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Character Education-Based Physics Digital Comic for 12-14 Years Old Students

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Abstract

Character values must be instilled in students through unique learning media. Therefore, it is necessary to investigate and develop new learning media relevant to character education's current challenges. This research aimed to determine the feasibility of character education-based physics digital comics. The R & D method with Borg and Gall model was employed in this development research. The product was validated by two media experts, two material experts, one language expert, and one IT expert. The development of character education-based digital comics received a material expert validation score of 98.33%, a media expert validation score of 90.33%, a language expert validation score of 80%, and an IT expert validation score of 80%. The product is appropriate for physics learning based on the validation score. However, because the product developed was limited to KI-3, more research is needed to develop the comic to contain KI-4 (skills).

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INTRODUCTION

Globalization has accelerated technological and information advancement. Thus, character values are required to ensure that technology is used wisely. Character education for students is critical (Aningsih et al., 2022; Cinantia et al., 2019; Fransyaigu et al., 2021; Husen et al., 2022; Pala, 2011). Character values can be taught in school (Hidayat & Rozak, 2022; Ismail et al., 2016; Lee & Chung, 2017; Syapal et al., 2022). One method for instilling character values in students is to deliver them during classroom instruction. Integrating learning materials with character values can be used to deliver the message (Dewi et al., 2020; Hilyana & Hakim, 2018; Kamus et al., 2019) so that the presented material becomes more meaningful and contains moral messages (Fransyaigu et al., 2021). Learning media can deliver character values (Saregar et al., 2019). However, there hasn't been much progress in developing learning media incorporating character values.

Comics are an appropriate learning media developed to convey character values (Rina et al., 2020; Solihatin et al., 2020; Swandi et al., 2015). Comics are an excellent medium for conveying character education to students, particularly those aged 12-14 (Fitrianingsih et al., 2019). According to previous research, comic development was aimed at junior high school students on human respiratory system material (Syarofa et al., 2022), mathematics (Azizi & Fauzan, 2020; Johar et al., 2023), arithmetic (Savitri & Qohar, 2022), and work and energy (Badeo & Koc, 2021). The features of comics that present stories as interesting images are appropriate for the psychology of students aged 12-14.

Comic books can be printed or digital. Digital comics can take the form of apps accessed via Android devices. Compared to printed comics, digital comics are very flexible and installed on

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smartphones, making them easy to carry anywhere. The novelty of this digital comic form is a form of digitization in the 21st-century learning process that has also been studied (Ardimas et al., 2021; Lindasari & Farida, 2021). Digital comics for learning have previously been developed (Mustikasari et al., 2020; Nikmah et al., 2019; Priyadi et al., 2020).

Previous studies on comic development have included the creation of local wisdom-based comics (Ntobuo et al., 2018; Sari et al., 2020), biotechnology comics (Utomo et al., 2020), and PBL-based comics (Fatimah & Widiyatmoko, 2014). There has even been the development of comics with character values, such as Trantri Kamandaka comics (Swandi et al., 2020), social study comics (Solihatin et al., 2020), and physics comics (Yulianti et al., 2016). However, the delivery of character values in these comics is limited to the storyline explanation. No researcher has explained the character values based on the learning material integration. The difference in this study is due to the inclusion of character values in the learning material. As a result, this research aimed to determine the feasibility of the developed character education-based physics digital comics.

METHODS

The R&D method and the Borg and Gall model were employed in this development research (Sugiyono, 2015). This research, however, was limited to the validation test stage since this stage has addressed the purpose of this research, namely determining the feasibility of the developed product. Figure 1 depicts the various stages of this research.

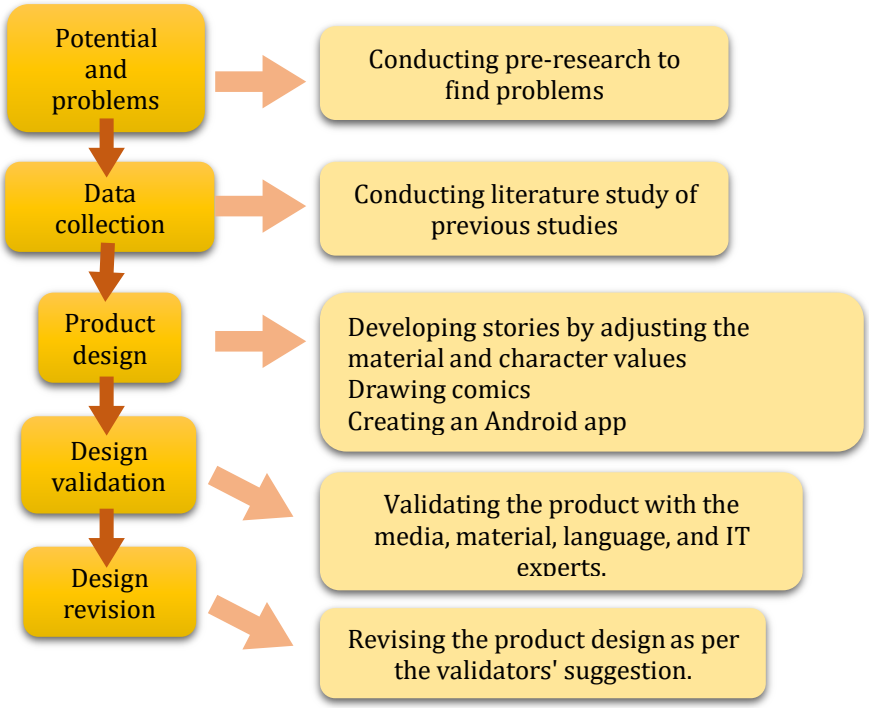


Figure 1. Research Procedure

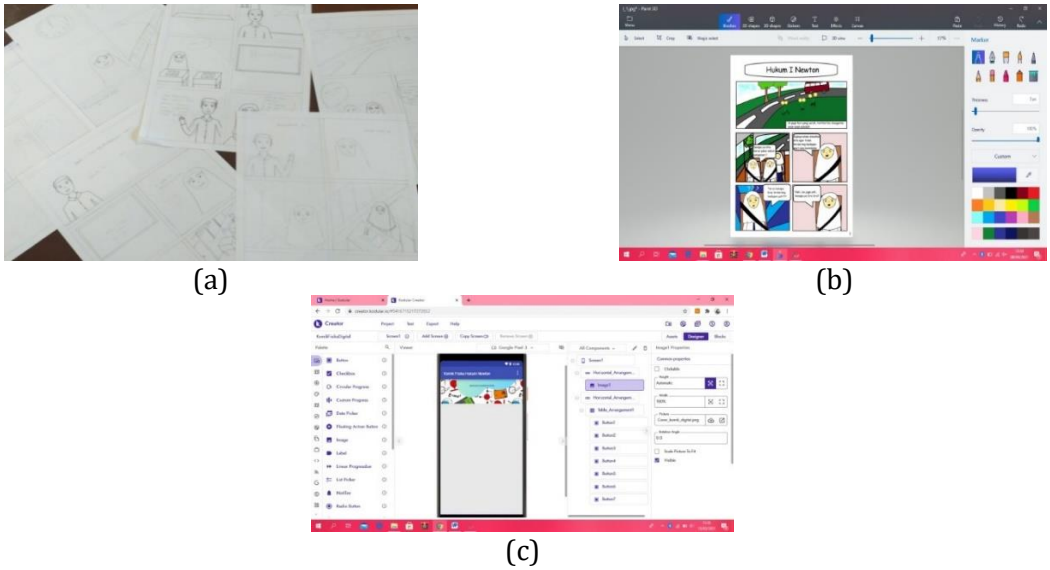
According to Figure 1, the research stage began with potential problems. This process began with pre-research to identify issues with physics learning and analyze student needs. The participants in this research were 12–14-year-old junior high school students. They were given a needs analysis questionnaire to determine the existing problems. A literature review on character education-based comic development research was conducted during the data collection stage. The product design stage was used to create comic products that incorporate character values by compiling stories, drawing comics, and assembling comic applications. The design validation stage was completed by two material expert validators, two media expert validators, one language expert validator, and one information technology expert validator. A validation questionnaire was used to validate the product. The descriptive data analysis technique was employed. The final stage was to improve the design based on the validators' suggestions.

RESULTS AND DISCUSSION

The research began with a needs assessment. The findings of this research need assessment were previously published (Fitri et al., 2021). The qualitative descriptive method was used to analyze students' needs regarding character education-based comic media. The needs analysis revealed that 74.24% of the 66 students had difficulty learning physics, despite the teacher's use of learning media. 75.75% of students have never used comic books as a form of learning media. Students require digital comics as learning media. Most students use smartphones, which can access learning media in the form of applications. Furthermore, the findings of this research show that no learning media are used to integrate character values. Thus, it requires comic book media with character values.

The next stage was data collection. To collect concrete data, a literature study was conducted. Journal articles served as sources of information. Based on the literature review, digital comics with character values have been developed. Muliyati researched environmental-themed character values found in comic books (Muliyati et al., 2021). Rina also created comics with character values but did not explain the values conveyed (Rina et al., 2020). Comic development can foster student empathy (Hanim & Djunaedi, 2019). several other research has also been conducted (Solihatin et al., 2020; Swandi et al., 2020; Yulianti et al., 2016). In general, however, the integration of character values is limited to the storyline. As a result, the material presented appears distinct from the storyline or character values.

Following the completion of a literature study, the next step was product design. Product design began with developing a storyline tailored to the material and character values. The next step was to create comic sketches. Next, the developers combined several comic pages to create a smartphone app. Figure 2 depicts the process of creating the comics.



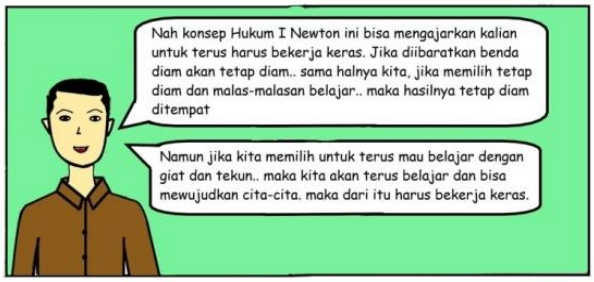
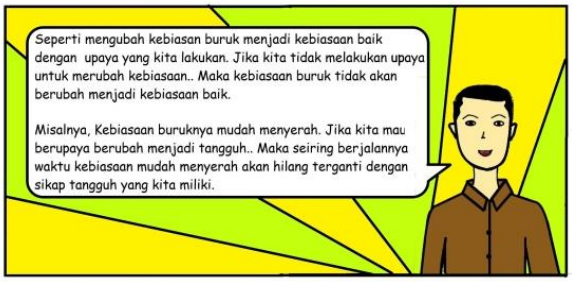
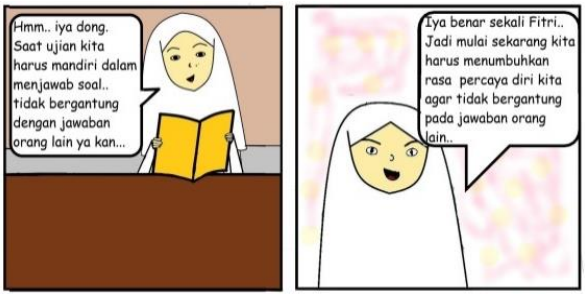
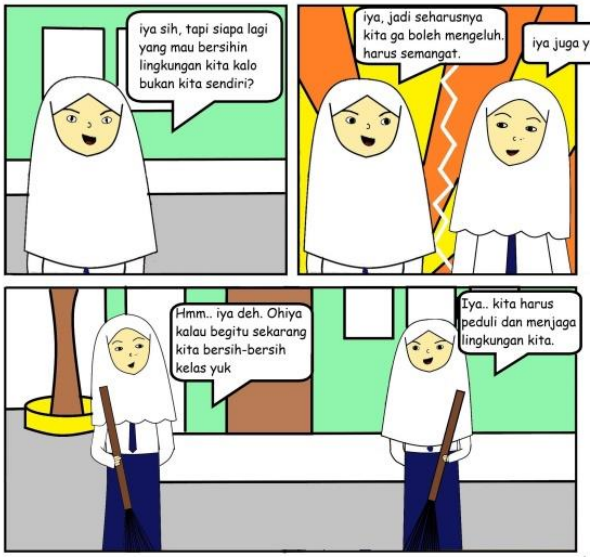
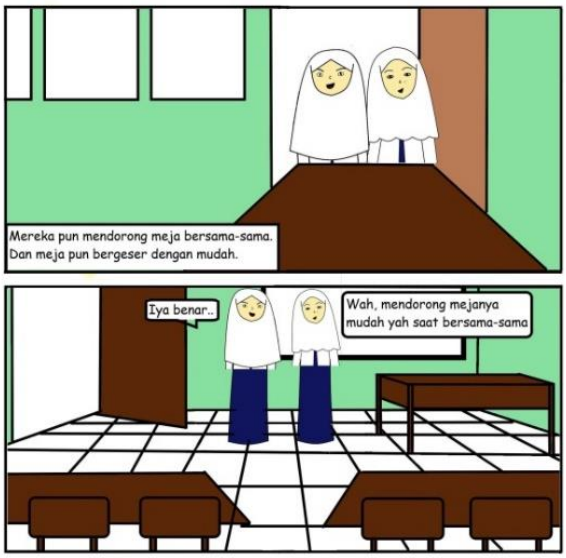
(a) (b) (c)

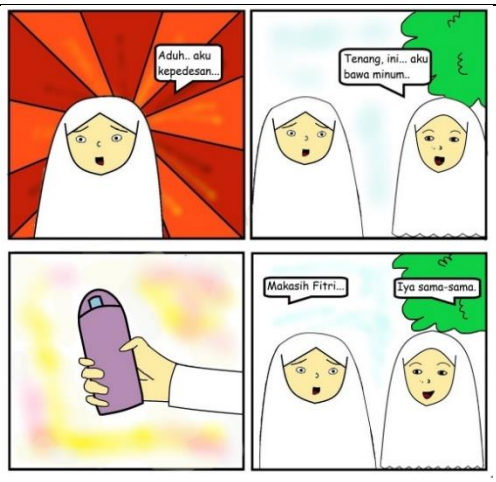
Figure 2. Comic creation (a) drawing stage on paper (b) coloring stage (c) application stage.

According to Figure 2 (a), the drawing was done manually on A4-size paper with a pencil. The drawings were adjusted to fit the story plot. Following the completion of the drawing, the paper was scanned to be used as a file in the format of the next stage, as shown in Figure 2 (b), namely the process of coloring the scanned image and providing the story text. Paint 3D software was used for this process. After coloring the comic sheet image and adding story text, the next step was to create the application shown in Figure 2 (c). The application was created using a web-based software called Kodular. Kodular allows you to create Android apps without knowing how to code. Existing coding has been simplified using command blocks. As a result, Kodular is a useful software for developing Android applications. The application process began with creating a front page, followed by the assembly of buttons in the application and arranging all comic images into pages that are presented in a vertical scroll. After the application had been assembled, the file was extracted into.apk format.

Digital comics were available for installation on Android devices. The following represents the comic's character values, as shown in Table 1.

Table 1. Storyboard Comic with Character Values

Comic snippet	Comic snippet
 Honesty	 Religiosity
 Hard work	 Perseverance
 Mutual respect	 Confidence
 Caring the environment	 Cooperation



Help each other

Table 1 displays the character values found in physics digital comics. In conversations between characters, the values of honesty, religiosity, self-confidence, environmental care, and helping are mentioned. Because not all character values are appropriate for the learning materials, these values are limited to appearing in character conversations. Character values should be customized using learning materials. Other values emerge as a result of the integration of learning materials.

Hard work and resilience emerged with the material of Newton's first law. Newton's first law states, "If the resultant force on an object is equal to zero, then an object that is initially at rest will remain at rest." Objects that are initially moving will continue to move at a constant speed. This law can be interpreted as a parable: if people choose to remain still and do not want to work hard, they will remain fixed and make no progress, and vice versa. Newton's second law states, "The acceleration of an object caused by a force is directly proportional to the magnitude of the force and inversely proportional to its mass." A character in the comic is pushing the table, but it does not work because the force pushing the table is not greater than the mass of the table. As a result, it takes cooperation to push the table so that the resulting thrust force is large and directly proportional to the table's acceleration. As a result, with cooperation, the table can be moved. Mutual respect is compared to Newton's third law, which states the law of action-reaction. If we can take action by respecting others, we will receive the same in return.

Validation was carried out by two material experts, two media experts, one language expert, and one IT expert. Material validation considered several factors, including content quality, character education, and presentation. Figure 3 depicts the results of material validation before and after revision.

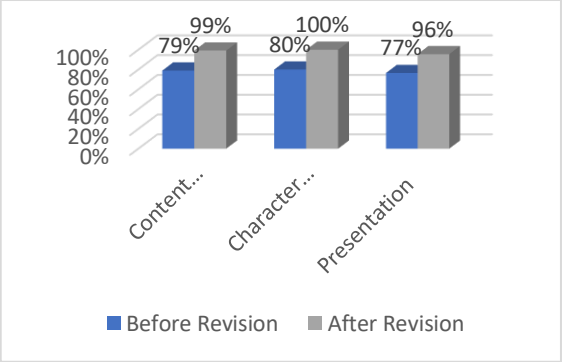


Figure 3. Material Validation before and after Revision

Based on Figure 3, there are changes after revision. The product was considered very feasible, with an overall percentage of 98.33%. Figure 4 presents the results of media validation before and after revision.

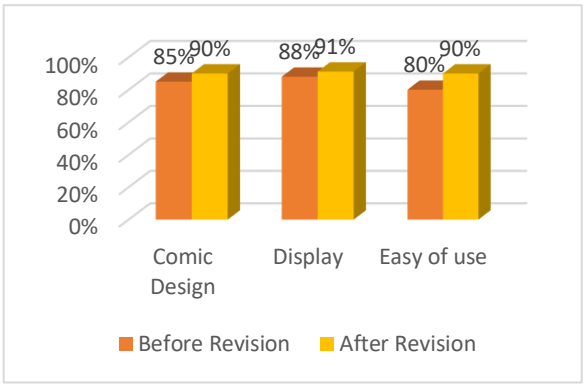


Figure 4. Media Validation before and after Revision

Based on Figure 4, there are changes after revision. The product was considered feasible with a percentage of 90.33%. Figure 5 presents the results of language validation.

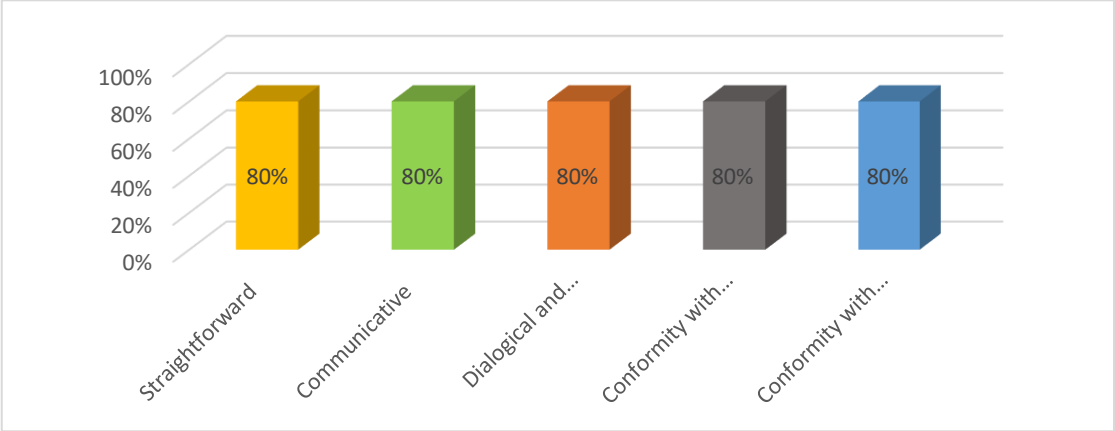


Figure 5. Language Exper Validation

Based on Figure 5, there are no revisions. The product was considered feasible with a percentage of 80%. Figure 6 presents the results of IT validation.

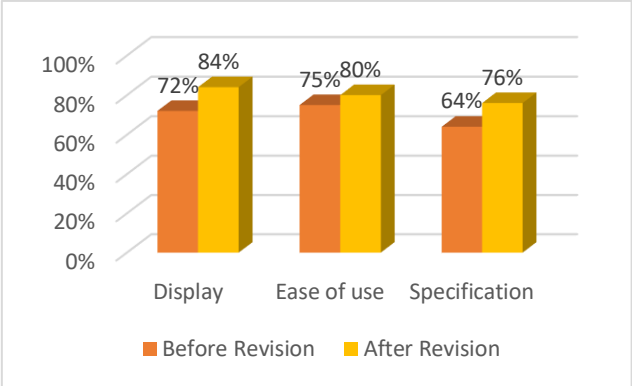


Figure 6. IT Expert Validation before and after Revision

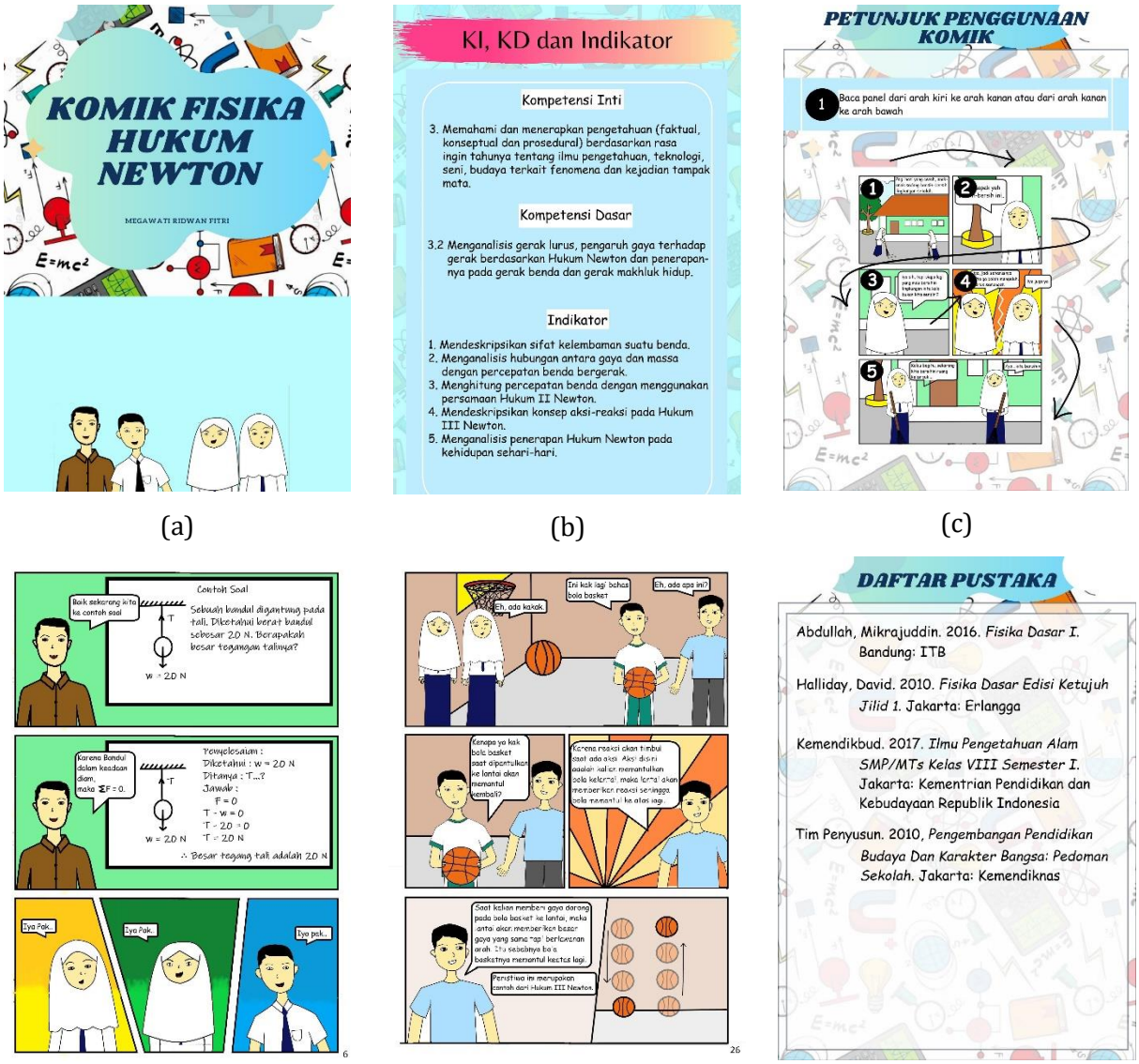
Based on Figure 6, there are changes after revision. The product was considered feasible with an overall percentage of 80%. Table 2 contains suggestions for improvement from the validators.

Table 2. Suggestions from the Validators

No	Validator	Suggestion
1	Material expert 1	Add reference list

2	Material expert 2	Add sample problems with solutions to Newton's First Law Comic characters in About and Comics must be synchronized Pay attention to font usage
3	Media expert 1	Character education as the basis of the comic has not been presented in detail. Please add real examples to the comic.
4	IT expert	Blur images on pages 2 and 8; please fix them. Add a back button at the end of each comic Enlarge the text display in the summary of Newton's Third Law.

After making improvements based on the validators' suggestions, the comics were revalidated to display the final results. As a result, digital comics had a high potential for use as physics learning media. Figure 7 depicts a snapshot of several pages of comics.



(a) (b) (c)

(d) (e) (f)

Figure 7. Digital comic display (a) initial cover (b) Core Competence (KI) and Basic Competence (KD) of Newton's Law material (c) instructions for use (d) comic display page 6 (e) comic display page 26 (f) bibliography.

Figure 7 depicts some comic perspectives. The comic's title is displayed on the cover by displaying the four main characters. In this comic, Core Competence (KI) and Basic Competence (KD) refer to KI 3, which is only concerned with cognitive knowledge. Because it is the realm of skills, KI 4 is not included in the comic. Instructions for reading comics are also provided so that readers can read them correctly. A discussion of the questions follows the material display. This digital comic also includes a bibliography. This comic application features various digital comic content components appropriate for physics education. The story presented in the comic is relatively light, making it simple for students aged 12 to 14. The story is set in a school, and the story activities depict daily life as it relates to the student's lives. To make learning more meaningful, material delivery incorporates character values.

Previous research has focused on the presentation of character values in comic books. Swandi created a comic based on the regional story Tantri Kamandaka (Swandi et al., 2020). This comic, however, does not include any educational content. Regional stories are simply used to integrate the character values to be conveyed. Similarly, Hanim and Djunaedi created comics with empathy values as a group guidance medium (Hanim & Djunaedi, 2019). There has also been comic development research on learning materials, such as development research that developed comics for social science learning materials (Solihatin et al., 2020).

Furthermore, Yulianti created comics based on physics material by incorporating character values (Yulianti et al., 2016). However, there is no explanation of how the character values appear in the comics. As a result, the novelty of the discoveries made during the development of this comic lies in the integration of character values presented in the material and storyline.

This comic development research is undeniably limited. The material presented in the comic is only described in Core Competency (KI) 3. Further development research is hoped to develop Core Competency (KI) 4. As a result, character values can be obtained from cognitive material and skill competencies. This study contributes to developing comics for physics learning by incorporating character values.

CONCLUSION

Character education-based digital comics are the result of this development research. The validation results show that this digital comic is suitable for character education-based physics learning with an excellent category. This finding is supported by the ability to properly and structuredly plan, design, implement, integrate, and validate. Storylines and methods of delivering material that incorporate character education values must be considered and adjusted. The product developed, however, is limited to explaining the material on Core Competency 3. More research is needed to develop comics by incorporating Core Competency 4. Comics are more than just cognitive knowledge; there is an application of knowledge/skills presented with the incorporation of character values.

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