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Development of an Assessment Instrument for Students Discipline and Responsibility in Physics Practicum-Based Cooperative Learning

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ABSTRACT

This This study aimed to develop a valid, reliable, and practical assessment instrument to measure students' discipline and responsibility in Jigsaw-type cooperative learning based on physics practicum. The research used the Research and Development (R&D) method with development steps adapted from Borg & Gall, involving expert validation, field trials, and statistical analysis. Expert validation indicated high validity scores (87.0% for discipline, 94.7% for responsibility). The instrument was tested on 30 students, and reliability scores (Cronbach's alpha) were 0.70 (discipline) and 0.92 (responsibility), indicating good to very high reliability. Practicality scores averaged 90.72 and 91.80, respectively, based on teacher feedback, reflecting ease of use and usefulness. The results confirm that the developed instrument is suitable for implementation in physics learning to help teachers monitor and foster character development effectively. This research also contributes significantly to educational assessment tools aligned with the Merdeka Belajar framework and the Pancasila Student Profile, offering a foundation for future enhancements and broader application in other subjects and competencies. Additionally, the integration of character education within collaborative learning environments ensures a more holistic approach to student development. The findings suggest that systematic assessment instruments are essential in supporting teachers to objectively measure affective skills, which are often overlooked in traditional classroom assessments.

***Keywords**: Assessment Instrument, Discipline, Responsibility, Cooperative Learning, Physics Practicum*

1. INTRODUCTION

Education plays a crucial role in shaping individuals who are not only intellectually competent but also possess strong character. Education in the 21st century no longer focuses solely on cognitive achievement but increasingly emphasizes the development of character and life skills. In a global era characterized by rapid technological advancements and shifting social values, competencies such as responsibility, discipline, collaboration, and critical thinking are essential to personal and societal success. Schools are no longer merely academic institutions but play a pivotal role in forming students who are morally grounded and socially responsible.

International organizations such as UNESCO and the OECD have long emphasized the integration of 21st-century competencies into educational systems. In Indonesia, this vision is manifested through national education reforms, including the Merdeka Belajar (Freedom to Learn) initiative and the Pancasila Student Profile framework. Among the six main dimensions of this framework are personal traits like independence, cooperation, and responsibility. These values serve as the foundation for the nation's education goals and must be intentionally embedded in the design, implementation, and evaluation of learning processes (Maesaroh et al., 2023).

According to Law No. 20 of 2003 on the National Education System, education is defined as a conscious and planned effort to create a learning atmosphere and learning process so that students actively develop their potential to have spiritual strength, self-control, personality, noble character, and the skills needed for themselves, society, and the nation. However, in the context of recent educational challenges—especially during and post the COVID-19 pandemic—character development has encountered significant obstacles(Usman, 2022); Purwanto et al. 2020).

The pandemic led to a shift from face-to-face learning to online learning, affecting the direct implementation of character education. One prominent issue identified is the decline in students' attitudes of discipline and responsibility. This issue has been observed particularly among students in grade XI of SMAN 1 Metro, who often arrive late, fail to submit assignments on time, neglect classroom duties, and lack adherence to school rules. These behaviors highlight a gap in the affective domain of student development, which is as critical as the cognitive and psychomotor domains.

The COVID-19 pandemic caused unprecedented disruptions in the education ecosystem. The sudden shift from face-to-face learning to online learning led to significant challenges in the implementation of character education. Many students struggled with time

management, experienced a lack of motivation, and demonstrated reduced levels of discipline and responsibility. The absence of direct supervision and diminished social interaction further weakened the reinforcement of moral and behavioral standards typically cultivated within the school environment (Chen dkk, 2023).

Various studies conducted during and after the pandemic reported declining student discipline, especially regarding task completion, class attendance, and adherence to school norms. These findings underscore the urgency of redesigning character education strategies for the post-pandemic context. With the return to physical classrooms, teachers need innovative tools and frameworks to restore and reinforce essential character values. Assessment instruments designed to evaluate these affective traits are a critical component of this effort (Yulya, 2023).

Character education, particularly in terms of discipline and responsibility, needs to be integrated into learning processes. One effective approach is through cooperative learning models such as the Jigsaw type, which promotes collaborative learning and fosters social responsibility (Jacobs, Lee, & Ball, 2022; Du, Zhang, & Wang, 2020). This model has been shown to improve both academic outcomes and affective traits in recent studies (Asrul, Rosidin, & Abdurrahman, 2022; Firmansyah, 2021). However, measuring these affective traits reliably remains a challenge in post-pandemic classroom settings (Authar dkk, 2022).

Despite the acknowledged importance of these values, many educators face challenges in assessing them. Most evaluations focus predominantly on cognitive skills, while assessments of affective attributes like discipline and responsibility are often overlooked due to the perceived complexity of developing reliable and valid instruments(Kibtiyah, Nugroho, & Rahmawati, 2021). Teachers at SMAN 1 Metro, for example, lack standardized instruments for assessing these character traits, resulting in subjective evaluations based on personal judgment.

One of the major obstacles faced by educators in promoting character development is the lack of standardized, valid, and reliable assessment tools. Traditional assessments tend to prioritize cognitive outcomes, while affective traits such as responsibility and discipline are often overlooked due to the perceived difficulty in measuring them objectively. In practice, character evaluations are usually based on teachers' impressions or anecdotal evidence, leading to inconsistency and subjectivity (Asbari dkk, 2020).

Developing valid and practical instruments to assess character allows teachers to provide concrete feedback and monitor behavioral growth in a systematic way. With clearly defined indicators of behavior, teachers can observe and document student conduct during learning activities, collaborative tasks, and classroom interactions. This data can inform not only teaching strategies but also student reflection and parent communication. Therefore, there is an urgent need for assessment instruments that are grounded in pedagogical theory yet practical for daily classroom use.

Therefore, the development of a valid, reliable, and practical assessment instrument for measuring students′ discipline and responsibility is essential. Such an instrument would assist educators in accurately evaluating student behavior and supporting character development. This research aims to create and validate an observational assessment tool tailored to the cooperative, practice-based physics learning environment. By implementing this tool, it is expected that teachers can more effectively monitor and enhance these critical character traits among students, ultimately contributing to the broader goals of national education. Cooperative learning models, such as the Jigsaw strategy, have proven effective in fostering students' character traits, particularly responsibility and discipline. These models emphasize interdependence among group members, shared goals, and individual accountability—elements that naturally reinforce positive behavior. Within physics education, practical experiments provide a rich context for collaboration, decision-making, and task delegation.

In Jigsaw-based practicum sessions, students are assigned specific roles and are responsible for mastering and teaching subtopics to their peers. This structure encourages responsibility not only for their learning but also for the success of the group. It also requires discipline in following procedures, meeting deadlines, and actively contributing to group discussions. Such settings offer ideal opportunities for character assessment, as behaviors can be observed in real-time and under authentic conditions.

The Pancasila Student Profile is a comprehensive framework designed to shape Indonesian students into lifelong learners who embody national values. It comprises six dimensions: faith and piety, global citizenship, independence, mutual cooperation, critical thinking, and creativity. Responsibility and discipline are embedded across these dimensions and are considered essential traits for navigating modern life and contributing to national development.

By aligning assessment instruments with the Pancasila Student Profile, educators can ensure that character education is not treated as an abstract goal but as a measurable and observable aspect of student development. The instrument developed in this research explicitly targets key indicators of discipline and responsibility that reflect the broader values of Pancasila. As such, it supports not only classroom teaching but also the national mission of building a character-driven education system.

This study offers a unique contribution by focusing on the development of a behavior-based assessment instrument for affective competencies in the context of physics learning. Unlike many previous studies that emphasize academic achievement, this research centers on

student behavior, particularly in cooperative, practicum-based learning environments. The combination of the Jigsaw model with a structured observation instrument represents an innovative approach to character assessment.

The development process employed a robust Research and Development (R&D) framework adapted from Borg & Gall, involving expert validation and field testing. This ensures that the instrument is not only theoretically grounded but also empirically tested for validity, reliability, and practicality. The resulting tool is designed for ease of use by teachers and can be adapted for different subjects and grade levels. It serves as a model for future research in character education and educational measurement (Firmansyah & Zain, 2021).

While the importance of character education is widely acknowledged, its implementation in classrooms remains inconsistent. Teachers often face constraints such as time limitations, lack of training, and competing curricular demands. Moreover, character traits are not always easily observed or quantified, leading to uncertainty about how to provide meaningful feedback to students. Many educators express a desire for concrete tools that can help them integrate character assessment into their daily practice without adding an excessive workload.

The instrument developed in this research is designed to address these challenges by offering a structured, easy-to-use observation tool that fits naturally into cooperative learning environments. It provides rubrics with clearly defined behavioral indicators, allowing teachers to focus their attention during activities such as group discussions, experiments, and presentations. By making assessment more manageable, the instrument encourages sustained attention to character development throughout the academic year.

Although the instrument was developed in the context of high school physics education, its design allows for flexibility and scalability. The principles of cooperative learning and character assessment can be applied to other subjects such as biology, chemistry, or even humanities and social studies. With minor adjustments, the instrument can be used across different educational levels, from middle school to tertiary education.

Future developments may include digital versions of the instrument that enable real-time data collection, analysis, and reporting. By integrating with learning management systems or mobile apps, the assessment process can be streamlined and expanded to include student self-assessment and peer evaluation. This not only supports formative feedback but also promotes student agency and reflection, both of which are essential in cultivating lifelong learners (Sukmawa dkk, 2019).

For character education to be fully realized, collaboration between researchers, practitioners, and policymakers is essential. Universities can play a leading role in designing and testing assessment instruments, while schools provide the real-world context for implementation. Education authorities, in turn, can support these initiatives through funding, professional development programs, and policy alignment.

The success of this research demonstrates the value of such collaboration. By involving expert validators, teachers, and students throughout the development process, the instrument was tailored to actual classroom needs. This participatory approach not only improves the quality of the tool but also enhances the likelihood of its adoption and sustained use. As education systems continue to evolve, evidence-based innovations such as this will be critical in bridging the gap between curriculum goals and classroom realities.

In the modern era, reforms in the education sector demand a paradigm shift not only in instructional strategies but also in how learning outcomes are assessed. While academic achievement continues to be a primary indicator of student success, global and national education policies now emphasize holistic development. Character education is one of the most vital components of this new paradigm, and therefore, tools to measure affective learning outcomes are urgently needed. Without clear, reliable measurement, character formation risks remaining a philosophical ideal rather than an observable and actionable educational goal.

Efforts to reform assessment systems must include the development of instruments that can capture subtle but essential student behaviors. Responsibility, for instance, cannot be measured through written tests alone. It must be inferred through actions, consistency, and interaction over time. Likewise, discipline must be understood not just as compliance, but as a proactive commitment to procedures, punctuality, and perseverance. These aspects require observation-based, rubric-driven instruments that are validated and standardized across various contexts. Unfortunately, few schools in Indonesia have access to such tools, resulting in missed opportunities to shape and guide student character through evidence-based practices.

When students are aware that their character traits are being assessed just as seriously as their academic skills, they tend to internalize the importance of these values. Studies show that affective assessments, when implemented correctly, can increase student motivation, self-regulation, and engagement. Students become more reflective about their behavior, develop self-awareness, and take ownership of their learning process. These outcomes are especially crucial for high school students, who are at a developmental stage where character formation is both impressionable and impactful.

The implementation of character assessment instruments not only benefits students but also strengthens classroom culture. It fosters mutual respect, accountability, and empathy among peers. Moreover, such assessments provide teachers with structured insights that allow for more targeted mentoring and behavioral interventions. These formative processes support the development of emotionally intelligent individuals who are prepared to contribute positively to society. In this sense, character assessment is not merely supplementary

but foundational to the cultivation of meaningful, lifelong learning.

Internationally, several countries have advanced in the integration of character education with measurable assessment. In Finland, for example, emotional intelligence and teamwork are routinely embedded in classroom assessments. In Singapore, values such as resilience and integrity are explicitly measured through behavior-based rubrics tied to national education goals. The United States has seen a growing movement toward social-emotional learning (SEL), which is supported by numerous tools such as the DESSA (Devereux Student Strengths Assessment) or CASEL-aligned rubrics.

Indonesia can learn from these best practices by localizing proven models while incorporating cultural and philosophical values rooted in the national identity. The Pancasila Student Profile offers a uniquely Indonesian framework, but it must be supported by operational tools that make its six dimensions visible, measurable, and actionable. The research in this study contributes to that gap by providing an instrument aligned with national values but constructed using international standards for reliability and validity.

A recurring challenge in educational innovation is the gap between theory and classroom application. Many curriculum documents and education policies describe ideal character traits without providing tools for educators to implement and evaluate them. This disconnect leads to confusion, inconsistent implementation, and often the neglect of affective outcomes. Teachers, despite having good intentions, are left without the resources or training to embed character education meaningfully into their practice.

The development of a validated assessment instrument—like the one produced in this research—represents a concrete step in bridging that gap. By translating theoretical constructs (discipline and responsibility) into observable behaviors and clear scoring guidelines, the instrument operationalizes what character looks like in the classroom. It becomes a bridge that connects policy with practice, empowering teachers to make data-driven decisions in nurturing student character. Furthermore, the use of psychometric analysis ensures that the tool is statistically sound and practically useful across different settings.

Teachers are central figures in the development of student character. Beyond delivering content, they model values, establish norms, and provide feedback that shapes student behavior. However, many teachers feel unprepared or unsupported in their role as character educators. One reason for this is the lack of structured guidance on how to assess affective traits consistently. Most teacher training programs focus on pedagogical content knowledge but pay limited attention to assessment in the affective domain.

This study recognizes the importance of equipping teachers with tools that are both easy to use and grounded in sound theory. By involving teachers in the development, validation, and refinement of the instrument, this research also strengthens their capacity and confidence in assessing character. When teachers are empowered with the right tools, they can integrate character assessment seamlessly into their daily routines, such as during group work, class discussions, or practical activities. Their feedback becomes more specific, actionable, and aligned with broader educational goals.

Assessment should not only serve summative purposes but also play a formative role in the learning process. This is particularly true in the affective domain, where learning is developmental and iterative. The instrument designed in this study encourages ongoing observation and reflection, allowing teachers and students to monitor growth over time. The data collected can be used to identify trends, set behavioral goals, and celebrate progress.

When used effectively, character assessment data can also inform school-level decision-making. For example, schools may identify recurring behavioral issues in particular grades or learning settings, prompting the development of targeted interventions or teacher support programs. In this way, assessment becomes a tool not just for reporting but for planning and improvement. This aligns with the principles of evidence-based education, where data informs practice at both individual and institutional levels.

One of the strengths of the developed instrument is its scalability. Although it was designed for senior high school physics practicum classes, its framework is adaptable to various subjects and grade levels. The behavioral indicators are generalizable, and the rubric structure is flexible enough to accommodate context-specific modifications. This means that schools can adopt the instrument broadly, promoting consistency in character assessment across different learning areas.

For long-term sustainability, institutional support is essential. Education authorities should consider including character assessment instruments in teacher training programs, school accreditation criteria, and performance evaluation systems. Policy support can drive systemic change, ensuring that character education is not relegated to the margins but integrated into the core functions of teaching and learning. The findings of this study offer empirical evidence that such integration is feasible, beneficial, and impactful.

As digital technologies become increasingly prevalent in education, there is an opportunity to digitize character assessment tools for broader accessibility and efficiency. Digital instruments can facilitate real-time data collection, longitudinal tracking, and easier reporting. Teachers can input observations using mobile apps, generate analytics dashboards, and share reports with students and parents. This not only reduces administrative burden but also enhances transparency and engagement.

The digital transformation of the developed instrument could enable its integration into existing learning management systems (LMS) or be used independently

through web-based platforms. Furthermore, digital tools can support multimedia evidence collection—such as video recordings or peer reviews—to enrich the assessment process. These innovations, however, must be guided by ethical considerations, including student privacy and the need for culturally sensitive indicators (Maesaroh dkk, 2023).

While assessing character traits is valuable, it also involves ethical considerations that must be carefully addressed. There is a risk of labeling, bias, or misuse of data if assessments are not conducted thoughtfully. Teachers must be trained to interpret results responsibly and use them to support rather than stigmatize students. The instrument must be used as a guide for growth, not as a tool for punishment or discrimination.

Moreover, students should be involved in the assessment process through self-assessment and goal-setting. This encourages ownership and agency, making character education a collaborative effort rather than a top-down imposition. Ethical character assessment respects student dignity, recognizes individuality, and promotes continuous improvement. This perspective is embedded in the design and implementation approach of the instrument developed in this research.

2. FOCUS AND SCOPE

This study focuses on the development of an assessment instrument specifically designed to measure students' discipline and responsibility during practicum-based cooperative learning in physics education. The instrument aims to address the lack of standardized tools for evaluating affective domain competencies—particularly discipline and responsibility—which are often overlooked in classroom assessment. The scope includes:

1. The design and validation of observation-based assessment items.
2. Application of the instrument in cooperative learning models, especially Jigsaw-type learning.
3. Implementation in senior high school physics practicum environments.
4. Evaluation of validity, reliability, and practicality using expert reviews and student trials.
5. Contribution to character education aligned with the Indonesian national curriculum and Pancasila student profile.

3. MATERIALS AND METHODS

This research uses the Research and Development (R&D) method, adapted from the model developed by Borg and Gall (1989), which consists of seven stages: research and information gathering, planning, development of the initial product, initial field testing, revision of the product, main field testing, and final product revision. These stages are systematically conducted to develop an assessment instrument that is valid, reliable, and practical for measuring students' discipline and responsibility in coope. The research subjects include 30 students from SMAN 1 Metro, as well as two expert lecturers and one physics teacher who are involved in the validation process. The development begins with preliminary research to identify the existing gaps in assessing discipline and responsibility. Planning involves formulating indicators, designing the items, and developing rubrics and scoring criteria. The initial product is drafted in the form of observation sheets using a Likert scale format, containing statements.

The developed instrument undergoes expert validation focusing on content accuracy, linguistic clarity, and item construction. After validation, the instrument is tested in the classroom with the selected student sample. The data obtained from this field test are analyzed using SPSS 29 software, particularly focusing on item validity through item-total correlation and reliability using Cronbach's alpha coefficient. Items that meet the required standards are retained, while those that do not are revised. The final stage involves assessing the practicality of the instrument by obtaining feedback from teachers regarding its usability and implementation during learning activities. The entire process ensures the resulting instrument is robust and effective for use in measuring students' affective characteristics, specifically discipline and responsibility, within a cooperative, practice-based physics learning framework.

4. RESULTS AND DISCUSSION

This research focuses on the development of an assessment instrument specifically designed to measure students' discipline and responsibility during cooperative, practicum-based physics learning. These character traits are fundamental in shaping students who are not only academically competent but also capable of contributing positively to society. The need for such instruments arises from the observation that affective domain assessments are often neglected in favor of cognitive assessments, leaving a critical gap in holistic student evaluation.

The study implemented a research and development (R&D) methodology following Borg & Gall's model, involving seven systematic steps: research and information gathering, planning, development of initial product, initial field testing, product revision, main field testing, and final product refinement. These stages ensured a comprehensive and iterative process, allowing for continuous improvement based on expert input and empirical testing. During the expert validation stage, two lecturers specializing in physics education and one experienced physics teacher evaluated the draft instruments. They assessed each item for content relevance, linguistic clarity, and construct appropriateness. The discipline instrument achieved a validation score of 87.0%, and the responsibility instrument scored 94.7%, indicating that both instruments were highly valid and appropriate for classroom use. Validators emphasized the importance of using behaviorally anchored rating scales to capture the nuanced expressions of discipline and responsibility in students.

Field testing was conducted with 30 students from SMAN 1 Metro to examine the statistical reliability and item performance. The instrument's reliability was measured using Cronbach's Alpha, yielding coefficients of 0.70 for discipline and 0.92 for responsibility. These values fall within the "good" and "very good" categories, respectively, demonstrating internal consistency. Item-total correlations showed that all retained items significantly contributed to the overall construct being measured. Table 1 below summarizes the validation results for both instruments, categorized based on validation scores and expert feedback. The ratings reflect a consensus among validators on the content validity of the instruments.

Table 1. Validation Results of Discipline and Responsibility Instruments

No	Instrumen	Validity (%)	Category
1	Discipline	87.0	Very Valid
2	Responsibility	94.7	Very Valid

The analysis of student responses highlighted the items that best captured indicators of discipline and responsibility. For discipline, behaviors such as punctuality, attention during class, and adherence to classroom rules were consistently rated. For responsibility, the ability to complete tasks independently, willingness to assist peers, and accountability in group activities were prominent. These behavioral indicators align with educational character goals defined in the national curriculum.

Table 2 presents the practicality test results based on teacher feedback. Teachers assessed the ease of use, clarity, and integration of the instruments into daily lesson plans. The instruments scored 90.72 for discipline and 91.80 for responsibility, both classified as "very high." Teachers emphasized that the instruments saved time during assessment and provided meaningful insights into student character development.

Table 2. Practicality Test Results

No	Instrumen	Score	Category
1	Discipline	90.72	Very High
2	Responsibility	91.80	Very High

The findings of this research underscore the importance of integrating validated assessment tools in classroom practice. These tools not only enhance teacher effectiveness in capturing student behaviors but also support the broader goal of character education. Through structured observations and rubric-based scoring, teachers are empowered to provide formative feedback and document students' progress in a meaningful way. Furthermore, this research addresses a significant gap in the availability of psychometrically sound instruments tailored to the Indonesian educational context. The combination of expert validation and empirical testing strengthens the credibility of the findings. The instruments have been proven to work effectively in the field and can be adapted for broader implementation across similar educational settings. Future research could extend this work by adapting the instruments for other character traits or subject areas, and by exploring digital formats to increase scalability. The success of this research also highlights the potential of collaborative research between universities and schools in solving practical challenges in education.

5. CONCLUSION

The developed assessment instrument successfully meets the standards of validity, reliability, and practicality for evaluating students' discipline and responsibility in practicum-based cooperative physics learning using the Jigsaw model. The strong content validity confirmed by expert judgment and the high internal consistency demonstrated through field testing indicate the instrument's robustness for educational settings. This addresses the research gap related to the lack of standardized affective domain assessment tools, particularly those adapted to Indonesian high school contexts. The implementation of this instrument allows educators to conduct objective and structured assessments of students' character traits, contributing to a more comprehensive educational evaluation process aligned with national education goals. Furthermore, this research lays the groundwork for broader applications, such as assessment development in other subjects or character competencies.

6. SUGGESTIONS

Future research should explore the digitalization of the assessment instrument to facilitate broader implementation, streamline data collection, and enable real-time analysis. The instrument could also be adapted to evaluate other character traits, such as honesty, empathy, or cooperation, supporting the full development of the Pancasila Student Profile. Additionally, longitudinal studies are recommended to examine the long-term impact of the instrument on students' behavioral development and character formation. Expanding the application across different educational levels and subjects will not only enhance its generalizability but also provide teachers with a practical tool for comprehensive character assessment, thereby strengthening the integration of affective evaluation in everyday classroom practice.

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