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Assessment Models in Physics Education: A Systematic Review of Diagnostic, Formative, and Authentic Approaches

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Abstract
The assessment in physics education plays a crucial role in understanding how well students grasp core concepts and apply their knowledge in real-life situations. This research explores various assessment models used in physics education to enhance student learning outcomes. The primary objective of this study is to examine the effectiveness of different assessment models, including diagnostic, formative, summative, and competency-based evaluations. Literature review method was employed to gather and synthesize relevant studies from academic databases such as Google Scholar and Science Direct. The results reveal that formative assessment is particularly effective in improving student engagement and learning by providing continuous feedback. Moreover, competency-based assessments offer a more comprehensive evaluation by considering cognitive, affective, and psychomotor aspects of student learning. Authentic assessments that simulate real-world tasks are also gaining traction for their ability to bridge theoretical knowledge and practical application. This study concludes by recommending a combination of these assessment models for optimal student development in physics education.
Keywords: *Physics education, Assessment models, Education models*

INTRODUCTION

Physics education plays a pivotal role in developing students' understanding of fundamental natural phenomena and the cultivation of essential skills to apply this knowledge in real-world contexts (Dewadi et al., 2023). Given the nature of physics, which integrates both theoretical learning and empirical application, it necessitates effective pedagogical strategies to ensure that students not only master theoretical concepts but also develop practical competencies to implement these concepts in daily life (Bao & Koenig, 2019). Within this framework, assessment serves as a critical element in the educational process, providing valuable insights into the extent of students comprehension and their ability to bridge theoretical knowledge with practical applications. Consequently, exploring various assessment models employed in physics education to optimize learning outcomes is imperative (Mudra et al., 2024).

Assessment in physics education encompasses a variety of forms, each serving distinct objectives and applications. Formative assessment, for example, is implemented throughout the learning process to monitor students' progress and offer feedback continuously (Kulasegaram & Rangachari, 2018). This model enables educators to identify students' difficulties and provide timely interventions to help them improve their understanding. Formative assessments engage students actively by offering opportunities for corrective action and refinement of their learning outcomes. In contrast, summative

assessment evaluates students' achievements after a learning cycle, typically through examinations or final assignments that measure overall comprehension (Heritage, 2021).

Another valuable assessment model is diagnostic assessment, which is typically employed at the beginning or early stages of the learning process to identify students' strengths and weaknesses in specific areas. By conducting diagnostic assessments, educators can design more targeted instructional strategies, ensuring that the learning process is tailored to the needs of individual students. Information gathered from diagnostic assessments allows educators to prioritize content areas requiring more focus and adjust teaching methodologies accordingly. Additionally, diagnostic assessments help uncover gaps in students' learning that may be overlooked in a more generalized approach to instruction.

Technological advancements have further reshaped assessment models in physics education. Project-based assessments, which involve students working on projects related to real-world applications, are becoming increasingly prevalent. These assessments allow students to apply the concepts they learn in physics to practical tasks, such as designing experiments or constructing physical models. The model evaluates students' theoretical knowledge and their ability to solve problems, collaborate effectively, and demonstrate practical skills. Project-based assessments allow students to develop critical and creative thinking skills while engaging with real-life challenges (Al-Kamzari & Alias, 2025).

Authentic assessment has also gained prominence due to its comprehensive evaluation of students' learning outcomes. Unlike traditional assessments that primarily focus on theoretical knowledge, authentic assessments evaluate students' ability to apply their knowledge and skills in real-world contexts. Authentic assessments provide a more holistic measure of students' learning by engaging students in real-life problem-solving tasks, focusing on how well they can utilize their knowledge in practical situations(Hidayat & Syafe'i, 2018).

Despite the advantages of these diverse assessment models, several challenges arise for both educators and students. One significant challenge is ensuring that assessments are conducted fairly and impartially. The application of different assessment models may lead to disparities in evaluations, especially when there are variations in students' academic backgrounds, learning styles, and capabilities. Thus, educators need to select assessment models that align with the learning objectives while accounting for the diverse characteristics of the student population. Another challenge lies in the limited time and resources available to educators for implementing complex and varied assessments. While project-based and authentic assessments offer substantial benefits, they require considerable time for planning, execution, and evaluation. This can be a significant barrier for educators with constrained schedules or limited access to necessary resources. Therefore, effective strategies are needed to integrate diverse assessment models into daily instruction in a manner that is both time-efficient and impactful (Afrida et al., 2021).

This study aims to explore the various assessment models utilized in physics education, critically evaluating the effectiveness of each model and offering recommendations for implementing optimal assessment strategies. A systematic literature

review approach will be employed to gather and synthesize relevant academic sources, comprehensively analyzing current trends in assessment models within physics education. The findings of this research are expected to offer valuable insights into the most effective assessment models, guiding educators toward improved practices in physics education.

The primary objective of this research is to identify assessment models that are better aligned with the evolving needs of physics education in the 21st century, focusing on those that assess not only students' theoretical knowledge but also their capacity to apply that knowledge in practical settings. Additionally, this study will explore integrating technology into physics education assessments, such as using automated assessment tools, to streamline the evaluation process. By doing so, the study aims to contribute to the identification of best practices and the development of innovative approaches to assessment in physics education.

Despite the growing body of research on assessment in physics education, most existing studies focus on examining individual assessment models in isolation, such as formative or summative assessment. Limited attention has been given to a comprehensive synthesis that systematically compares multiple assessment models across cognitive, affective, and psychomotor domains within physics learning contexts.

Furthermore, previous reviews often emphasize general educational assessment without explicitly addressing the unique characteristics of physics as a discipline that integrates conceptual understanding, mathematical reasoning, and experimental skills. This lack of comparative and discipline-specific synthesis creates a gap in understanding how different assessment models can be strategically combined to support effective physics learning.

Therefore, this study aims to fill this gap by providing a comparative literature review of diagnostic, formative, summative, portfolio-based, project-based, and authentic assessment models in physics education. The novelty of this review lies in its integrative and comparative approach, offering both theoretical insights and practical implications for physics teachers in designing balanced and effective assessment strategies.

METHODS

This study employed a systematic narrative literature review to examine assessment models used in physics education, with a focus on diagnostic, formative, summative, portfolio-based, project-based, and authentic assessment approaches. This review was conducted to synthesize existing research findings, identify prevailing trends, and highlight gaps related to assessment practices that support conceptual understanding and skill development in physics learning.

The literature search was carried out using several academic databases, including Google Scholar, ScienceDirect, Elsevier, and Garuda, to ensure comprehensive coverage of both international and national publications. The search process utilized combinations of keywords such as physics education, assessment models, formative assessment, diagnostic assessment, authentic assessment, and project-based assessment. The search was limited to

articles published between 2015 and 2025 to ensure the relevance and currency of the reviewed studies. To maintain the quality and relevance of the selected literature, explicit inclusion and exclusion criteria were applied. The inclusion criteria comprised: (1) peer-reviewed journal articles, (2) studies focusing on assessment models in physics education or closely related science education contexts, (3) articles written in English or Indonesian, and (4) studies that discussed the implementation, effectiveness, or conceptual framework of assessment models. Articles were excluded if they were non-academic publications, opinion pieces without empirical or theoretical grounding, or studies unrelated to assessment practices in physics or science education (Taylor et al., 2023).

The selection process involved three stages: identification, screening, and eligibility assessment. Initially, articles were identified through keyword searches in the selected databases. Duplicates were removed, and titles and abstracts were screened to assess relevance to the research focus. Subsequently, full-text articles were reviewed to ensure alignment with the inclusion criteria. Through this process, a total of 19 relevant articles were selected for in-depth analysis (Gottlieb et al., 2024).

Data analysis was conducted using a thematic synthesis approach. Each selected article was examined to extract key information, including the type of assessment model, educational level, research design, main findings, and reported strengths or limitations of the assessment approach. The extracted data were then categorized into thematic groups corresponding to different assessment models. Comparative analysis was performed to identify patterns, similarities, differences, and recurring issues across the reviewed studies.

Literature Search and Selection

This literature review followed a structured article selection process adapted from the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines. Relevant studies were identified through database searches in Google Scholar, ScienceDirect, Garuda, and Elsevier using keywords related to physics education and assessment models.

The initial search yielded 124 articles. After removing 28 duplicate records, 96 articles remained for screening. Titles and abstracts were then screened based on relevance to assessment models in physics education, resulting in the exclusion of 61 articles that did not meet the inclusion criteria. A full-text eligibility assessment was conducted on 35 articles, of which 16 articles were excluded due to insufficient methodological clarity, lack of relevance to physics education, or incomplete assessment model discussion. Finally, 19 articles were included in the synthesis and analysis of this review.

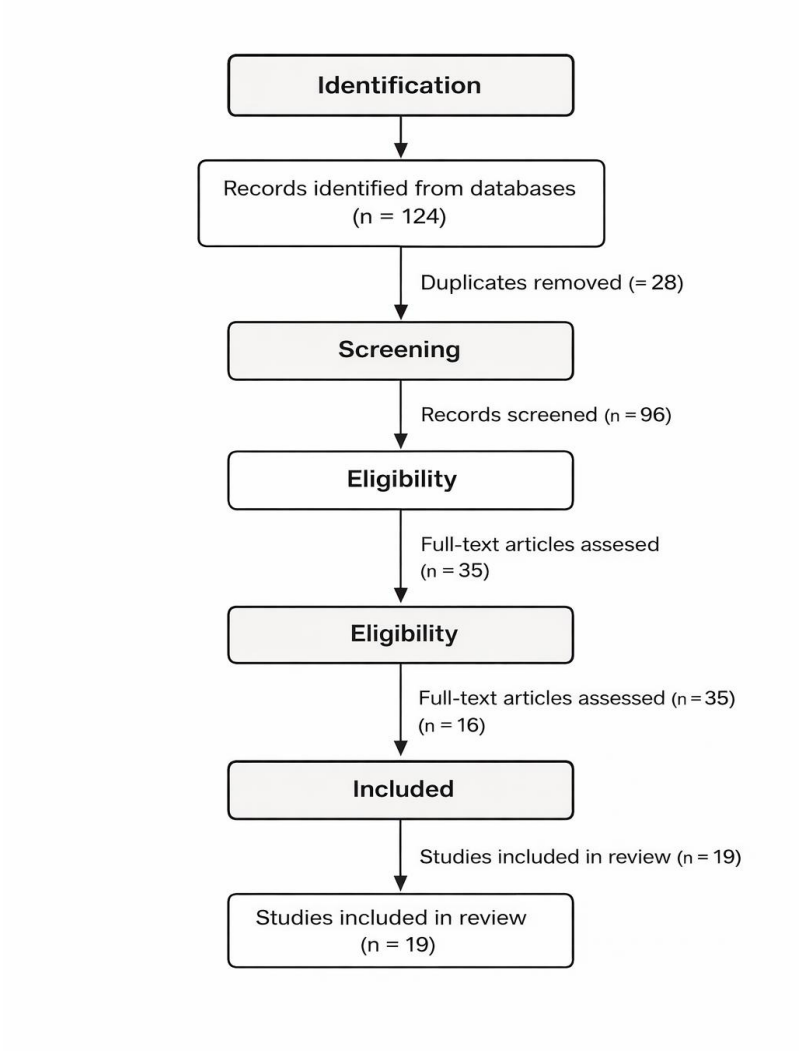

Figure 1. PRISMA Flow Diagram of Article Selection

To ensure the quality of the reviewed studies, a basic quality appraisal process was applied. The selected articles were limited to peer-reviewed publications relevant to physics education assessment, published within the last ten years. Each article was examined based on the clarity of research objectives, methodological rigor, relevance to assessment models in physics education, and the transparency of reported findings. Articles that did not meet these criteria were excluded from the final synthesis.

FINDING AND DISCUSSION

This review synthesizes findings from 19 selected studies addressing assessment models in physics education. The analysis reveals that no single assessment model sufficiently captures the complexity of physics learning, which involves conceptual understanding, mathematical representation, experimental skills, and scientific reasoning. Instead, the effectiveness of assessment practices depends on how well the chosen model aligns with instructional objectives and the unique epistemological characteristics of physics.

Table 1. Summary of Reviewed Studies on Assessment Models in Physics Education

No	Author(s)	Year	Research Method	Assessment Model	Main Finding
1	Bao & Koenig	2019	Conceptual review	Formative	Formative assessment enhances conceptual understanding and scientific reasoning in physics learning
2	Kulasegaram & Rangachari	2018	Review	Formative	Continuous feedback improves student engagement and learning regulation
3	Heritage	2021	Theoretical analysis	Formative	Assessment for learning supports adaptive instruction in science classrooms
4	Hidayat & Syafe'i	2018	Qualitative	Authentic	Authentic assessment bridges theory and real-world physics applications
5	Baneres et al.	2016	System design study	Digital / e-assessment	Technology-based assessment increases assessment efficiency and reliability
6	Schildkamp et al.	2020	Systematic review	Formative	Teacher assessment literacy is critical for effective formative assessment
7	Alfath & Raharjo	2019	Descriptive	Norm- & criterion-referenced	Criterion-referenced assessment better reflects competency achievement
8	Aliyan & Dayanti	2021	Case study	Criterion-referenced	CRA supports mastery learning and remedial instruction
9	Puteri et al.	2023	Quantitative	Authentic	Authentic assessment positively affects learning outcomes and motivation
10	Dewi	2018	Experimental	Portfolio	Portfolio assessment improves reflective learning and conceptual mastery
11	Mahardika	2018	Classroom action research	Portfolio	Portfolios document students' progress holistically
12	Budiati	2020	Experimental	Project-based	Project assessment enhances creativity and problem-solving skills
13	Amam et al.	2020	Development research	Project-based	Project assessment supports higher-order thinking skills
14	Mita et al.	2023	Instrument development	Project-based	Project assessment measures psychomotor and creative skills effectively
15	Warasini	2021	Descriptive	Diagnostic	Diagnostic assessment identifies students' cognitive readiness
16	Lahay et al.	2024	Mixed methods	Diagnostic	Cognitive and non-cognitive diagnostics guide adaptive teaching
17	Magdalena et al.	2020	Descriptive	Summative	Summative assessment remains relevant for accountability purposes
18	Barokah	2020	Case study	Summative	Summative assessment supports evaluation of curriculum outcomes
19	Idris & Asyafah	2020	Qualitative	Authentic	Authentic assessment measures learning process and outcomes comprehensively

Comparative Analysis of Assessment Models in Physics Education

The synthesis of the reviewed studies indicates that assessment models in physics education serve distinct yet complementary functions. Diagnostic assessment is primarily

effective at the initial stage of instruction, as it identifies students' prior knowledge, cognitive readiness, and learning barriers. Compared to summative assessment, diagnostic assessment provides more actionable information for instructional planning, particularly in heterogeneous classrooms. Formative assessment emerges as the most influential model in supporting continuous learning improvement. In contrast to summative assessment, which focuses on outcome measurement, formative assessment emphasizes feedback, interaction, and learning regulation. Multiple studies highlight that formative assessment is more effective in enhancing conceptual understanding, student engagement, and metacognitive skills in physics learning. Summative assessment, although limited in supporting learning processes, remains relevant for evaluating overall achievement and accountability. However, when used as the sole assessment strategy, summative assessment is less effective in capturing students' problem-solving processes and practical competencies. Portfolio, project-based, and authentic assessments demonstrate strong potential in assessing higher-order thinking skills and real-world application of physics concepts. Compared to traditional assessments, these models provide a more holistic evaluation by integrating cognitive, affective, and psychomotor domains. Nevertheless, their implementation requires greater time, planning, and assessment literacy from teachers.

Overall, the findings suggest that no single assessment model is sufficient to address the complex learning objectives of physics education. An integrated assessment approach that combines diagnostic, formative, summative, and authentic assessments is recommended to optimize both learning processes and outcomes.

Assessment Approach of Learning

Assessment is a crucial part of the evaluation process. The assessment of student learning outcomes conducted by teachers is not only to monitor the progress and development of student learning outcomes by their potential, but also to provide feedback to teachers to improve their planning and teaching process. However, suppose the assessment process carried out by teachers is careless and without clear direction. In that case, it will ultimately produce inaccurate information about students' learning outcomes that do not correspond to what is happening in the classroom (Alfath & Raharjo, 2019).

The assessment approach in learning refers to the methods educators use to assess the extent to which students have achieved learning objectives. This approach encompasses various aspects of the learning process, such as data collection, evaluation of skills, knowledge, attitudes, and understanding of students. Two types of assessment approaches can be used to interpret scores into grades, namely norm-referenced assessment (NRA) and criterion-referenced assessment (CRA). These two approaches use different assumptions about a person's abilities.

Namely Norm-Referenced Assessment (NRA)

The Norm-Referenced Assessment (NRA) is an evaluation method that compares students' learning outcomes against the outcomes of other students within the same group. NRA compares the scores obtained by a student with relative standards or norms. This means that a student who excels in group A may only perform at an average level if

transferred to another group. This assessment approach can be considered as an "as-is" approach, where the comparative benchmarks are solely based on the actual outcomes obtained during the measurement or assessment process, i.e., the student's learning results being measured. NRA is not linked to any standards outside the results of the measurements within a specific student group (Alfath & Raharjo, 2019).

This approach involves comparing students' achievements or raw scores with those of other students in the same group or class. The meaning of values, whether in numerical or qualitative form, is relative. This means that once a conversion guideline based on test scores in a particular class or group is established, it only applies to that group and is unlikely to be valid for other groups, as the score distribution of the test takers will differ. Unless, during score processing, the scores from different groups are combined. Norm-referenced assessment scores students by comparing the learning outcomes of one student with those of others in the same group or class. Norm-referenced assessment (NRA) is considered a classical approach, as it evaluates students' achievement on a test by comparing their performance to that of other students who took the same test. This measurement method is used as a competitive learning measurement approach.

Criterion-Referenced Assessment (CRA)

Criterion-referenced assessment (CRA) is an evaluation model that refers to specific criteria for achieving predetermined learning objectives. CRA is an assessment approach that compares a student's performance against a "passing standard" established for each subject area. Unlike Norm-Referenced Assessment, which compares students to others in their group, CRA compares the scores obtained by students against an absolute standard or norm. Thus, CRA examines what a student can achieve, not by comparing the student to their peers but by comparing their performance to a specific criterion or benchmark. These criteria are defined in terms of the level of learning experience or a set of fundamental competencies that must be established before the learning activities occur. For example, the criteria might be 75% or 80%. Students performing below the established criteria are considered unsuccessful and must undergo remedial action (Aliyan & Dayanti, 2021).

The goal of CRA is to precisely measure whether the objectives or competencies set as criteria for success have been achieved. CRA is highly beneficial in improving the quality of learning outcomes because it encourages students to meet the established standards, allowing for an assessment of their level of achievement. To determine the passing grade using this approach, each student's score is compared with the ideal score that could be achieved. This approach is not oriented towards "as-is" performance. First, it uses average scores but establishes the success criteria, namely the "passing grade" for mastering the subject matter or the target learning outcomes (TKP). Students who meet this threshold are considered to have succeeded in learning and can proceed to more advanced material, while those who do not are considered to have failed and must reinforce their understanding. Second, in the teaching process, instructors do not leave students to navigate their learning independently; instead, they continuously, both directly and indirectly, stimulate and monitor students' progress, helping them successfully pass through

the stages of the learning process. Using formative assessments in this approach significantly supports identifying students' learning success (Widiyono, 2021).

Models in Physics Learning Assessment

The Assessment Model is a framework that estimates the level of trust between students and their institutions based on various activities and information. It introduces security mechanisms to activate virtual assessment systems while maintaining the integrity of face-to-face evaluations. (Baneres et al., 2016). Physics learning assessment, various assessment models are used to evaluate students' understanding and skills. These models are essential to ensure that the assessment covers all aspects of physics learning, from cognitive aspects to practical skills. Below are some of the commonly used assessment models in physics education.

Formative Assessment

Formative assessment has the potential to support teaching and learning in the classroom. Assessment for formative purposes is intended to guide the learning process and enhance student learning outcomes (Schildkamp et al., 2020). Formative assessment in learning involves providing appropriate guidance and support from teachers to students while encouraging active student engagement. Therefore, at the initial stage, teachers must clarify the learning objectives to students and share success criteria with them. This ensures that students clearly understand the learning goals, can assess their peers' work, provide constructive feedback, and learn from one another. Furthermore, through intensive interactions between teachers and students and implementing alternative strategies such as peer assessment, self-assessment, and questioning, teachers can evaluate whether students' progress aligns with the learning objectives and adjust the necessary instructions. Motivation to actively participate in the assessment process and provide constructive feedback is a crucial aspect of the teacher's attention (Demekash et al., 2024).

The most effective form of assessment is formative assessment. Teachers respond to and collect evidence of students' thinking and their feedback. Quantitatively, this alone is not sufficient to enhance learning. Qualitative feedback is what truly helps students achieve their learning objectives. The use of formative assessment provides teachers with the ability to offer continuous feedback to students. This serves as a technique to motivate and encourage students in learning a language more efficiently. On the other hand, the assessment process can be effective when conducted continuously, through day-to-day assessments and periodic assessments, thus creating authentic assessment practices that are carried out regularly (Puteri et al., 2023).

Summative assessment

Summative assessment is a method used to evaluate the curriculum at the end of a syllabus, focusing on outcomes. Through this assessment, a teacher aims to determine what students remember from their learning and to what extent they have achieved proficiency or success at the end of a unit, subject, or overall program. Summative assessments are almost always formally evaluated. Final exams, final presentations, or final projects are examples of summative evaluations. The ultimate result of this evaluation is to determine

whether a student should progress to the next grade level or remain in the same class (Adinda et al., 2021).

Summative assessment concerns summarizing student performance and is directed toward reporting at the end. It does not have a direct impact on learning, although it often influences decisions that may have consequences for students' learning. The functions of summative assessment include measuring students' abilities and understanding, providing feedback to students, offering feedback to instructors as a measure of learning success, ensuring accountability and monitoring standards for academic staff, and motivating students (Barokah, 2020). Educators can conduct summative assessments to enhance students' self-esteem during the learning process. If the educator requires additional information to measure students' learning achievements, it can still be performed at the end of the semester. Summative assessment requires educators to understand various techniques and instruments, not only in the form of tests but also through methods such as observation and performance. (Magdalena et al., 2020).

Diagnostic assessment

Diagnostic assessment is defined as an assessment explicitly conducted to identify students' competencies, strengths, and weaknesses so that learning can be designed according to the students' competencies and conditions. Diagnostic assessment is primarily used to uncover students' strengths and weaknesses in the learning process. The diagnostic assessment results serve as a basis (entry point) for educators to plan learning activities that align with the characteristics and learning needs of the students. When planning instruction, information related to family background, school readiness, learning motivation, and students' interests can be considered.

Diagnostic assessment is divided into two types: cognitive assessment and non-cognitive assessment. The objectives of cognitive diagnostic assessment are as follows: (1) to identify students' competency achievements, (2) to adjust classroom instruction according to the average competency level of the students, and (3) to provide remedial classes or additional lessons for students whose competencies fall below the average. From this explanation, it can be understood that cognitive diagnostic assessment aims to obtain a comprehensive overview of a student's readiness to learn in the cognitive domain. Consequently, educators can implement instructional activities aligned with the student's competencies and characteristics and apply various necessary adaptations (Sujinah et al., 2024). The objectives of the non-cognitive diagnostic assessment are: (1) to determine students' psychological well-being and socio-emotional status, (2) to identify their activities during home-based learning, (3) to understand students' family conditions, (4) to gain insight into students' social backgrounds, and (5) to identify students learning styles, character traits, and interests (Lahay et al., 2024).

Portfolio assessment

Portfolio assessment can be utilized to document students' development. Recognizing that the learning process is essential for lifelong success, portfolios enable students to observe their progress, particularly regarding their development, attitudes, skills,

and expressions toward various subjects. These examples of student work provide a basis for considering their learning advancement and can be communicated with students, parents, and other relevant stakeholders. Thus, portfolios can be used to document students' progress throughout every activity and learning process. In general, within the field of education, a portfolio refers to a collection of students' works or records concerning students, which are systematically and properly documented. Portfolios may consist of assignments completed by students, students' responses to teachers' questions, teachers' observation notes, records of teacher-student interviews, reports of students' activities, and essays or journals written by students (Mahardika, 2018). A portfolio is a compilation of a student's works, resulting from completing performance tasks, as determined by the teacher or collaboratively by the teacher and the student, as part of the effort to achieve learning objectives or the competencies specified in the curriculum.

During each learning opportunity, students can process, consider, compare, internalize, and engage in self-reflection or self-discussion. The final stage of contextual learning involves assessment. Portfolio-based assessment facilitates the acquisition of information regarding the learning process's quality and its outcomes. Portfolio assessment is an approach or model of evaluation aimed at measuring students' abilities to construct and reflect on a task or work by collecting materials relevant to the objectives and interests established by the students themselves. This allows the teacher to evaluate and comment on the resulting work within a specific period. Portfolio assessment serves both formative and summative purposes. As a formative assessment tool, portfolios are used to monitor students' learning progress daily and detect potential learning difficulties. Research demonstrates that implementing portfolio assessment in contextual learning has a positive impact on student's cognitive abilities and language skills, as it enables continuous documentation of student work and provides a comprehensive picture of their ongoing development. Portfolios may include a variety of student outputs such as assignments, daily learning journals, summaries, projects, end-of-lesson reflections, error logs, worksheets, quizzes, homework, and tests. This comprehensive documentation supports formative assessment progress and provides feedback and summative assessment achievement at the end of a learning period. Overall, portfolio assessment in contextual learning measures student achievement, encourages self-reflection and motivates students to improve their learning outcomes (Dewi, 2018).

Project assessment

Project assessment is an evaluation of tasks that involve investigative activities which must be completed by students within a predetermined timeframe. In the implementation of project assessment, students are assigned projects that require them to engage in various activities, including the creation of a creative product (Amam et al., 2020). Therefore, students are assessed based on the process and the skills they demonstrate in completing the project, with the outcome being a product or work that can be beneficial in real-life contexts. Students can enhance and develop their creativity according to their respective levels through project assignments. Creativity is defined as an individual's ability to generate something new, which may take the form of ideas or concepts, as well as tangible works

that are either novel or represent modifications of existing forms. In this context, creativity is not limited to cognitive processes but also encompasses motor skills or the practical abilities students demonstrate during task completion.Motor skills refer to all activities related to bodily movement, which involve three main components: muscles, nerves, and the brain. Thus, mathematical motor creativity can be defined as students' ability to use their body and hand movements creatively and innovatively within mathematical problem-solving. The psychomotor domain is divided into seven levels of learning: perception, readiness, guided response, habitual response, complex response, adaptation of movement patterns, and creativity (Mita et al., 2023).

The implementation of project-based assessment comprises four stages. The planning stage is when students formulate the core research problems to be investigated or observed and establish a project implementation schedule, location, tools, materials, and other requirements according to teacher or mentor instructions. Students collect data in the analysis stage. The action type depends on the project's focus, whether it emphasizes process or product outcomes. During the implementation stage, students compile the data obtained according to the core problems to be solved and then analyze it. The report preparation stage involves drawing conclusions and presenting data. Teachers implementing project-based assessments must understand students' abilities in selecting topics, seeking information, collecting data, ensuring project relevance to the studied material, and verifying project authenticity. According to Haryati in her book "Model and Assessment Techniques," project-based assessment has several advantages: it represents a standardized learning process with meaningful pedagogical content; it provides opportunities for students to fully express their acquired competencies; it is more efficient and produces tangible outcomes; and it generates defensible competency mastery values (Budiati, 2020).

Authentic assessment

Authentic assessment provides students significant opportunities to demonstrate what they have learned during the instructional process. This assessment approach is considered more capable of comprehensively measuring student learning outcomes because it evaluates learning progress not merely the results but also the learning process itself. Authentic assessment also provides extensive opportunities for students to apply their existing knowledge, skills, and attitudes. In certain circumstances, assignments may not be completed within the classroom, requiring students to work on them outside class hours or even beyond school premises. This assessment method was developed because traditional approaches often ignore real-world contexts and fail to represent students' capabilities holistically. They have typically overlooked the authentic application of knowledge and skills in contexts that reflect actual challenges and situations students might encounter outside academic settings (Idris & Asyafah, 2020).

Authentic assessment is the process of teachers gathering information about student learning development and achievement through various techniques that can accurately reveal, prove, or demonstrate that learning objectives have been genuinely mastered and achieved. The data collected through assessment activities is not intended to seek

information about student learning merely. Proper instruction should emphasize helping students learn how to learn rather than focusing on acquiring as much information as possible by the end of the instructional period. This approach prioritizes evaluating students' ability to apply knowledge meaningfully and to develop independent learning skills. Unlike traditional assessment methods that often emphasize content memorization, authentic assessment focuses on measuring students' capacity to utilize their knowledge in realistic contexts that demonstrate accurate understanding and mastery of learning objectives (Umami, 2018).

CONCLUSION

This literature review highlights the importance of assessment models in supporting effective physics education. The findings indicate that assessment in physics learning should not be limited to measuring final learning outcomes but should also function as a tool to guide instruction, identify students' learning difficulties, and support the development of conceptual understanding and practical skills. Various assessment models, including diagnostic, formative, summative, portfolio-based, project-based, and authentic assessment, play complementary roles in evaluating different aspects of student learning.

Diagnostic assessment is particularly useful for identifying students' prior knowledge and misconceptions at the beginning of instruction, enabling teachers to design more targeted learning activities. Formative assessment contributes significantly to improving students' engagement and understanding through continuous feedback during the learning process. Summative assessment remains necessary for evaluating overall learning achievement and ensuring accountability at the end of instruction. In addition, portfolio, project-based, and authentic assessments provide opportunities to assess students' learning processes, creativity, and ability to apply physics concepts in real-world contexts.

Overall, the review suggests that the use of a combination of assessment models is more effective than relying on a single approach. Integrating multiple assessment strategies allows educators to obtain a more comprehensive picture of students' learning and better align assessment practices with the characteristics of physics education. Future studies are encouraged to further explore the implementation of assessment models in classroom practice, particularly by examining the use of technology-based assessments to enhance efficiency and effectiveness in physics learning.

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