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Manga versus webtoon: Alternative science learning module based on Dr Stone

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Abstract: Reading activities for junior high school students in Indonesia are carried out at school when the instructor requests that they study the learning topic being taught. Therefore, learners may become bored due to the thickness of the available books. Indonesian students are more likely to read when they encounter visualizations in images, and a small amount of text, commonly referred to as comics. Students like reading numerous popular comics, such as manga and webtoons, but it is exceptionally uncommon to discover a popular comic that teaches the subject of a specific discipline, particularly natural sciences, which has a challenging scientific picture. This study aims to examine the many forms of manga comics and webtoons that may be utilized as alternative student learning modules when students study from home without regard for space or time constraints during the covid-19 epidemic. The descriptive qualitative research approach was applied. Manga comics, particularly Dr Stone's manga, were more accepTable for use as alternative scientific learning modules in junior high schools in terms of completeness of module parts and learning contexts. Comic Dr Stone can boost learners' cognitive and psychomotor skills by vividly seeing daily situations. This research is intended to be expanded by further researchers to give more alternative module alternatives for students and aid teachers in educating Indonesian learners.
Keywords: Manga, Webtoon, Dr Stone, Module

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INTRODUCTION

Learning is a constant action that individuals engage in daily (Sudrajat, 2020). Learning is an activity that allows people to develop themselves, enhance their quality and ability, and obtain information in order to live their life (Wahyulestari, 2018). Reading is one of the numerous aspects that contribute to learning achievement during the learning process (Kurniawan, 2017). Reading is a fundamental skill in education. Reading is acquiring new knowledge about oneself, in which ideas/ideas/information are obtained and created from the items we read (Shim et al., 2020). A country's reading culture is a barometer of its growth and civilization. Reading expands the boundaries of one's thinking, broadens one's knowledge, and improves one's thinking process. Reading not only expands one's knowledge but may also enhance and deepen memory in comprehending what one has learned at school and in the community (Ningsih et al., 2021). Reading activities for kids can be done not only during the learning process at school but also at the library, at home, or anyplace else during the students' leisure time. Students may learn a lot by reading, with or without adult supervision, and with age-appropriate reading themes.

Reading interest greatly influences the execution of reading activities (Steiger & Steiger, 2008). Reading interest is a powerful motivator in the fulfilment of the reading process. High curiosity attracts students to develop their reading abilities and the learning process to obtain information (Van de Velde et al., 2021). As a result, if reading interest is poor, it will have a detrimental influence on one's capacity to learn, grow, and improve one's self-performance (Shim et al., 2020). According to the 2018 Program for International Student Assessment (PISA) survey findings, Indonesia was placed 74th out of 79 participating nations in the categories of reading ability, mathematics, and science (PISA, 2018). This

demonstrates that Indonesia's reading ability remains in the bottom range. According to PISA (2018), 30% of Indonesian students, or an average of 77%, have level 2 reading ability. At this level, Indonesian students can identify the main concept in a text, retrieve information using explicit criteria, and determine the purpose and structure of writing when guided directly. Indonesian students perform below average in reading, maths, and science. According to the PISA 2018 results, Indonesian students scored 371 (average score of 487) in reading, 379 (average score of 489) in maths, and 396 in science (average score is 489). These results make it possible to conclude that Indonesian students have the lowest reading scores. This demonstrates that Indonesian students have a low level of interest in reading. Students who are uninterested in reading will be hesitant to spend their free time reading; they will read only when commanded to do so; and these students are unaware of the relevance of reading activities in everyday life (Pisl et al., 2021) .

Indonesian students' lack of reading interest may be due to their unfamiliarity with reading activities, limited facilities, and low book output (Mu'ayyadah & Sahiruddin, 2020). Students' unfamiliarity with reading can be exacerbated by the monotony of book readings, which causes boredom and has a detrimental influence on technological improvements (Ferdiansyah et al., 2020). Television shows and mobile phone features that are made such appealing damage the public's experience with the content they observe. Indonesian students today choose to play with gadgets rather than read books; they prefer to watch serials and read comic books rather than books containing text (Ambarawati, 2016). Youngsters are more prone to enjoy bright things and illustrated. Therefore, Indonesian students are more interested in reading comics than textbooks (Ningsih et al., 2021). As shown in a study by Utami, Wibowo, and Susanti (2018), giving fascinating books based on what students desire, such as illustrated comic books, is a factor in improving students' interest in reading.

The shortage of reading resources contributes to the poor interest in reading. The state of books in Indonesia is underprivileged, and kids have shown little enthusiasm for reading (Ziska, 2021). In terms of quantity, the number of reading books in Indonesia has not satisfied the demands of the entire population (Mailizar et al., 2021). According to the state of school libraries in Indonesia, it is tough to find general books that increase students' knowledge, especially those that may pique kids' attention by including colours and pictures (Ferdiansyah et al., 2020). Children should be given books full of colours and pictures to entice their imagining powers. These pictures and colours may appear to slightly grasp their reading and can also sharpen children's thinking capacity (Seko & Kikuchi, 2021). According to Wahyuni (2010), youngsters like reading tale books, such as comic book stories. Children like illustrated fantasy stories in the form of books. Unfortunately, few comics teach in Indonesia, i.e. a shortage of learning resources produced in comic books (Febriansyah et al., 2020). Education in schools should be further developed into creative and inventive learning, and students should be more focused on growing their interest in reading (Trust & Whalen, 2020). Currently, not many classes require students to read and gather knowledge on their own; instead, learning is based on the lecture technique, so students merely listen without any reading exercises (Allam & Martin, 2021). Teachers' difficulties generating innovative learning modules are the driving factor behind Indonesian students' lack of reading enthusiasm (Mayseless & Shamay-Tsoory, 2015). Teachers exclusively use government textbooks or urge students to hunt out new material on the internet, which makes the learning process tedious and dull for kids (Montgomery et al., 2012).

Based on the students' enthusiasm for colourful and illustrated books, studying comics media might be a viable option for establishing an effective and engaging learning environment (Hwang et al., 2020). Since that contains visual media, this learning comic media can increase students' motivation and interest in reading. Comic media in visual/graphic form is particularly effective in enhancing learning efficiency since students grasp and assimilate content more efficiently in visual form than in text alone (Ziska, 2021). According to Sujadna (2013), visual media is a medium that may express knowledge more effectively by combining words and graphics. The majority of research that employs comics is research that creates its comic on a single material or theme that becomes a student learning difficulty so that students are only interested in a relatively short period of time because one learning material is only delivered in two to three learning meetings.

Several popular comics may be read daily without regard for space or time constraints (Seko & Kikuchi, 2021). Two forms of comics are widespread worldwide: manga and webtoons (Fatha & Mansoor, 2021; Febriansyah et al., 2020; Ziska, 2021). Many comics in the form of manga and webtoons are now popular with Indonesian students. However, no one has investigated whether these mangas and

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webtoons can be utilized as materials/media that assist learning for junior high school students, particularly in science topics. This piqued the interest of experts, who decided to study manga comics and webtoons to develop learning modules for junior high school students to help them pass the time during the corona epidemic. Because manga and webtoon comics include numerous chapters and are released every week, instructors can utilize them for one semester till the conclusion of the academic year. As a result, this study was carried out with the aim that there would be popular manga comics or webtoons that students may use as alternative modules to stimulate students to read and learn, as well as the educational consequences of reading manga and webtoons.

METHOD

Types of research

This is a descriptive qualitative study in which the researcher is the research subject, and the manga comic series, webtoon, and 2013 curriculum are the research objects. In this study, qualitative research was chosen because (1) researchers were unable to control popular comics that are published regularly, including the date of publication, the number of pages published at one time, and the number of readers who have assessed popular comics, and (2) researchers consider the popularity of comics. Comics for Indonesians to read at any time via the mobile phone layer, (3) the number of comic models published by individuals as well as specific institutions/institutions that publish them, and (4) the number of websites that offer free comic book reading in both Indonesian and Indonesian languages—a second language. This study's criteria for selected comic themes correspond to the availability of comics published on major Indonesian websites such as Mangacan, Mangaku, Komikkid, Mangakita, Komikkindo, and Webtoons official URL. Furthermore, the comics chosen to match the requirements for the evaluation are popular comics with a reader rating of 3 stars out of a maximum of 5 stars or a minimum rating of 7 out of a maximum score of 10.

This study had some limitations in that (1) the comics used as subjects have been published regularly, and at least 25 chapters have been published and published on websites (online) rather than print (printout), (2) have a language that the Indonesian people at large can understand, namely Indonesian, and (3) the number of comic chapters researched is 25. The manga and webtoon series in this study were chosen based on the high degree of comic reading in junior high school students, with 70% choosing to read comics rather than school or teacher-supplied textbooks (Hwang et al., 2020). The names of the selected manga and webtoon comic series will be examined by science content based on the 2013 Indonesian science curriculum.

Research Subject

This study identified research volunteers following the declared requirements. The research subjects included three manga comic series titles, three webtoon series, and the 2013 junior high school curriculum in natural science disciplines (IPA). Comics are chosen based on a reader's star rating of at least 3 out of 5 stars or 7 out of 10.

The subject was determined by ten science instructors whom the researchers requested to read comics on the comickindo website and webtoons for 14 days (from March 3 to 17, 2021) and to list comics essential to scientific learning in junior high schools on a google form. The science instructors who participated hailed from diverse places, including two from Surabaya, two from Sidoarjo, one from Mojokerto, one from Lamongan, one from Bojonegoro, one from Bekasi, one from Palangkaraya, and one from Kapuas in Central Kalimantan. The science instructors hold S1 Science Education degrees from several campuses and have at least four years of teaching experience in junior high schools. There is a requirement that the number of chapters in the comics analyzed in each series title start from chapter 1 to chapter 25 due to the large number of chapters in each comic series title so that the researcher determines the sample chapter used, aside from the fact that there are still several comic series titles used that is still published weekly. Table 1 shows the outcomes of suggestions from ten science professors who have been recorded and satisfy the requirements.

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Table 1. The outcomes of ten science instructors' proposals for research topics

Types	Comic title	Author	Publication Year	Star rating (0-5)	Rating number (0-10)	Link
Manga	Dr Stones (M1)	Inagaki Riichiro, Boichi	2017	3	7	https://komikindo.co/manga/dr-stone/
	Silver spoon (M2)	Arakawa Hiromu	2011	3	7	https://komikindo.co/manga/silver-spoon/
	Cell at Work (Hataraku Saibou) (M3)	Shimizu Akane	2015	4	8	https://komikindo.co/manga/hataraku-saibou-black/
webtoon	We Are Pharmacists (W1)	Qoni	2016	-	9.82	https://www.webtoons.com/id/drama/we-are-pharmacists/list?title_no=828&page=1
	Amoeba sisters: sisterhood (W2)	Not known	2019	-	9.35	https://www.webtoons.com/en/challenge/amoeba-sisters-sisterhood/list?title_no=289479&page=7
	Simple thinking about blood type (W3)	Dongsun Park	2015	-	9.61	https://www.webtoons.com/id/comedy/a-simple-thinking-about-blood-type/list?title_no=520&page=1

Description: Manga rating: comicindo.co
Webtoon rating: webtoons.com

Research instrument

After obtaining the research participants, the observation sheet was used to analyze the science material under examination. The instrument science material is based on the 2013 junior high school science courses curriculum, which includes core competencies (KI) and fundamental competencies (KD) beginning in class VII and progressing through class IX. The front and end of the comic were employed as the second observation tool. Table 2 shows the second observation instrument indication for the completeness of comedic aspects in study subjects (Chairunnisa, 2021).

Table 2. Aspects of Completeness Assessment of Comic Elements

No	comic elements	
1	The front	Cover (A1)
		Credits (A2)
		Indicia (A3)
2	Contents section	Panels (B1)
		Reading balloons/word balloons (B2)
		Narrative (B3)
		Gutter (B4)
		Splash page (B4)
		Sound effects (B5)
3	Final part	Summary of the story (C1)

Data collection and analysis techniques

In this qualitative study, the researcher used an observation approach to examine the scientific content in the study's comic books (Rahmatullah et al., 2021; Troussas et al., 2020). Observations are utilized to generate checklists, which are then used to analyze the data. The data analysis approach employed is to compare the completeness of comic components and KI/KD/concepts in the 2013

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curriculum, which can subsequently be used as an alternative to the selected comic material. Science study module for junior high school students. Five science specialists were requested to witness, and five assessed the completeness of comic components and analyzed science content in comics. The observer is a university-level scientific education instructor with 5 to 10 years of teaching experience.

RESULTS AND DISCUSSION

This study's data is separated into two parts: data based on the completeness of comedy components and data based on scientific analysis of comic content from observers who make observations.

The result of observing the completeness of comic elements

As an alternate module to boost students' understanding, the comedic aspect of the research subject resulted in extremely encouraging observation data. Students will be more passionate about reading comics with visual pictures and storylines that catch their attention and engage their thoughts than they would be about reading textbooks in the form of books given by the government (Febriansyah et al., 2020; Sopacua et al., 2020). Continuous comic pieces combine to form a coherent and inseparable whole, allowing the viewer to comprehend the complete contents of the depicted comic (Susanti et al., 2020). Popular comics are commonly adapted into anime so that, in addition to 2-dimensional representation, comic readers may now see comic material in 3 dimensions or more realistically, rather than merely envisioning it via each person's imagination (Hwang et al., 2020).

Five observers conducted in-depth examinations of three research subjects: three manga comics and three webtoon comics. Following the observations of five assigned observers, M1 and M2 comics include components of A1, A2, A3, B1, B2, B3, B4, and B5 but do not have parts of C1. M3 comics have components A1, A2, A3, B1, B2, B3, B4, B5, and C1, indicating that the elements held by M3 comics are complete in terms of assessing the comic elements in this study. Elements A1, A2, A3, B1, B2, B3, B4, B5, and C1 were seen by the five assigned observers in comics W1, W2, and W3, ensuring that every comic coming from the webtoon includes comprehensive and systematic comic elements based on features of comic element assessment. Furthermore, the scientific substance of the subject of observation is thoroughly examined in this study. The first object of observation is the Manga comic Dr Stone (M1), which was studied for its scientific content and yielded many scientific notions, which are shown in the Table below:

Table 3. The results of the analysis of science content in the comic Dr Stones (M1)

Comic Title	*Science content*	Chapter	Competency of Curriculum 2013 Science Middle School (Class)	Concept analysis
Dr Stones (M1)	Diversity of living things	2, 3, 4, 14	3.2 (VII)	Aconitum, artemisia process, Japanese mugwort, amanita muscaria, Amanita virosa, hypsizygus tessellates, oyster mushroom, grape, population, virus
	Pressure	21	3.8 (VIII)	Rocket
	Chemical reaction	7, 8, 9, 10, 14, 18	3.8 (IX)	Making nitric acid from bat droppings. Manufacture of gunpowder, Gunpowder and gun, a mixture of nitric acid and alcohol
	Food chain	3, 4	3.7 (VII)	Lion and deer, fish and man
	Measurement	7	3.1 (VII)	Sextant, latitude and longitude
	Rotation and revolution	7, 21	3.11 (VII)	Day and night, season
	Layer of earth	7	3.10 (VII)	Mountain slope
	Temperature	7, 8, 10	3.4 (VII)	Hot
	Style	8	3.3 (VIII)	Friction

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Comic Title	*Science content*	Chapter	Competency of Curriculum 2013 Science Middle School (Class)	Concept analysis
	Refraction of light	10	3.12 (VIII)	Sunlight and forget
	Wave	10	3.11 (VIII)	tv wave
	Friction	13		Friction to make fire with wood
	Energy	14	3.5 (VII)	Kinetic energy
	Pulley	16	3.3 (VIII)	free pulley
	Electricity	18	3.4 (IX)	Static electricity, electricity
	Bacteria	20		Bacteria
	Magnets	21	3.6 (IX)	Magnets, magnetic attraction with iron ore
	Chemical compounds and their properties	2, 8, 9, 10, 20, 21	3.3 (VII) and 3.8 (IX)	Nitric acid, ethanol, corrosive, alcohol, calcium carbonate, sulfur, charcoal
	Unit	2,5,8,10,13,14,16	3.1 (VII)	Seconds, years, months, days, degrees

Based on Table 3 above, it is possible that one science content that is owned can be developed and delivered in several published comic chapters from Dr Stone's 25 comic chapters that have scientific content in various science-related disciplines such as physics, chemistry, biology, geography, and mathematics, as well as the science content contained in each chapter. This repeat may improve knowledge, and in-depth scientific information study is considered required to enhance the conversation. Following that, observers examined the scientific content of Silver Spoon (M2) comics, as indicated in Table 4.

Table 4. The results of the analysis of science content in silver spoon (M2) comics

Comic Title	*Science Content*	Chapter	Competency of Curriculum 2013 Science Middle School (Class)	Concept analysis
Silver Spoon (M2)	Animal reproduction	1,2, 7, 17	3.1 (IX)	Cow reproduction, cloaca, anus, mammary glands,
	Clone	1, 3	3.6 (VII)	Cow clone, horse clone
	Chromosome	1	3.6 (VII)	Cow Chromosomes
	Unit	1, 5, 18	3.1 (VII)	Tons, Km, Hours, Kilograms
	Dye	2	3.6 (VIII)	
	Chemical compound	2	3.8 (IX)	Sodium nitrate, phosphate, methaemoglobin, metmyoglobin, nitroso-haemoglobin,
	Addictive substance	2	3.6 (VIII)	Addictive substance
	Sense of taste	2		tongue
	Diversity of living things	3, 10	3.2 (VII)	cows, pigs,
	Measurement	5, 16	3.1 (VII)	Measurement of weight, mass,
	Species	6	3.7 (VII)	Species of horse, cat, cow,
	Fermentation	10	3.10 (IX)	Cheese, yoghurt, sake
	Extract	20	3.8 (IX)	Vanilla Extract

According to Table 4, the findings of the scientific content analysis in Silver Spoon (M2) comics contain one dominating subject, biology, but are supported by other disciplines such as chemistry to enhance the notion to be conveyed. Each published chapter is also determined by the scientific material you wish to transmit to comic readers. Furthermore, the most recent Manga comic thoroughly examined was the Cell at Work (Hataraku Saibou) (M3) comic, the findings of which are shown in Table 5 below.

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Table 5. The findings of an investigation of the science content in the comic book Cell at Work (Hataraku Saibou) (M3)

Comic Title	*Science content*	Chapter	Competency of Curriculum 2013 Science Middle School (Class)	Concept analysis
Cell at Work (Hataraku Saibou) (M3)	Chemical compound	1,2,3	3.3 (VII)	Oxygen, red blood cells, cholesterol, carbon monoxide, haemoglobin, acetylcholine, carbon dioxide, nicotine, alcohol, water, acetal decide
	respiratory organs	1, 13, 15, 22,24	3.9 (VIII)	Lungs
	Cell	1,2,3, 8, 14, 19,20	3.6 (VII)	Cells, red blood cells, white blood cells, Sertoli cells, egg cells
	Hormone	1.5, 6, 8		Adrenaline, cortisol, non-adrenaline, antigen, ADH
	Bloodstream system	1,3,14	3.7 (VIII)	Heart, blood pressure, blood vessels, hemolysis, Heslin arteries, Veba blood vessels
	Oxidation reaction	1, 17, 16	3.8 (IX)	Oxidation reaction
	Bacteria	1.4	3.6 (VII)	Bacterial pneumonia
	human brain	1, 17, 21, 23	3.1 (VIII)	human brain
	Heart	2, 23, 12, 11	3.10 (VIII)	Hepatocytes, liver dysfunction, Kuffper cells
	Erection	3.4	3.10 (VIII)	Corpus cavernosum, erectile dysfunction (impotence), penis, ejaculation, gonorrhoea

The findings of the science content analysis in the Cell at Work (Hataraku Saibou) (M3) comic comprise the primary chemical disciplines in the human body, according to Table 5. The name of the phrase is given to all sorts of chemical components that exist in the human body, but specific names are transmitted without being accompanied by an explanation in ordinary language, so readers must find out the explanation for themselves so that there are no mistakes. All manga comics have been assessed in scientific content, and the science information included in webtoon comics will be analyzed next. The We Are Pharmacists (W1) webtoon comic was the first to be evaluated, and the findings of the science content analysis are displayed in Table 6.

Table 6. The results of the analysis of scientific content in the comic We Are Pharmacists (W1)

Comic Title	Science content	Chapter	Competency of Curriculum 2013 Science Middle School (Class)	Concept analysis
W1	Temperature	1	3.4 (VII)	Hot, thermometer, chills
	Measuring instrument	4,5,6	3.1 (VII)	Scales, mortar, stamper, measuring cup, Erlenmeyer, pipette, stirring rod,
	Unit	6	3.1 (VII)	Mass, Length, height
	Mixture	6.12	3.3 (VII)	Homogeneous, solution
	Chemical compound	11,12, 13	3.3 (VII)	Aminophylline, FECL3, KSCN, sulfuric acid, water, sodium carbonate, levertran, HCL, acetaminophen, thiamine HCL, sulfamerazine, trimethoprim, lactose
	MH Diversity	16	3.2 (VII)	Chameleon

According to Table 6, the scientific content of the "We Are Pharmacists" (W1) comics is less than that of the manga comics. A single-subject does not dominate the scientific content but is a mixture of two sciences, notably chemistry and biology. The We Are Pharmacists (W1) comics' predominance of

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science material does describe drugs relevant to health. Furthermore, the second webtoon comic examined was Amoeba sisters: sisterhood (W2), as shown in Table 7.

Table 7. The results of the analysis of scientific content in the comic Amoeba sisters: sisterhood (W2)

Comic Title	Science content	Chapter	Competency of Curriculum 2013 Science Middle School (Class)	Concept analysis
W2	MH Diversity	1, 2,3, 6	3.2 (VII)	Bees, flowers, bacteria, Amoeba, fungi, protists, reptiles, animals, chickens, fish, rabbits, euglena,
	Enzyme	1.13	3.10 (VII)	enzyme
	Cell	2, 6, 10, 13,19	3.6 (VII)	Plasmids, vacuoles, photosynthesis, membranes, lipids, DNA replication, DNA, chromosomes
	MH Organs	2	3.4 (IX)	Pollen, Leaf, fruit
	Microscope	9	3.1 (VII)	microscope
	Gelatin	14	3.3 (VII)	gelatin

The comic Amoeba sisters: sisterhood (W2) offers a unique tale with Amoeba as the primary character, although the science content is limited compared to manga comics. The final webtoon comic is titled A simple thought about blood type (W3, with the content analysis findings shown in Table 8.

Table 8. The scientific content analysis in the cartoon. A simple thought regarding blood type (W3)

Comic Title	Science content	Chapter	Competency of Curriculum 2013 Science Middle School (Class)	Concept analysis
W3	Blood group	1, 2, 3.5, 18,20	3.7 (VIII)	A, AB, B, O, B-
	Ecosystem	4, 8	3.7 (VII)	Population, Mountain, coast, river
	Acceleration	10	3.2 (VIII)	Speed, time, reaction, average speed
	Solar system	12	3.11 (VII)	Earth, meteors.

In contrast to other webtoon comics, a basic understanding about bloodtype (W3) cartoons features more advanced disciplines, especially physics, chemistry, and biology. Based on an examination of comic characteristics in manga and webtoon comics, it was discovered that 95% of manga M1, M2, and M3 as well as webtoon W1, W2, and W3 had aspects that classify as comic. Every comic has a beginning, middle, and end. Manga comics in M1 and M2 do not have an ending since the manga is continuously ongoing and is released every week. The website may, however, typically narrate the final part of the M1 and M2 manga, even though it does not yet exist officially.

Manga and webtoon comics must have unique covers that describe the contents of the comics. The comic cover portrays the main character in the comic, the supporting characters who play a role in the comic, the author's or artist's name, and the comic publisher (Badeo & Koc, 2021; Septaria et al., 2020). Covers of comic books can describe specific events or primary plot threads that occur in each chapter (Hwang et al., 2020). Each chapter in the comic features panels, balloons, and narration to explain the conditions on the panel, and a gutter serves as a divider between panels (Beard & Rhodes, 2002). Components in comics are the most significant aspects for describing events and allowing comic readers to envision themselves as if they were personally participating in the comic tale (Young-Min, 2019). Word balloons come in various shapes and may express the intonation of voice in each comic character so that every event can be portrayed on comic balloons, and intonation that appears to be removed from a comedy character can be depicted using word balloons (Seko & Kikuchi, 2021).

Although not all comics or webtoons available to the general public have comprehensive comic components, individuals are nevertheless passionate about reading the comics they enjoy. Comics with comprehensive components are emphasized because they have more significant benefits in teaching or

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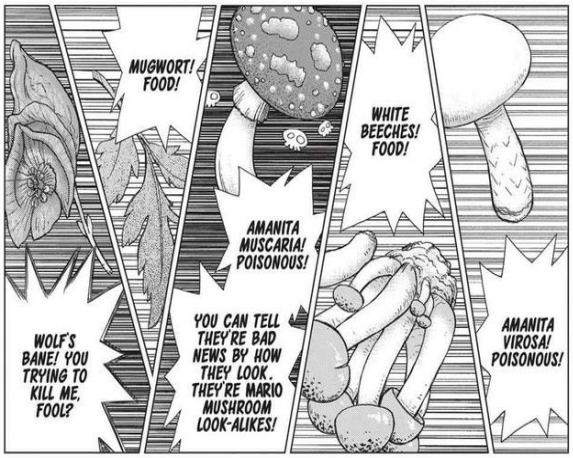
making comic readers better grasp the plot of the comics they are reading, allowing readers to remember comic information for longer (Stell et al., 2013).

The findings of the scientific content analysis

Observers' observations of science content in manga and webtoons (Table 2) comprise four components: science content, language, distinctiveness, and artwork in the science content column. Every piece of science material in manga and webtoons comprises cognitive competency, referred to as KI-3 in the 2013 curriculum for science topics ranging from class VII to class IX. Compared to manga or webtoon-type comics utilized as topics, M1 comics have more science information. The science information in M1 comics is quite precise and organized. The second chapter of Comic M1 (Figure 1a) shows the various diversity of mushrooms that may be detailed in detail, the name of the species, and the advantages of each form of mushroom to be consumed or not by the community. This accurate labeling can educate the public when confronted with the various species of mushrooms that are available, allowing people to pick mushrooms that are safe for ingestion. The M1 comic accurately depicts the methods required to generate static electricity from items in the surrounding environment in chapter 18 (Figure 1b). The techniques mentioned are highly detailed and may be performed by the general public, and the materials or instruments required are also readily available.

M1 comics contain science information covering many scientific subjects, including biology, physics, chemistry, earth, and others. The variety of scientific subjects that may be portrayed in a comic book immensely appeals to readers, bolstered by the occurrences around it (Jang & Song, 2017; Yecies et al., 2020). Readers can comprehend the plot and scientific topics presented in comics (Hwang et al., 2020). The findings of science content analysis in M2 comics primarily point to the subject of biology, which is, of course, connected to the title of the M2 comic, which has detailed events that lead to the study of biology. The bulk of M3 comics incorporates science information based on a mix of biology and chemistry by depicting processes in the human body in the form of interactions between cells that are equivalent to the physical body.



(a) Mushroom Diversity (Chapter 2)

(b) The process of the occurrence of static electricity (Chapter 18)

Figure 1. The Science Content in Comics

Because it pertains to comics about pharmaceutical titles that involve chemical interactions of various combined components, science material in W1 comics refers to the subjects of chemistry and physics. The scientific terminology in W1 comics is not too complex for ordinary people to understand, but there are specific sophisticated phrases, such as trimethoprim, that have no scientific explanation. Therefore, W1 comics are suggested for students interested in or knowledgeable about the pharmaceutical sector. Science material in W2 comics focuses on biology, with the main character represented as an amoeba. The W2 comic portrays an amoeba with a sister going through various situations, but the events that occur are meant to be a joke for the main character and his brother. Science content in W3 comics includes information on biology and physics. Even though the comic's title contains a scientific term, the content of W3 comics does not have a scientific aspect; this is because W3 content covers perception and comedy connected to blood type in people.

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The benefits of manga comics over webtoon comics include thorough clarity and regulated processes that, in addition to enhancing students' knowledge, may also increase students' psychomotor abilities when students reenact the same scenario in manga (Seko & Kikuchi, 2021). The webtoon comic contains a visualization of events that cites terminology in scientific content without any explanations or scientific manufacturing techniques. Therefore, it only adds essential information, especially C1 on Bloom's taxonomy, but it has not been able to boost high-level comprehension in students. Even if a webtoon comic has a title that includes scientific terms, the substance or topic of the comic is not always instructional concerning the scientific terms in the title (Jang & Song, 2017; Lynn, 2016). The scientific phrase is notably included in the title of the W3 Webtoon comic. However, it is just mentioned in the text without being explained (MOON et al., 2020; Shim et al., 2020).

CONCLUSION

Based on the research and debate results above, both manga comics and webtoons may be utilized as alternative modules for junior high school students. However, manga comics are preferable to webtoons in terms of science content and completeness of comic components. Because manga comics can communicate cognitive material in detail and are supported by methods that can develop students' psychomotor abilities, it is believed that students' understanding will be better / more effective utilizing manga comics than webtoon comics. This research advises conducting an in-depth investigation of the language used due to the original publisher's usage of Japanese, which was subsequently translated into Indonesian. This proposal is made because the phrases used in science differ from the language used in everyday activities in Japan, and there are many non-standard vocabularies used in Indonesian-language comics are feared to create a change in the real meaning that the author wishes to express.

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