of the article. This contextual scope allowed the study to examine assessment instruments not as isolated testing tools, but as pedagogical instruments that must be aligned with learners' cognitive readiness, classroom practices, and expected levels of thinking.

c. Source Population and Literature Sample

The population of this study consisted of scholarly publications related to cognitive development, cognitive assessment, formative assessment, authentic assessment, Bloom's taxonomy, and elementary school learning. The literature sample included peer-reviewed journal articles, review papers, theoretical papers, and selected educational books or official documents that were directly relevant to the topic. The main sources were searched through Scopus, Web of Science, ERIC, ScienceDirect, Taylor & Francis Online, SpringerLink, MDPI, SAGE Journals, and Google Scholar as a supplementary search engine. The inclusion criteria were: articles published between 2021 and 2026, studies written in English or Indonesian, studies focusing on assessment instruments or cognitive learning outcomes, studies addressing elementary or K-12 education, and studies providing theoretical or empirical relevance to Piagetian theory, Bloom's taxonomy, formative assessment, authentic assessment, or teacher assessment literacy. The exclusion criteria were: articles unrelated to classroom assessment, papers without full-text access, non-academic web sources, opinion pieces without scholarly grounding, duplicated records, and studies focusing exclusively on higher education without transferable relevance to assessment design. Older references were included only when they were considered seminal theoretical sources, such as Piagetian cognitive development and Bloom's revised taxonomy.

d. Research Instruments

The main instrument used in this study was a literature extraction matrix developed by the researchers to organize and analyze the selected sources. The matrix consisted of several indicators, including author and year, research context, education level, type of assessment instrument, cognitive level measured, theoretical framework, main findings, limitations, and relevance to elementary students' cognitive development. The

indicators were developed based on the conceptual focus of the study, namely the relationship between assessment instruments, developmental appropriateness, and cognitive-level classification. The assessment instrument categories included multiple-choice tests, short-answer items, matching tests, essay tests, portfolios, project-based assessment, and product-based assessment. The cognitive-level categories were mapped using Bloom's taxonomy, including remembering, understanding, applying, analyzing, evaluating, and creating. The developmental suitability of each assessment type was interpreted using Piagetian theory, particularly the concrete operational stage that characterizes most elementary school students. This matrix enabled the researchers to compare different assessment instruments systematically and to identify patterns of alignment between assessment format, cognitive demand, and students' developmental characteristics.

e. Validity and Reliability of the Review Procedure

To ensure methodological validity, the study applied content validity through expert-oriented theoretical alignment. The selected literature was examined based on its relevance to three conceptual dimensions: elementary cognitive development, assessment instrument design, and Bloom-based cognitive classification. The validity of the literature selection was strengthened by applying explicit inclusion and exclusion criteria before data synthesis. To improve reliability, the researchers used a structured coding matrix and reviewed each selected article consistently using the same categories. The coding process focused on whether a source discussed assessment format, cognitive level, developmental suitability, classroom implementation, or assessment validity. When a publication contained more than one relevant focus, it was coded into multiple categories to avoid losing important conceptual information. The credibility of the synthesis was also supported by cross-checking findings across recent review studies on formative assessment, authentic assessment, and teacher assessment literacy. This strategy is important because recent research has shown that assessment effectiveness depends not only on the type of instrument, but also on implementation quality, teacher interpretation, feedback practices, and learner characteristics (Sortwell et al., 2024; Yan et al., 2021).

f. Data Collection Procedure

The data collection procedure was conducted in four sequential stages. First, the researchers identified keywords based on the title and research focus. The main search strings included "cognitive assessment instruments," "elementary students' cognitive development," "Piagetian theory in elementary education," "Bloom's taxonomy assessment," "formative assessment in K-12 education," "authentic assessment," and "teacher assessment literacy." Second, the researchers searched relevant databases and exported bibliographic information from eligible sources. Third, the retrieved literature was screened by reading the title, abstract, keywords, and full text when necessary. Studies that did not correspond to the research focus were excluded during this stage. Fourth, the selected studies were entered into the extraction matrix and analyzed according to the assessment type, cognitive level, developmental relevance, and pedagogical implication. The procedure followed the logic of transparent literature identification and screening as recommended in PRISMA-based review practices (Page et al., 2021). The purpose of this procedure was not to calculate statistical effect sizes, but to build a rigorous conceptual synthesis that could explain how assessment instruments should be aligned with elementary students' cognitive development.

g. Data Analysis Technique

The data were analyzed using thematic synthesis supported by a descriptive-comparative approach. The analysis began with repeated reading of the selected literature to identify concepts related to assessment formats, cognitive processes, and developmental characteristics. The researchers then conducted initial coding by grouping data into categories such as objective tests, subjective tests, authentic assessment, lower-order thinking assessment, higher-order thinking assessment, and developmental appropriateness. After coding, the categories were compared and refined into broader themes. The main themes included: the suitability of objective tests for measuring remembering and understanding, the role of essay tests in assessing reasoning and explanation, the relevance of portfolios and projects for observing learning development over time, and the need to align cognitive demand with the concrete operational stage of elementary students. Thematic analysis was used because it allows researchers to identify patterns across multiple sources and organize them into meaningful analytical themes (Braun & Clarke, 2021). The synthesis was then interpreted using Piagetian theory and Bloom's taxonomy as the main analytical lenses. Through this process, the study generated a conceptual explanation of how different assessment instruments correspond to students' cognitive development and learning objectives.

h. Methodological Framework

The methodological flow of this study was organized to ensure that the review process was transparent and replicable. The process began with the formulation of the review focus, followed by database searching, literature screening, eligibility assessment, data extraction, thematic coding, synthesis, and interpretation. The framework is presented in Table 1 to clarify how the review was conducted and how each stage contributed to the final analysis.

Table 1. Methodological Framework of the Literature Review

Stage	Procedure	Output
Stage 1	Formulating the research focus on cognitive assessment instruments and elementary students' cognitive development	Clear review focus and analytical scope
Stage 2	Searching literature through Scopus, Web of Science, ERIC, ScienceDirect, Taylor & Francis Online, SpringerLink, MDPI, SAGE Journals, and Google Scholar	Initial pool of relevant studies
Stage 3	Screening titles, abstracts, keywords, and full texts based on inclusion and exclusion criteria	Selected literature for review
Stage	Procedure	Output
Stage 4	Extracting data using a literature extraction matrix	Organized information on assessment type, cognitive level, and developmental relevance
Stage 5	Coding the literature into conceptual categories	Initial analytical categories
Stage 6	Conducting thematic synthesis based on Piagetian theory and Bloom's taxonomy	Integrated themes and conceptual findings
Stage 7	Interpreting the synthesis into pedagogical implications	Recommendations for elementary cognitive assessment design

Table 1 shows that the study was conducted through a structured review process rather than an unsystematic summary of previous studies. Each stage was designed to support the main purpose of the article, namely to explain how cognitive assessment instruments can be selected and designed according to elementary students' cognitive development. The table also clarifies that the findings were generated through literature extraction and thematic synthesis, not through statistical testing or field experimentation. Therefore, the conclusions of this study should be understood as conceptual and pedagogical implications derived from the reviewed literature.

i. Ethical Considerations

This study did not involve human participants, classroom intervention, personal data, or direct interaction with students and teachers. Therefore, formal ethical clearance was not required. Nevertheless, the study followed academic ethical principles by ensuring accurate citation, avoiding plagiarism, and representing previous studies fairly. All sources used in the review were acknowledged through proper in-text citations and reference entries. The researchers also avoided manipulating previous findings to support predetermined conclusions. The interpretation of the literature was conducted carefully to maintain conceptual accuracy and scholarly integrity. Since the study was based entirely on published literature, issues of participant confidentiality, anonymity, and informed consent did not apply. However, the principles of transparency, honesty, and responsible academic writing were maintained throughout the research process.

C. Result and Discussion

a. Result

The literature synthesis shows that the relevance of cognitive assessment instruments in elementary education is determined by the alignment among students' cognitive developmental characteristics, the cognitive level being measured, and the assessment format used by teachers. The findings indicate that elementary school students require assessment tasks that are concrete, contextual, gradual, and appropriate to their level of reasoning. Since most elementary students are generally associated with the concrete operational stage, assessment should not only measure students' ability to recall information, but also their capacity to understand, apply, explain, analyze, and construct knowledge through developmentally suitable tasks. Based on the reviewed literature, three major findings were identified. These findings include the alignment between assessment instruments and students' cognitive development, the suitability of different assessment formats for measuring cognitive outcomes, and the need to combine objective, subjective, and authentic assessment

instruments to obtain a more comprehensive picture of students' cognitive growth.

1. Alignment Between Assessment Instruments and Students' Cognitive Development

The first finding indicates that cognitive assessment instruments for elementary students should be selected by considering the developmental characteristics of learners. Students at the elementary school level are generally able to think logically, classify objects, compare information, sequence events, and solve simple problems. However, their thinking is still closely connected to concrete experiences, familiar contexts, visual support, and direct interaction with learning materials. Therefore, assessment instruments that use clear instructions, simple language, concrete examples, and contextual situations are more appropriate for measuring students' cognitive achievement. When an assessment task is too abstract, too linguistically complex, or unrelated to students' everyday experiences, the result may not fully represent students' actual understanding. In such cases, students may fail to answer not because they do not understand the concept, but because the task exceeds their developmental readiness.

For lower-grade students, especially grades 1 to 3, objective and short-response instruments are more suitable for measuring basic cognitive processes. Multiple-choice tests, short-answer items, and matching tests can be used to assess remembering, understanding, and simple application. These instruments are useful for identifying students' mastery of factual knowledge, vocabulary, simple concepts, and basic reading comprehension. Nevertheless, the items should still be constructed using familiar contexts, concrete wording, and age-appropriate language. For upper-grade students, especially grades 4 to 6, assessment instruments can be expanded to include essay tests, portfolios, projects, and product-based assessments. These instruments are more suitable for students who have begun to organize ideas, explain reasoning, connect concepts, and solve contextual problems. This finding confirms that assessment design in elementary education should be progressive rather than uniform across all grade levels.

2. Suitability of Different Assessment Instruments for Measuring Cognitive Outcomes

The second finding reveals that no single assessment instrument is sufficient to measure the whole range of students' cognitive development. Each assessment instrument has a different function, strength, and limitation. Objective tests, such as multiple-choice and short-answer items, are suitable for measuring lower-order cognitive skills because they are practical, efficient, and relatively easy to score. These instruments are particularly useful when teachers need to assess factual knowledge, conceptual recognition, basic comprehension, and simple application. However, objective tests have limited capacity to capture students' reasoning processes, argument construction, creativity, and ability to explain relationships among concepts. Therefore, objective tests should not be used as the only instrument for evaluating cognitive development in elementary education.

Essay tests provide broader opportunities for students to express their reasoning and organize their ideas in written form. They are more suitable for measuring application, analysis, and evaluation because students are required to construct answers rather than merely select responses. However, essay tests require clear scoring rubrics to reduce subjectivity and improve consistency in assessment. Authentic assessment instruments, including portfolios, projects, and product-based assessments, provide more comprehensive evidence of students' cognitive development. These instruments allow teachers to observe students' learning processes, progress, creativity, and ability to apply knowledge in meaningful contexts. Portfolios are useful for documenting students' development over time, while projects and products are appropriate for assessing problem-solving, integration of concepts, and creative performance. However, these instruments require careful planning, explicit criteria, sufficient time, and consistent teacher guidance.

3. Combined Assessment Instruments as a Developmentally Appropriate Approach

The third finding shows that the most relevant approach for assessing elementary students' cognitive development is the combined use of objective tests, subjective tests, and authentic assessment. This combination allows teachers to assess cognitive achievement across different levels, from remembering and understanding to analyzing, evaluating, and creating. Objective tests are useful for identifying students' basic mastery of concepts, essay tests are useful for examining explanation and reasoning, while portfolios, projects, and product-based assessments are useful for observing higher-order thinking and learning progress over time. Through this combination, assessment becomes more balanced because it captures both learning outcomes and learning processes. This approach also prevents teachers from relying too heavily on one type of test that may only represent a limited aspect of students' cognitive ability.

The combined use of assessment instruments also supports the principle of developmental appropriateness. In lower grades, teachers may begin with simple objective tests, oral questions, short responses, matching activities, and guided tasks. In upper grades, teachers may gradually introduce open-ended questions, essay tasks, portfolio documentation, project-based assessment, and product-based assignments. This progression helps students move from concrete understanding toward more complex cognitive performance. It also enables teachers to align assessment tasks with Bloom's cognitive levels while still considering students' cognitive readiness. Therefore, the selection of assessment instruments should be based on learning objectives, grade level, cognitive demand, task complexity, and students' ability to engage meaningfully with the assessment.

Table 1. Alignment of Cognitive Assessment Instruments with Elementary Students' Cognitive Development

Type of Assessment Instrument	Cognitive Level Measured	Main Indicators	Findings from the Literature Synthesis	Developmental Suitability
Multiple-choice test	C1–C2, remembering and understanding	Recalling facts, recognizing concepts, identifying correct information	Suitable for measuring basic knowledge and conceptual recognition, especially when items are concrete, contextual, and clearly worded	High
Short-answer test	C1–C3, remembering, understanding, and applying	Mentioning, explaining briefly, applying simple concepts	Effective for identifying early understanding and simple misconceptions because students produce short responses independently	High
Matching test	C1–C2, remembering and understanding	Connecting terms, definitions, concepts, or examples	Relevant for assessing students' ability to recognize relationships between concepts, especially in lower grades	Moderate to high
Essay test	C3–C5, applying, analyzing, and evaluating	Explaining reasons, organizing ideas, analyzing simple problems	Useful for examining students' reasoning and conceptual explanation, but requires clear scoring rubrics to ensure consistency	High
Portfolio assessment	C2–C6, understanding to creating	Documenting learning progress, conceptual growth, and reflective understanding	Provides a comprehensive picture of students' cognitive development over time through accumulated learning evidence	Very high
Project-based assessment	C3–C6, applying to creating	Solving contextual problems, integrating concepts, producing meaningful work	Relevant for measuring higher-order thinking because students apply knowledge in real or simulated contexts	Very high
Product-based	C4–C6,	Designing,	Shows students' ability to	High

assessment	analyzing, evaluating, and creating	producing, revising, and presenting learning products	synthesize knowledge and transform understanding into concrete outputs
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Table 1 presents the alignment between assessment instruments, Bloom's cognitive levels, measurable indicators, and developmental suitability for elementary students. The table shows that multiple-choice, short-answer, and matching tests are more suitable for measuring lower cognitive levels, particularly remembering, understanding, and simple application. These instruments are practical for elementary classrooms because they provide structured tasks and can be adapted to concrete learning contexts. However, their use should be limited when the assessment objective is to measure deeper reasoning, evaluation, creativity, or complex problem solving. For this reason, objective tests are more appropriate as diagnostic or basic mastery instruments rather than as the sole basis for evaluating students' cognitive development.

The table also indicates that essay tests, portfolios, projects, and product-based assessments are more appropriate for measuring higher cognitive processes. Essay tests help students demonstrate reasoning, explanation, and conceptual relationships. Portfolio assessment provides longitudinal evidence of learning progress and allows teachers to observe the development of students' understanding over time. Project-based and product-based assessments are particularly useful for measuring students' ability to apply, analyze, evaluate, and create knowledge in meaningful contexts. Nevertheless, these instruments require explicit rubrics, clear performance criteria, and consistent teacher guidance to ensure fairness and reliability. Thus, assessment quality in elementary education depends not only on the type of instrument used, but also on the extent to which the instrument is aligned with students' developmental stage, learning objectives, cognitive level, and classroom context.

Overall, the results confirm that cognitive assessment in elementary education should be designed as a developmental and progressive process. Lower-grade students require more structured, concrete, and guided assessment formats, while upper-grade students can gradually be introduced to more open-ended and performance-based assessment instruments. The integration of Piagetian developmental principles and Bloom's taxonomy provides a useful basis for selecting assessment instruments that are both cognitively appropriate and pedagogically meaningful. In this regard, assessment should not be understood merely as a tool for measuring final achievement, but as an instructional mechanism that supports students' cognitive growth, identifies learning needs, and helps teachers improve classroom learning. These findings emphasize that a well-designed assessment system should combine practicality, developmental suitability, cognitive depth, and meaningful learning evidence.

b. Discussion

The first major finding indicates that cognitive assessment instruments in elementary education must be aligned with students' developmental characteristics rather than selected only on the basis of practicality or curriculum coverage. This finding is conceptually important because it shows that assessment validity in elementary classrooms is not limited to whether an item measures the intended content, but also whether the task is cognitively accessible to children at a particular developmental stage. From a Piagetian perspective, elementary students who are generally situated in the concrete operational stage are able to reason logically, but their reasoning still depends on concrete situations, familiar contexts, and observable relationships. Therefore, assessment tasks that are too abstract or linguistically complex may underestimate students' actual understanding because the difficulty lies in the format of the task rather than in the concept being assessed. This interpretation supports Piaget's developmental theory while extending it into the field of classroom assessment by emphasizing developmental validity as a necessary dimension of assessment quality. The finding is also consistent with recent formative assessment literature, which argues that assessment should help teachers diagnose learning needs and adapt instruction rather than merely classify achievement (Sortwell et al., 2024; Yan et al., 2021). However, this study adds a more specific argument by showing that diagnostic assessment in elementary education must be sensitive to children's cognitive readiness, not only to their correct or incorrect responses.

The second finding shows that different assessment instruments measure different layers of cognitive performance, which means that no single instrument can represent the whole range of students' cognitive development. Objective tests, such as multiple-choice, short-answer, and matching items, are suitable for

assessing remembering, understanding, and simple application because they provide structured tasks that are manageable for young learners. However, their usefulness becomes limited when teachers aim to measure reasoning, explanation, evaluation, or creative production. This finding supports Bloom's taxonomy because the taxonomy clarifies that cognitive learning outcomes range from lower-order to higher-order thinking, but it also modifies its classroom application by arguing that cognitive level must be interpreted together with developmental readiness (Anderson & Krathwohl, 2001). Previous studies have similarly shown that Bloom's taxonomy can guide assessment design, yet teachers often struggle to translate the taxonomy into well-balanced assessment tasks (Na et al., 2021; Qadar et al., 2025; Sypré et al., 2025). The present study differs from those studies by situating Bloom's taxonomy within elementary cognitive development, where the movement from C1 to C6 cannot be treated as a purely hierarchical technical process. Instead, higher-order assessment in elementary classrooms requires gradual scaffolding, concrete contexts, and task formats that allow students to demonstrate reasoning without being blocked by abstract language or unfamiliar problem situations.

The third finding emphasizes that authentic assessment instruments, such as portfolios, projects, and product-based tasks, provide richer evidence of students' cognitive development than conventional tests when the assessment goal involves higher-order thinking. This result is meaningful because authentic assessment allows teachers to observe how students apply knowledge, connect concepts, revise ideas, and produce learning outcomes over time. In theoretical terms, this finding strengthens the constructivist interpretation of Piagetian learning because students are not assessed only as receivers of information, but as active constructors of meaning through concrete and purposeful tasks. It also supports the upper levels of Bloom's taxonomy, especially analyzing, evaluating, and creating, because authentic tasks require students to transform knowledge into performance or products. This interpretation is in line with recent studies showing that authentic assessment can support problem-solving, critical thinking, and real-world learning when task criteria are clear and learning contexts are meaningful (Papanastasiou et al., 2025; Vlachopoulos & Makri, 2024; West, 2023). Nevertheless, the finding must be read critically because authentic assessment is not automatically superior in every classroom situation. Without explicit rubrics, sufficient time, and teacher guidance, portfolios and projects may produce subjective judgments or unequal opportunities for students; therefore, authentic assessment should be understood as a powerful but demanding approach that requires strong assessment literacy.

The fourth finding reveals that a combined assessment approach is more developmentally appropriate than reliance on a single type of instrument. This finding has important conceptual implications because it moves the discussion beyond the common dichotomy between traditional tests and authentic assessment. Rather than treating objective tests as weak and performance-based tasks as superior, this study argues that each instrument has a legitimate function when it is aligned with the intended cognitive level and students' developmental stage. In this sense, the study contributes a more integrative assessment perspective in which multiple-choice and short-answer tests can serve diagnostic and basic mastery purposes, while essays, portfolios, projects, and products can be used to examine reasoning, progress, and higher-order performance. This argument is consistent with studies on teacher assessment literacy, which show that effective assessment depends on teachers' ability to select, interpret, and use assessment information in context (Çibukçiu & Koliqi, 2026; Lei & Lei, 2025; Li et al., 2023; Pastore, 2023). It also explains why assessment reform cannot be achieved only by introducing new instruments; teachers must understand why, when, and how a particular instrument fits a specific learning objective. Therefore, the novelty of this study lies in proposing assessment alignment as a relationship among content, cognition, context, and developmental suitability.

The final finding situates this study within the broader global literature on assessment quality by showing that elementary cognitive assessment requires an integrated theoretical foundation. While many previous studies have examined formative assessment, authentic assessment, teacher assessment literacy, or Bloom's taxonomy separately, this study brings these strands together through the lens of elementary students' cognitive development. This integration is important because assessment instruments may be technically valid, but still pedagogically inappropriate if they demand cognitive operations that students are not yet ready to perform independently. The study therefore extends Piagetian theory by applying it to assessment design and extends Bloom's taxonomy by arguing that cognitive complexity should be mediated by age, task format, and classroom context. At the practical level, the findings suggest that teachers should design assessment progressively, beginning with concrete and structured tasks in lower grades and gradually moving toward

open-ended, reflective, and performance-based tasks in upper grades. At the same time, the study has an implicit limitation because its conclusions are derived from literature synthesis rather than direct classroom observation or empirical testing. Future studies should therefore validate this conceptual alignment framework through classroom-based research involving teachers, students, and real assessment artifacts across different elementary grade levels.

D. Conclusion

This study concludes that the quality of cognitive assessment in elementary education depends on the alignment among assessment instruments, students' cognitive developmental characteristics, and the level of cognitive demand expected in learning objectives. The literature synthesis shows that elementary students require assessment tasks that are concrete, contextual, gradual, and developmentally appropriate because their reasoning is still closely connected to direct experience and familiar learning situations. Objective instruments, such as multiple-choice, short-answer, and matching tests, are suitable for measuring lower cognitive levels, particularly remembering, understanding, and simple application. However, these instruments are insufficient when assessment aims to capture reasoning, conceptual explanation, creativity, and higher-order thinking. Essay tests, portfolios, projects, and product-based assessments provide broader evidence of students' cognitive development because they allow learners to organize ideas, apply concepts, solve contextual problems, and demonstrate learning progress over time. Therefore, the most appropriate assessment approach for elementary education is not the use of a single instrument, but a balanced combination of objective, subjective, and authentic assessment instruments.

The main contribution of this study lies in its integrated perspective that connects Piagetian cognitive development theory with Bloom's taxonomy to guide the selection and design of cognitive assessment instruments in elementary classrooms. This perspective emphasizes that valid assessment should not only be content-based, but also developmentally suitable, cognitively meaningful, and pedagogically useful. The findings suggest that teachers need to design assessment progressively, beginning with structured and concrete tasks in lower grades and gradually introducing more open-ended, reflective, and performance-based tasks in upper grades. Practically, this study provides guidance for teachers to use assessment as a diagnostic, formative, and instructional tool rather than merely as a mechanism for assigning scores. Nevertheless, because this study is based on literature synthesis, future research should empirically test the proposed alignment between assessment instruments, Bloom's cognitive levels, and students' developmental stages through classroom-based studies. Such research would strengthen the practical validity of the framework and provide more specific evidence for improving assessment quality in elementary education.

E. Author Contributions Statement

Andi Nur Aisyah was the sole author of this article and was responsible for all stages of the research and manuscript preparation. The author conceptualized the study, designed the literature review framework, collected and selected relevant sources, conducted the literature analysis, interpreted the findings, and developed the discussion. The author also prepared the original manuscript, revised the intellectual content, ensured the coherence of the theoretical argument, and approved the final version of the article for publication.

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