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E-Comic Based on SETS: A Digital Learning Media to Improve Student's Character and Critical Thinking Skills

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Abstract

This research aims to test the feasibility and effectiveness of electronic science comic learning media based on character education and SETS in improving students' character and critical thinking skills. This research is development research oriented towards testing product effectiveness. The data collection methods employed in this study included observation, tests, and questionnaires. The research findings indicate that, 1) the feasibility of SETS-based e-comics is measured through expert assessments of media and materials with the criteria of a very viable product; 2) The average gain test results show that SETS-based science electronic comic media is effective in improving students' character moderately by 5,04 and students' critical thinking abilities with a score of 4,03 are included in the medium category. This can be interpreted as saying that the use of SETS-based science e-comics is able to improve student behavior and influence students to be more enthusiastic and broad-minded to actively ask scientific questions.

Keywords: *Critical Thinking, Motivation, E-Comic, SETS, Character*

INTRODUCTION

The issue of the reduced students' character is now in the public spotlight. Conflicts in the country are a lot happen today, such as student unrest, wars between tribes or villages, disputes over racial intolerance, pride in products from foreign countries, rubbish scattered in places, increasingly lazy students who are lazy in school, very closely related to the character of the student's personal.

Character is a unique attribute, a quality that sets individuals apart, embodying moral fortitude and the behavioral patterns observed in an individual or a collective group. (Tanujaya, 2016). A character that is defined as inner human nature, moral beliefs, intentions, and predispositions which influences all thought and behaviour; a character so that it can be interpreted in general that the character is related to moral strength, has a positive connotation (McGrath, 2015; Sosik & Cameron, 2010; Staub, 2013). People with character are people who have certain moral qualities who are positive mind (Valente et al., 2023; Cejudo, J., & López- Delgado, 2017; Faiz & Purwati, 2022; Assalihee, M., & Boonsuk, 2023).

The alternative that has been put forward to overcome the problem of character faded is through education (Murray et.al., 2019; Saidek & Islami, 2016; Santoso, 2016). Education is considered as a preventive alternative because education builds a better young generation. Character building education implicitly means building behavioural traits based on or relating to a particular moral dimension. Education is crucial as it forms the foundation for human development. Without proper education, progress becomes difficult and may even stagnate. (Ari, 2023; Ari, A. & Stöckli, 2021; Quftan et al., 2023; Al- Mahasneh, 2018; Birgili, 2015). Education should be aimed at producing individuals who are competent and capable of competing in addition to possessing noble character and ethical values (Fauz, 2016; Suarda et.al., 2018).

Science is the unity of the scientific body of nature. Science is a product of observation or observation, general understanding, rational thinking and sometimes an extraordinary view (Hewitt et.al., 2013). Learning natural sciences involves systematically exploring nature to understand it. Thus, science education goes beyond simply

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acquiring factual knowledge, concepts, or principles; it is a process of discovery that fosters the development of students' faith and character (DeBoer, 2019; Hewitt et al., 2013).

Character education is fundamental in the field of science because one of the core aspects of science is the cultivation of scientific values or attitudes, which are essentially components of character itself (Berkowitz & Bier, 2017; Chowdhury, 2018; Isdaryanti et al., 2018; Park & Park, 2016). The assessment of character education must also be carried out comprehensively and holistically with the realm of assessment, including thoughts, feelings, and habits of daily behaviour (Isdaryanti et al., 2018; Park & Park, 2016).

Another problem in the world of education apart from character is that students' critical thinking skills have not been maximized. One of the basic thinking skills that is really needed by students in the 4.0 era is critical thinking skills. Critical thinking skills are very important provisions that students in the 4.0 era must have in order to be able to face the challenges of a more complex and free market future (Stehle & Peters-Burton, 2019). The results of a critical thinking skills survey conducted by researchers via Google Form on 300 students in Indonesia randomly from several schools on the islands of Sumatra, Java, Lombok, Flores and Maluku obtained an average result of 57.30 with scores ranging from 20-85 in scale 0-100. The survey results showed that 69% of students scored below 60. These findings suggest that there is a need for improvement in students' level of critical thinking skills.

The problem of character and critical thinking skills which are still lacking is reinforced by the condition of science learning media in the field which is still not attractive and not yet electronic- based. The media used by teachers still does not attract students' interest. Presently, the teaching and learning paradigm has transitioned from a teacher-centered approach to a student-centered approach (Irwanto et al., 2018). Existing science learning tends to emphasize the development of cognitive abilities and is not yet oriented towards character education. One of the innovations carried out was developing a science comic learning media based on SETS approach (Science, Environment, Technology, and Society) with characters building of students (Sani et al., 2022; Koutnikova, 2017; Yevira, 2023; Aisyah, R. S. S., Langitasari, I., & Sadiyah, 2021; Asrial et al., 2019).

In this field, the reality is that students easily lose interest and motivation to learn about the environment due to a lack of character education regarding natural surroundings. Consequently, the literacy process struggles to function optimally, leading to difficulties in grasping essential concepts and a diminishing sense of curiosity. To address this issue, science comics have emerged as engaging educational tools for junior high school students. These comics have shown promising results in enhancing critical thinking skills, comprehension, and overall interest in learning. However, there is a gap in the market for digitally integrated science comics that specifically target students' affective aspects. Therefore, researchers are endeavoring to develop SETS-based electronic science comics, aiming to enhance students' character development and critical thinking skills through captivating and innovative learning materials.

LITERATURE REVIEW

Comics are a form of visual communication media used to convey information in a comprehensible manner, as they combine images and text within a single storyline, resulting in an aesthetic experience (Farinella, 2018; Koutníková, 2017; Waluyanto, 2006). Due to their ability to present captivating ideas, comic books have been found to enhance student learning outcomes and increase motivation and engagement levels during the learning process (Enawati & Sari, 2010). Moreover, (Puspitorini et al., 2014; Shurkin, 2015; Spiegel et al., 2013) have asserted that comic media can improve both the cognitive and affective learning outcomes of students, particularly in science subjects. The function of comics in conveying ideas lies in their capacity to convey a significant amount of information through imagery, thereby serving as a powerful tool to stimulate creative thinking among students and potentially making scientific subjects more accessible (Farinella, 2018; Friesen et al., 2018; Koutníková, 2017; Purwanto, 2013).

Zuchdi (2012) states that the assessment of character education must also be carried out comprehensively or holistically with the realm of assessment covering thoughts, feelings, and habits of daily behavior (habit). Assessment of the development of thought can be done using the moral dilemma. The development of feelings

can be assessed with various forms of attitude scales or interviews. The actualization of values in daily behavior so that they become habits can be done through observation in the educational process.

Stevenson (2006) defines responsibility as being accountable for one's words, actions, or commitments. According to Sabini & Silver (1998), responsibility plays a role in regulating one's emotions and reactions in various situations, whether experiencing anger or sadness. Meanwhile, Samani & Hariyanto (2012) describe responsibility as an individual's attitude and conduct in fulfilling their duties and obligations, encompassing obligations to oneself, society, the environment (including nature, society, and culture), the state, and the divine.

According to Stevenson (2006), care encompasses a sense of interest or fondness towards someone or something. Naim (2012) elaborates that human character involves having a sense of responsibility towards the environment, encompassing both the physical and social aspects. The act of caring for the environment ideally begins with self-care, as individuals who prioritize environmental concerns should also extend that care to their personal lives. This entails maintaining personal hygiene, keeping surroundings tidy, and ensuring cleanliness in both personal and living environments. Additionally, Naim (2012) emphasizes that caring for others should be selfless, meaning it should be done without expecting anything in return. True caring, therefore, is characterized by unconditional giving and support.

According to Aman (2009) the spirit of nationalism in a national state is imbued with five principles of nationalism, namely 1) the unity of the government system, the economic system, the defense system and the cultural system; 2) freedom (liberty, freedom, independent) in religion, speech and opinion; 3) equality in legal standing, rights and obligations; 4) personality (personality) and identity (identity) has a sense of self-confidence, pride and love for the country; and 5) achievement, namely the desire to realize prosperity. Sutarjo (2009) stated that all countries and nations need nationalism as an integrative factor. Nationalism is one of the glue tools for social cohesion to maintain the existence of the state and nation. There are several ways to instill a sense of nationalism in students, and education is one of them.. In line with what was stated by Tilaar (2007) that there are several factors in an effort to grow nationalism, including language, culture, and education.

METHOD

Types of Research

The type of used in this research research is development research oriented to developing and testing the effectiveness of products in achieving goals. This research refers to the development model developed by (Gall et al., 1996), which consists of three stages: preliminary study (planning), product design development, and product validation and revision.

Place and time of research

This research was carried out from February to December and was carried out at a private junior high school in Yogyakarta, Indonesia.

Research Subject

The participants of this study comprised seventh-grade students from a private junior high school in Yogyakarta. The reason for selecting the schools was random and those with many problems related to student character were chosen.

Research Procedure

This research is development research (R & D) which refers to (Gall et al., 1996). The orientation of this research and development is science comics learning media based on SETS approach with character building of students. The development procedures carried out in this study include seven stages, as shown in Figure 1.

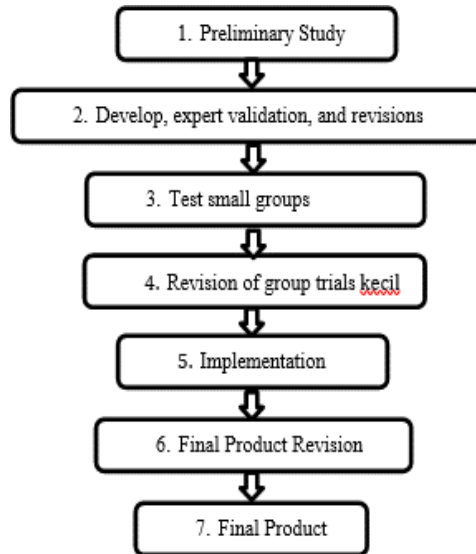


Figure 1 Stages of Research

Data Collection Instrument

The instrument used as a data collection tool for feasibility, practicality and effectiveness of product research and development in this study is an expert validation sheet, product assessment questionnaire, character observation sheet, and student character questionnaire.

Data Analysis Technique

Data analysis of the quality variables of science comic is descriptive analysis. The data analysis technique is carried out by the following steps: 1) summarize all data obtained from expert validators and practitioners from the assessment items available in the assessment instrument; 2) calculating the total score obtained from the number of scores of experts and practitioners and peers is then analysed by converting the values. This accumulated value represents the total value of each assessment component. 3) the results of the percentage obtained are then transferred into value form and converted in the form of an assessment guide table as in Table 1.

Table 1 Formatting sections, subsections and subsubsections.

No	Percentage of Score	Conversion Value	Category
1	$81\% \leq x \leq 100\%$	A	Very decent
2	$61\% \leq x \leq 80\%$	B	Decent
3	$41\% \leq x \leq 60\%$	C	Decent enough
4	$21\% \leq x \leq 40\%$	D	Inadequate
5	$0\% \leq x \leq 20\%$	E	Very less

While the analysis of the observation sheet and character questionnaire of students use the gain score (Shabrina & Kuswanto, 2018). Compared with the gain score criteria presented in Table 2 according to the paragraph above, the steps are as follows (R. R.Hake, 1999).

Table 2 Normalized Gain Score Criteria

No	Normalized Gain Score Criteria	Category
1	$g \geq 7$	Height
2	$7 > g \geq 3$	Medium
3	$g < 3$	Low

FINDINGS AND DISCUSSION

Based on the assessment of media experts, material experts, educators/ teachers, and students showed that the comics developed were very suitable for use both in terms of material and media. Furthermore, based on the experts' input, revisions were made to the science comics products to be used in learning. comics are suitable for teaching material that is difficult to observe directly and can be used to improve students' understanding (Winarto et.al., 2018). Science comics are also very good for increasing learning motivation (Kurniawati, Wahyuni, & Putra, 2017; Widyawati & Prodjosantoso, 2015) and students' interest in learning (Widyawati & Wijayanti, 2019). The percentage of comic feasibility in material aspects is presented in Table 3.

Table 3 Percentage of Material Aspect

No	Aspect	Percentages	Feasibility
1	Material content	92%	Very decent
2	SETS and character integration	93%	Very decent
3	Language	93%	Very decent

The percentage of comic feasibility in the media aspect is presented in Table 4.

Table 4 Percentage of Media Aspect

No	Aspect	Percentage	feasibility
1	Science comics structure and anatomy	86 %	very decent
2	Quality of layout and pictures	91%	very decent
3	Quality of story lines	92%	very decent
4	Overall look design	91%	very decent

The small trial phase was carried out after the science comics were revised based on the assessment and input from media experts, material experts and education practitioners. The trial was conducted on 8 students of grade VII with a questionnaire instrument for students' responses to the media and the developed science comic material with SETS approach. Based on data acquisition on the small trial results, a second revision was carried out on the science comics. Inputs and suggestion from some students among them include printed text that is less clear and needs to increase the attraction on the cover and introduction section.

The results of the second revision were used for field testing of 30 students of class VII. Furthermore, the data obtained was analysed and revised or refined the comic products for producing the final product. The final product in the form of science comic teaching materials based on SETS approach with the theme of the Land of Heaven in the material of earth structure and dynamics in class VII, comics developed by carrying out character education to build a sense of nationalism among students.

School as a place to build character, morals, and a sense of nationalism in students so that students must be able to balance between science and technology to strengthen students' social roles as members of society (Munardji, Kholis, & Mufidah, 2020; Chouari, 2016; Leite et al., 2019; Nauzeer & Jaunky, 2019; Ambele & Boonsuk, 2018; Temiz, 2016). This requires the SETS approach to be applied in learning so that the science and technology produced will be in accordance with moral axiology (Widyawati & Listiyani, 2018) so that it is beneficial for the community with the least risk (Pedretti, 2003). Comics can prompt students to consider scientific concepts from various angles. These tools have the capacity to present scientific topics visually and in an entertaining manner, leveraging the visual appeal of images. Consequently, learning science becomes more captivating, shifting away from mere memorization of subjects solely for exam success.

The product of this development research is a science comic based on SETS plus national building which consists of 6 episodes with each episode printed in 1 book/comic, so that it consists of 6 comics. The science comics based on the SETS approach that were developed have the following characteristics: 1) the main title of the comic is Tanah Heaven as shown in Figure 2; 2) developing six comic sets which are divided into six subtitles, one of which is shown in Figure 2; 3) Earth's material structure and dynamics related to SETS (science, environment, technology, and society) as shown in Figure 3; 4) comic content leading to cultural introduction and character cultivation can be seen in Figure 4; and 5) student activities in LKS lead to higher order thinking skills as shown in Figure 5.



Figure 2 Cover of science comic

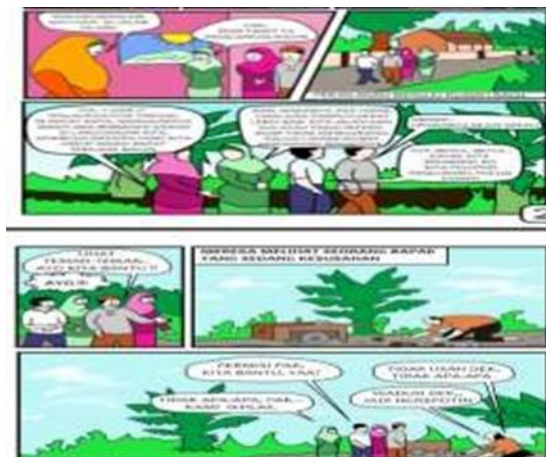


Figure 3 Aspects of SETS in comics



Figure 4 Elements of national culture in comics

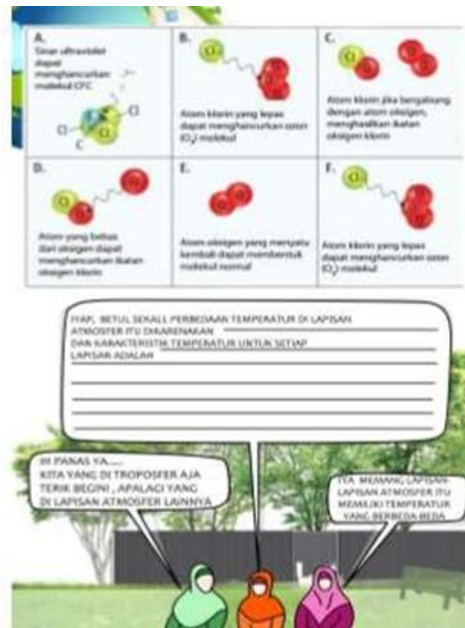


Figure 5 Comic activities that invite higher order thinking

Student character reinforcement is included in every comic series. The comic tells about how students care about the environment and social care, students are responsible for each task or in making decisions. The focus of the character developed in this research is on the components of caring, a sense of responsibility, and nationalism. Character education is moral education for students (Amri et al., 2020; Novianti, 2017; Tutkun, Görgüt, Erdemir, 2017; Ülger, Yigittir, Ercan, 2014). The results of research (Alim et.al., 2020; Berliani & Sudrajat, 2018; Sutarman et.al., 2017) show the influence of the role of pesantren as an effort to improve character education towards nation's generation. Strengthening character as Pancasila students with one of their characters, namely nationalism (Agussalim et al., 2021) is urgently needed to be integrated into learning in the 4.0 era (Sudjimat et al., 2020) to produce strong graduates. The results of research from (Hsieh & Hsieh, 2019; Maisyaroh, 2017; Supriyadi, 2018) state the importance of improving the character of students who can through learning outside the classroom.

The value of environmental stewardship should be instilled in students starting from elementary school as a cornerstone of moral development, aiming to foster individuals with an ecological mindset, who are environmentally conscious, and exhibit reverence towards nature. (Nusantari et al., 2020; Hidayati, Waluyo, & Winarni, 2020; Anggraini & Tuti, 2017; Saidek & Islami, 2016; Rambe, Setiawan, & Yus, 2018; Lewis & Ponzio, 2016). To serve as a reference point for values education, it is essential for a lecturer to establish an environment that is conducive to nurturing students' character development. Strengthening character is one solution to protect students from rapidly advancing technology so that everyone including teachers is asked to be able to use new technology effectively in facing the future (Nainggolana et al., 2020).

The effectiveness of the use of comics to improve the character of students when viewed from the gain score indicates that the characteristics of the score gain of the score is 5,04 and enter the medium category. While the gain score of the characteristics of concern score of the gain score is 4,01 and is in the medium category. It is the same result of the research (Buchori & Setyawati, 2015) which states that comics media can improve students' character (high category)

(Listianingsih et al., 2021; Akcanca, 2020; Krisnan & Othman, 2016; Kurniawati, Wahyuni, & Putra, 2017; Lestari, Ahmadi, & Rochmad, 2021).

The research results show that SETS-based electronic science comics are able to improve students' critical thinking skills with a gain figure of 4,03 which is included in the medium category. These results show that students are motivated to learn science so they have a great sense of curiosity to ask questions and investigate

and look for solutions and learn various things they don't know yet. The findings of this study align with the research conducted by Setyowati et al. (2023), which suggests that comics are efficacious in enhancing students' critical thinking abilities. (Azmy, et al. 2020; Damayanti & Kuswanto, 2020; Dini, et al. 2023; Putri, et al. 2018; Rahayu & Kuswanto, 2021; Shabrina & Kuswanto, 2018).

CONCLUSION

Based on the analysis and discussion findings, it can be concluded that: 1) the science comics learning media based on SETS approach plus nation building deserve to be used; and 2) e-comics based on SETS effective to improve the character of students with a gain score of 5,04 and critical thinking skills with a gain score of 4,03 (medium category).

CONFLICT OF INTEREST

The authors wish to emphasize that there are no conflicts of interest in this study. Participants' personal information was safeguarded throughout the research process. They were informed that participation was voluntary, and they had the option to withdraw from the study at any time.

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