BITARA Jurnal Pendidikan Bitara UPSI
Universiti Pendidikan Sultan Idris
Sultan Idris Education University
eISSN 2821-3173

Validity of a Physicist-Muslim Comic-Based Learning Module on Newton's Laws for Senior High School Students

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ARTICLE HISTORY
Received: 14th January 2026
Revised: 25th March 2026
Accepted: 3rd May 2026
Published : 19th May 2026

KEYWORDS
Comic-based learning module
Newton's Laws
content validity
physics learning
senior high school students

ABSTRACT - This study was conducted to examine the content validity of a comic-based learning module on Newton's Laws that was developed to address students' difficulties in understanding fundamental physics concepts and to enhance their learning motivation at the senior high school level. The module was developed using the ADDIE development model. the focus of this study was limited to evaluating the content validity of the module as an essential prerequisite for instructional feasibility The validation process involved nine experts with relevant expertise in physics education, instructional media development, and integrated Islamic physics learning. Their evaluations were guided by a structured validation instrument covering five key aspects: content accuracy, presentation, language, graphic design, and multimedia components. To determine the adequacy of the module's content validity, expert judgments were analyzed using the Content Validity Index (CVI), comprising both the item-level CVI (I-CVI) and the scale-level CVI (S-CVI/Ave). Consistent with established validation criteria, an I-CVI value of 0.78 and an S-CVI/Ave value of 0.90 were applied as benchmarks to confirm that the module met acceptable content validity standards prior to classroom use. The results show that the module achieved acceptable content validity with an excellent rating in all aspects evaluated, with expert agreement consistently meeting the established CVI criteria.

INTRODUCTION

Physics education at the senior high school level continues to encounter persistent challenges, particularly in supporting students' conceptual understanding of Newton's Laws of Motion. Findings from previous studies consistently indicate that students tend to develop misconceptions related to force, motion, and the application of Newtonian principles in everyday contexts (Isra & Mufit, 2023; Kaniawati et al., 2019; Kurniawan, 2018; Mushthofa et al., 2020). These misconceptions suggest that students often rely on intuitive reasoning rather than scientifically accepted explanations when interpreting physical phenomena.

In line with these findings, preliminary research conducted in several senior high schools in West Sumatra, Indonesia, revealed that both teachers and students perceive Newton's Laws as one of the most difficult topics in physics learning (Sari et al., 2026). Classroom observations and initial discussions further indicate that these difficulties are not solely related to the mathematical demands of the topic, but also to the abstract nature of the concepts and the way learning materials are commonly presented. Instruction that emphasizes formulas and symbolic manipulation, while offering limited

https://doi.org/10.37134/bitara.vol19.1.1.2026

connections to students' real-life experiences, tends to reduce students' engagement and hinders meaningful conceptual understanding.

Another factor that intensifies students' conceptual difficulties is the limited capacity of existing learning resources to accommodate diverse learning preferences (Sari et al., 2026). The findings of this study indicate that students demonstrate varied learning preferences, including visual, auditory, kinesthetic, as well as combinations of these modalities. However, in classroom practice, the learning resources most frequently used tend to emphasize visual modes only. Physics textbooks, in particular, often prioritize symbolic manipulation and formula-based problem solving, with relatively little attention given to the underlying conceptual meaning.

Such instructional conditions may impede students' opportunities to construct deep conceptual understanding and, over time, can diminish their motivation to learn physics (Mayer, 2024; Mayer & Moreno, 2003). These observations highlight the need for innovative learning resources that present physics concepts in ways that are more contextual, student-centered, and closely connected to students' learning experiences. Within this context, comic-based learning emerges as a promising alternative. By integrating dialogue, visual narratives, and illustrative representations, comics have the potential to support multiple learning preferences while simultaneously fostering students' engagement and conceptual understanding (Clark & Paivio, 1991; Mayer & Moreno, 2003).

The need for more innovative learning resources was also clearly expressed by students, particularly in relation to the use of physics comics as an alternative instructional medium (Sari et al., 2026). Students perceived that comics could help them better understand physics concepts by transforming abstract ideas into representations that are more concrete, relatable, and engaging. This perception aligns with findings from previous studies reporting that comics are effective in stimulating students' interest and attention, supporting the achievement of learning objectives, and reducing cognitive load through explicit visual representations of abstract scientific concepts (Hosler & Boomer, 2011; Lin et al., 2015). Furthermore, existing research suggests that comic-based learning can situate scientific knowledge within meaningful contexts by employing narratives, characters, and everyday situations that are familiar to students. Such narrative-driven explanations allow students to follow conceptual development coherently, thereby supporting deeper understanding and sustained engagement with physics content.

In addition to the need for more innovative learning resources, greater attention should also be given to the integration of socio-cultural aspects and values within instructional materials. Learning resources that are culturally and contextually responsive have been shown to contribute positively to students' meaningful learning experiences, as they allow learners to relate scientific concepts to their social and cultural backgrounds (Jubhari et al., 2022). Within the context of Indonesian education, particularly in schools where religious values are embedded in daily learning practices, the integration of Islamic values with scientific principles offers a potential pathway to enhance the relevance of physics learning. Previous studies suggest that such integration can support students in constructing meaning by connecting abstract scientific concepts with value-based perspectives that are familiar to them, thereby fostering a more holistic learning experience (Handayani, 2025).

In response to these learning needs, a comic-based learning module on Newton's Laws was developed for senior high school students by adopting a Muslim physicist perspective. The module presents Newtonian concepts through visual narratives, simple experimental activities, and multimedia enrichment designed to support students' engagement with the learning content. Reflective elements are also incorporated through selected wisdom from the Al-Qur'an, which are intended to encourage students to connect scientific concepts with broader reflections that are meaningful within their learning context. While maintaining scientific rigor and conceptual accuracy, the design of the module seeks to facilitate students' conceptual understanding, enhance learning motivation, and accommodate diverse learning preferences. By situating physics learning within the cultural and religious context familiar to the students, the module is expected to support a more meaningful and coherent learning experience without compromising the integrity of physics concepts.

Although comic-based learning modules offer substantial potential as innovative instructional resources, the quality and appropriateness of the developed materials must be carefully examined before they are implemented in classroom settings. In development-oriented research, content validity represents a fundamental requirement for ensuring that a learning module accurately reflects the

https://doi.org/10.37134/bitara.vol19.1.1.2026

intended learning domain and is aligned with the predetermined learning objectives (Lynn, 1986; Polit & Beck, 2006). Without a systematic content validation process, even learning resources that appear well designed may contain conceptual inaccuracies, misleading representations, or design weaknesses that reduce their instructional effectiveness. Therefore, content validity assessment serves not only as a quality control mechanism, but also as an essential step in establishing the feasibility of instructional innovations prior to their broader application in physics learning.

The Content Validity Index (CVI) is widely used as a quantitative approach for examining the level of agreement among experts regarding the relevance and clarity of learning components (Polit & Beck, 2006). Lynn (1986) proposed that when a validation panel consists of six to ten experts, an item-level CVI (I-CVI) value of at least 0.78 is required to indicate acceptable content validity, while a scale-level CVI (S-CVI/Ave) value of 0.90 or higher reflects excellent overall validity. Owing to its systematic and transparent evaluation procedure, the CVI is particularly appropriate for development-oriented research that emphasizes rigorous validation across multiple aspects of instructional design. In this study, the CVI framework enables a comprehensive assessment of key components, including content accuracy, presentation, graphic design, language, and multimedia quality, thereby supporting a thorough evaluation of the learning module prior to its implementation.

Although the educational benefits of comic-based learning resources have been widely reported, empirical evidence focusing on their content validity remains limited, particularly studies that simultaneously examine multiple instructional aspects. In many cases, validation efforts tend to emphasize a single dimension, while other important components—such as instructional substance, organizational structure, language clarity, visual design, and the integration of multimedia elements—receive less systematic attention. This limitation becomes more pronounced in the context of comic-based physics learning modules that explicitly integrate Islamic values and are intended to accommodate diverse learning preferences. Under these conditions, comprehensive and methodologically rigorous validation research is required to establish a solid empirical foundation. Such evidence is essential not only to ensure the feasibility of the developed module, but also to support subsequent stages of implementation and effectiveness evaluation.

Based on the identified gaps and learning needs, this study was conducted to examine the content validity of a Physicist-Muslim comic-based learning module on Newton's Laws developed for senior high school students. The validation process focuses on the level of expert agreement across five key dimensions, namely content accuracy, presentation, language, graphic design, and multimedia components. By applying the Content Validity Index (CVI), this study not only establishes the content validity of the developed module but also contributes empirical evidence to the field of physics education by providing a validated instructional resource that is ready for classroom implementation.

METHOD

This study employed a development research design using the ADDIE model. The present investigation was limited to the evaluation of content validity conducted during the development stage, prior to the module's implementation in classroom learning. This focus was intended to determine the relevance of the Physicist-Muslim comic-based learning module as a learning resource for physics instruction at the senior high school level.

The content validation process encompassed five key dimensions: the accuracy of physics concepts, the organization of material presentation, the appropriateness of language use, the quality of graphic design, and the integration of multimedia elements. A total of nine experts participated as validators, comprising individuals with professional backgrounds in physics education, instructional media development, and integrated Islamic physics learning. The number of experts involved aligns with methodological recommendations for Content Validity Index (CVI) analysis, which suggest that panels consisting of six to ten experts are adequate for content validation purposes (Lynn, 1986).

Expert judgments were obtained using a structured validation instrument containing specific statements for each assessed dimension. Responses were rated on a four-point Likert scale ranging from 1 (strongly disagree) to 4 (strongly agree). The exclusion of a neutral response option was intended to encourage clear and decisive evaluations from the experts. For CVI analysis, the ratings were subsequently dichotomized, with scores of 3 and 4 classified as relevant and scores of 1 and 2 classified

https://doi.org/10.37134/bitara.vol19.1.1.2026

as irrelevant (L. L. Davis, 1992; Polit & Beck, 2006). An item was considered to have acceptable content validity if the item-level CVI (I-CVI) reached a minimum value of 0.78, while excellent overall content validity was indicated by a scale-level CVI (S-CVI/Ave) value of at least 0.90 (Lynn, 1986; Polit & Beck, 2006).

RESULTS AND DISCUSSION

Results

Prior to classroom implementation, the Physicist-Muslim comic-based learning module underwent expert validation to ensure the accuracy of the physics content, its pedagogical appropriateness, and its overall feasibility as an instructional resource. Consistent with the developmental nature of the module, this expert review was conducted as a preliminary step to determine whether the module was suitable for use in senior high school physics learning.

The content validity assessment was carried out using the Content Validity Index (CVI) and involved nine experts with professional expertise in physics education, instructional media development, and integrated Islamic physics learning. Each expert evaluated the module using a four-point Likert scale ranging from strongly disagree to strongly agree. For the purposes of CVI analysis, the rating categories were subsequently dichotomized into relevant and irrelevant classifications.

The results of the expert validation for the Physicist-Muslim comic-based learning module on Newton's Laws are summarized in Table 1. In this table, I-CVI denotes the Item-Level Content Validity Index, while S-CVI/Ave represents the Scale-Level Content Validity Index calculated using the averaging procedure.

Table 1. Expert Validation Results

Aspect Evaluated	I-CVI	S-CVI/Ave	Interpretation
Content	1	1	Excellent content validity
Presentation	1	1	Excellent content validity
Language	1	1	Excellent content validity
Graphic Design	1	1	Excellent content validity
Multimedia	1	1	Excellent content validity

Table 1 presents the Content Validity Index (CVI) results across the five evaluated dimensions, namely content, presentation, language, graphic design, and multimedia integration. The analysis indicates complete agreement among experts, with both the Item-Level CVI (I-CVI) and the Scale-Level CVI (S-CVI/Ave) achieving a value of 1.00 for all assessed aspects. These results suggest that each item included in the validation instrument was consistently judged as relevant within its respective dimension.

An S-CVI/Ave value of 1.00 reflects unanimous expert agreement regarding the relevance of the learning module components based on the established validation criteria. Referring to the threshold proposed by Polit & Beck (2006), which classifies an S-CVI/Ave score of 0.90 or higher as evidence of excellent content validity when the expert panel consists of more than six members, the findings of this study indicate that the Physicist-Muslim comic-based learning module demonstrates very high content validity. From the perspective of expert judgment, the module can therefore be regarded as a well-designed and feasible instructional resource for physics learning.

Beyond the quantitative CVI results, qualitative feedback in the form of comments and suggestions from the experts was also considered to further refine the module. A summary of the main recommendations and the corresponding revisions implemented during the development process is provided in Table 2.

https://doi.org/10.37134/bitara.vol19.1.1.2026

Table 2. Summary of Expert Suggestions and Revisions

Aspect	Main Expert Suggestions	Revision Action
Content	Several physics terms required additional clarification. In addition, the representation of force diagrams needed to be more contextual and consistent across all developed comics.	Brief explanations were added for selected physics terms, and force representations were revised using everyday-life contexts to improve clarity and consistency.
Presentation	The cover design should more explicitly reflect the instructional focus of the module. In particular, the inclusion of key Newton's Laws equations, the authors' names, and a comic series number was recommended to strengthen the identity of the learning material and to support its use as part of a sequential comic-based learning series.	Newton's law equations were incorporated into each comic cover, authors' names were added, and serial numbering was included to facilitate ordered use by students.
Language	The language was generally clear and communicative; however, several technical terms could be further clarified.	Minor revisions were made by adding concise explanations without altering the original writing style or tone.
Graphic Design	The layout and illustrations were appropriate, but contextual visual elements could be strengthened.	Illustrations were refined to depict everyday phenomena closely related to students' experiences.
Multimedia	The embedded videos and interactive quizzes functioned well and supported the learning process.	No major revisions were required; multimedia components were retained as originally designed.

Overall, the expert feedback was constructive and primarily focused on suggestions related to presentation quality and contextual relevance, rather than identifying conceptual shortcomings in the module. The revisions implemented were therefore directed toward enhancing the overall quality of the learning material while preserving its original instructional objectives. These findings indicate a strong level of agreement among the experts regarding the validity of the developed module, which is further examined and interpreted in the discussion section.

Discussion

The Physicist-Muslim comic-based learning module was designed as an instructional resource to support senior high school students with diverse learning preferences in understanding Newton's Laws, while simultaneously fostering learning motivation and reflective engagement with values. Rather than presenting physics concepts through conventional expository explanations, the module emphasizes visual narratives and contextual scenarios that enable students to relate Newtonian principles to everyday experiences in a more meaningful manner. This design choice reflects an effort to reduce abstraction and support students in constructing conceptual understanding through familiar contexts.
The physics concepts are delivered through a comic-based storyline that portrays common situations involving force and motion. By situating Newton's Laws within recognizable and realistic scenarios, the module allows students to visualize physical interactions more concretely. This narrative-based approach is expected to enhance conceptual clarity and student engagement, particularly for learners who experience difficulties when dealing with highly symbolic or mathematically abstract representations of physics concepts.

Structurally, the module consists of several interconnected components, including a cover page, a user guide, comic-based explanations of physics concepts, practical activities supported by experiment videos accessed through QR codes, reflective explanations of selected Al-Qur'an verses related to Newtonian ideas accompanied by short videos, and interactive quizzes for self-assessment. These components are deliberately organized to accommodate diverse learning preferences and to support both conceptual understanding and learning motivation in a coherent instructional sequence.

https://doi.org/10.37134/bitara.vol19.1.1.2026

Prior to classroom implementation, the feasibility and quality of the module were examined through a content validity evaluation. This validation process aimed to ensure that the developed learning resource met essential academic, pedagogical, and contextual standards. Using the Content Validity Index (CVI) method and involving nine experts, the analysis revealed that all assessed dimensions—content accuracy, presentation, language, graphic design, and multimedia integration—achieved a Scale-Level CVI (S-CVI/Ave) value of 1.00. These findings indicate unanimous expert agreement regarding the relevance of all evaluated components and suggest that the module is built upon a strong instructional and design foundation.

From a content perspective, experts agreed that the Newtonian concepts presented in the module are scientifically accurate, internally consistent, and aligned with the senior high school physics curriculum. The appropriate use of symbols, equations, and conceptual explanations reflects adherence to established scientific knowledge. As emphasized by Lynn (1986) and Polit & Beck (2006), such alignment is a fundamental requirement for strong content validity, as instructional materials must accurately represent the intended knowledge domain. Moreover, experts noted that the factual and coherent presentation of concepts has the potential to support students' deep conceptual understanding, in line with principles of meaningful learning.

Beyond conceptual accuracy, the module was also considered effective in accommodating diverse learning preferences and encouraging student motivation. The use of comics as a visual narrative medium allows physics concepts to be represented through multiple forms, including text, images, dialogue, and activities. This multimodal representation is consistent with theories of differentiated learning and multiple intelligences, which emphasize that learning resources combining various representations are better suited to addressing learner diversity (K. Davis et al., 2011; Gardner, 1999; Langelaan et al., 2024; Mayer, 2024; Mayer & Moreno, 2003). The integration of Islamic values through relevant Qur'anic verses was also viewed positively, as these elements were meaningfully connected to physics concepts rather than presented as isolated additions. Such contextual integration aligns with contextual learning theory, which highlights the importance of linking learning content to learners' cultural and belief systems (Jubhari et al., 2022).

Regarding presentation, expert evaluations indicated that the module is logically structured and pedagogically coherent. Clear usage instructions, systematic sequencing of material, and smooth transitions between sections were considered supportive of effective cognitive processing. Well-organized learning materials help reduce unnecessary cognitive load and guide learners progressively from basic concepts to more complex ideas (Alemnge & Andongaba, 2021; Gagne et al., 2005). In addition, the close alignment between illustrations, narrative flow, and physics explanations reflects the principle of dual coding, which emphasizes the benefits of integrating verbal and visual information to enhance learning (Clark & Paivio, 1991).

The inclusion of experiments and project-based activities embedded within the comic format was also evaluated positively. These activities provide opportunities for active learning, which lies at the core of constructivist learning theory. Through hands-on experiments and interactive tasks, students are encouraged to actively construct their own understanding of physics concepts (Kolb, 1984, 2014; Piaget, 1977; Samet & Samet, 2025). Furthermore, experts noted strong instructional alignment among experiments, Qur'anic reflections, videos, and quizzes, as all components were directed toward shared learning objectives. This alignment is consistent with the principle of constructive alignment, which emphasizes coherence between learning objectives, instructional activities, and assessment (Biggs & Tang, 2011; Fischer-tenhagen et al., 2016).

From a linguistic standpoint, experts agreed that the module employs clear, communicative language that is appropriate for senior high school students. The consistent use of accurate scientific terminology was considered important for minimizing potential misconceptions when learning Newton's Laws. Importantly, the explanations of Qur'anic verses related to physics concepts were viewed as clear and supportive, without compromising scientific accuracy. The dialogue-based narrative style, which mirrors adolescents' communication patterns, was also regarded as effective in maintaining reading interest and emotional engagement. Studies on interest development suggest that emotionally engaging texts can support motivation and sustained engagement with complex subject matter (Hidi & Renninger, 2006; Keller, 1987).

https://doi.org/10.37134/bitara.vol19.1.1.2026

The graphic design dimension also demonstrated excellent validity. Experts observed that visual elements effectively support instructional content, character expressions are consistent with the storyline, and the overall layout facilitates a smooth reading experience. According to multimedia learning theory, visual elements should function as cognitive supports rather than merely decorative features (Mayer, 2024; Mayer & Moreno, 2003). Balanced color schemes, legible typography, and well-organized layouts contribute to visual comfort and readability, which are essential for maintaining learners' attention (Biglu & Ghavami, 2016; Ware, 2004). In addition, effective panel sequencing, as emphasized in comic theory, supports narrative continuity and conceptual flow (McCloud, 1993).

Finally, the multimedia dimension achieved excellent validity, reflecting expert agreement on the instructional relevance and technical quality of the multimedia components. The clarity of visual and audio elements in the videos was considered supportive of learning by minimizing cognitive distractions. Easy access through smartphones aligns with the principles of mobile learning, which emphasize flexibility and accessibility in contemporary educational contexts (Alkhalifah et al., 2017; Dolawattha et al., 2020; Sinen, 2015). Interactive quizzes accompanied by immediate feedback were also viewed as effective for reinforcing understanding and addressing misconceptions. Feedback is widely recognized as a critical factor in effective learning, as it enables learners to monitor progress and improve performance (Hattie & Timperley, 2007).

Overall, the consistently perfect S-CVI/Ave score of 1.00 across all evaluated dimensions indicates that the Physicist-Muslim comic-based learning module demonstrates excellent content validity. The findings suggest that the module is conceptually accurate, pedagogically appropriate, contextually relevant, and technically feasible. Consequently, the module is considered suitable for further implementation through classroom trials and subsequent effectiveness evaluation.

CONLUSSION

The results of this study indicate that the Physicist-Muslim comic-based learning module demonstrates an excellent level of content validity. This conclusion is supported by a Scale-Content Validity Index (S-CVI/Ave) of 1.00 across all evaluated dimensions, including content accuracy, presentation, language, graphic design, and multimedia integration. The unanimous agreement among experts suggests that the module fulfills essential scientific, pedagogical, contextual, and technical standards required for senior high school physics instruction.

From an instructional standpoint, the module is considered both scientifically sound and pedagogically appropriate, as evidenced by the coherent integration of physics concepts with comic-based narratives, experimental activities, and multimedia components. Notably, the incorporation of Islamic values does not compromise scientific rigor; instead, it is meaningfully embedded within the instructional design to support students' conceptual understanding and learning engagement. Overall, these findings indicate that the developed module has achieved sufficient feasibility to proceed to subsequent stages of evaluation, including practicality testing and classroom-based effectiveness studies aimed at examining its impact on students' physics learning outcomes and motivation.

CONFLICTS OF INTEREST

The authors declare that there are no conflicts of interest regarding the publication of this paper. All stages of the research, including data collection, analysis, and interpretation, were conducted objectively and independently, without any external influence.

ACKNOWLEDGEMENT

The authors would like to express their sincere gratitude to Universiti Pendidikan Sultan Idris for the institutional support and facilities provided throughout the study. Special thanks are also extended to all participants/respondents who generously contributed their time and insights during the data collection phase.

https://doi.org/10.37134/bitara.vol19.1.1.2026

CONFLICT OF INTEREST

The authors declare no conflicts of interest. This includes financial, political, personal, or professional relationships that could be perceived as influencing the content or conclusions of this manuscript.

AUTHORS CONTRIBUTION

All listed authors have made a significant scientific contribution to the research in the manuscript, approved its claims, and agreed to be an author.

DECLARATION OF GENERATIVE AI

During the preparation of this work, the authors used ChatGPT (OpenAI) to enhance the clarity and readability of the manuscript. After using this tool, the authors reviewed and edited the content as needed and take full responsibility for the content of the publication.

ETHIC STATEMENTS

Not applicable.

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