Comic for Developing Big Data Literacy

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Abstract
Big Data is one of the sources of information needed in responding to the challenges of very fast information needs in the era of the COVID-19 Pandemic. However, communication tools are needed to build Big Data literacy in the general public and build public trust in Big Data itself. The communication tool used in this research is comics. Information about Big Data is made from comic strips posted through social media, namely Facebook and official Instagram from BPS. This study wants to see how much community involvement is with Big Data information created using comics in building Big Data literacy in the community. We found that community engagement was relatively high when Big Data literacy content was made in the form of comics. In previous studies, most research was limited to a narrow audience, such as in classrooms at schools/campuses. This research can reach a more comprehensive and diverse community as an audience because it uses social media to help disseminate Big Data comic content. In the first edition, Big Data comics on Facebook reached 17,495 accounts and 44,497 accounts on Instagram. The use of Big Data literacy comics posted through social media triggers much active discussion from the public. This research shows that comics can achieve high engagement in conveying information about Big Data on social media and trigger active discussions from the public about Big Data.

Keywords: big data; comic; dissemination; literacy; communication.

INTRODUCTION
The world has been facing the COVID-19 Pandemic for more than a year since the World Health Organization (WHO) declared COVID-19 a global pandemic on 11 March 2020. The COVID-19 Pandemic has boosted digitalisation adoption in all sectors around the world. The public must adapt to all the limitations of their daily activities to reduce the number of additional active cases of COVID-19—one of the most visible differences in how information is spread. People use the internet as a source of information for their consumption. Unfortunately, not all information on the internet is accurate. The condition of the post-truth society has made fake news about COVID-19 spread so fast. This has created chaos in the community in handling COVID-19.

The community needs a compass to guide information on social and economic changes during the COVID-19 Pandemic. The need for data that can be presented quickly and accurately is getting more significant to combat hoaxes and misinformation in the community. To answer these challenges comes Big Data. (Laney, 2001) describes Big Data into 3 V dimensions: Volume, Velocity, and Variety. The volume describes the size of data, velocity describes the speed of incoming and outgoing data, and variety refers to the sources and types of data. Big Data answers the challenges of society's need for fast, large, and varied information. All aspects of life are now transformed into quantifiable data (Naimi & Westreich, 2014).

The development and application of Big Data have been carried out by United Nations (UN). The UN Global Working Group (GWG) provides strategic vision, direction, and coordination of a global programme on Big Data for official statistics. Some National Statistical Office (NSO) in the world, such as the Australian Bureau of Statistics (ABS), Office for National Statistics (ONS) in the UK, and Statistics Indonesia (BPS), use Big Data to support official statistics.

Statistics Indonesia published several publications that review the impact of COVID-19 on various socio-economic sectors in Indonesia. These publications include "*Big Data Overview on the Impact of Covid-19 2020*," "*Big Data Analysis amid New Habits of Adaptation*," "*Big Data Studies as Complementary to Social Statistical Data and Information*," and "*Big Data Study Signals Indonesia's Recovery from the COVID-19 Pandemic*." Statistics Indonesia is also building a Big Data dashboard so that the public can monitor socio-economic changes from a Big Data perspective in real-time.

The big challenge of Big Data today is how to build Big Data Literacy in the general public. Literacy can no longer be defined in terms of reading, writing, or numeracy, nor can it be seen as an end. The rapid changes in science and technology suggest that "people must be able to adapt continually to developments in science, technology and to the pressures of social integration, participation, and democratisation" (Unesco Institute for Education., 1997). Data literacy is characterised by a combination of numerical, statistical, and technical capacities (Gray *et al.*, 2018). Sander (2020) suggested that critical Big Data literacy in practice should mean an awareness, understanding and ability to critically reflect upon Big Data collection practices, data uses and the possible risks and implications that come with these practices, as well as the ability to implement this knowledge for a more empowered internet usage.

A communication strategy is needed to reach the wider community and build people's understanding of the importance of Big Data (Faris & Pramana, 2021). Communicating statistics is a fundamental and legitimate responsibility as part of the transparency and accountability objectives of institutions engaged in official statistics and crowd out low-quality statistics and cyclical sentiment-based policy strategies (Andersen, 2017). Communicating statistics is a mandatory obligation for NSOs regarding transparency issues or data statistics access openness. Furthermore, a standard legal education does not include rigorous statistics training or scientific evidence evaluation (Enos *et al.*, 2017).

Therefore, Big Data must be communicated well and clearly to help people understand the use of Big Data as a reliable source of information.

Various ways have been done to build Big Data literacy in the community. Big Data is a concern for various curricula in formal education and course. Implementing an interdisciplinary field in a traditional curriculum that is mainly built upon discrete educational fields such as mathematics, statistics, computer sciences, sociology, law, and philosophy challenges contemporary teaching practices (François *et al.*, 2020). However, these methods do not attract many ordinary people to understand. Ultimately, Big Data literacy is only developed in certain highly segmented groups of people.

One of the communication tools that can be used to build Big Data literacy for the wider community is comic. Visual narratives, such as comics and animations, are becoming increasingly popular as a tool for science education and communication. Combining the benefits of visualisation with powerful metaphors and character-driven narratives, comics have the potential to make scientific subjects more accessible and engaging to a broader audience (Farinella, 2018). This study focuses more on the sub-genre of science comics, which has been defined by (Tatalovic, 2009) as comics which have as one of their main aims to communicate science or to educate the reader about some non-fictional, scientific concept or theme.

Research on comics as an educational medium has been widely carried out. However, some studies are limited to audiences that are only students in the classroom, such as those conducted by Hosler & Boomer (2011) or Spiegel *et al.* (2013). Existing studies have focused on stereotypical perceptions of comics, such as their 'humorous' nature and appeal to children (partly because many studies were conducted in the classroom). This approach ignores the rich and diverse tradition of comics, which have adopted various registers and styles and successfully engaged audiences of all ages (Farinella, 2018). Yuniarti & Faris (2018) researched comics as a statistical education tool for explaining seasonal adjustments and inflation.

This research focuses on how science comics become a communication tool to build Big Data literacy in the community. The educational comics created were then posted on the official Statistics Indonesia social media, namely Facebook and Instagram fan pages, to make it easier to reach a wider audience. Martin & MacDonald (2020) mentioned that today many science communicators are using social media to share scientific information with citizens, but, as research showed, fostering conversational exchanges remains a challenge. Plowman & Wilson (2018) said that the practice of public relations increasingly includes using social media. It is only natural that the strategic communication process forms their use.

This study proposes a communication strategy for building Big Data literacy using science comics. This research will show how much public engagement can be achieved with Big Data information made in the form of comics through social media.

Research question:
How much is public engagement with the Big Data information communicated through comics on social media?

METHOD

The methodology in this study will use science comics to build Big Data literacy for the community. Farinella (2018) suggested that comics have great potential for engaging wide and diverse audiences with STEM (Science, Technology, Engineering, and Mathematics) subjects.

Storytelling and Comic

Every comic needs a good story in the process of making it as well as scientific communication. Storytelling, an effective method for scientific communication, has been used for a general audience and among scientific communication experts and practitioners (Riedlinger *et al.*, 2019). Storytelling can be used to communicate science to address various objectives: from raising awareness to critical deliberations on science (Igarashi *et al.*, 2020). This comic will combine Big Data knowledge with Indonesian people's daily conversation culture. We will show the development process of making the comic and analyse the responses from the reading public on the official social media of Statistics Indonesia.

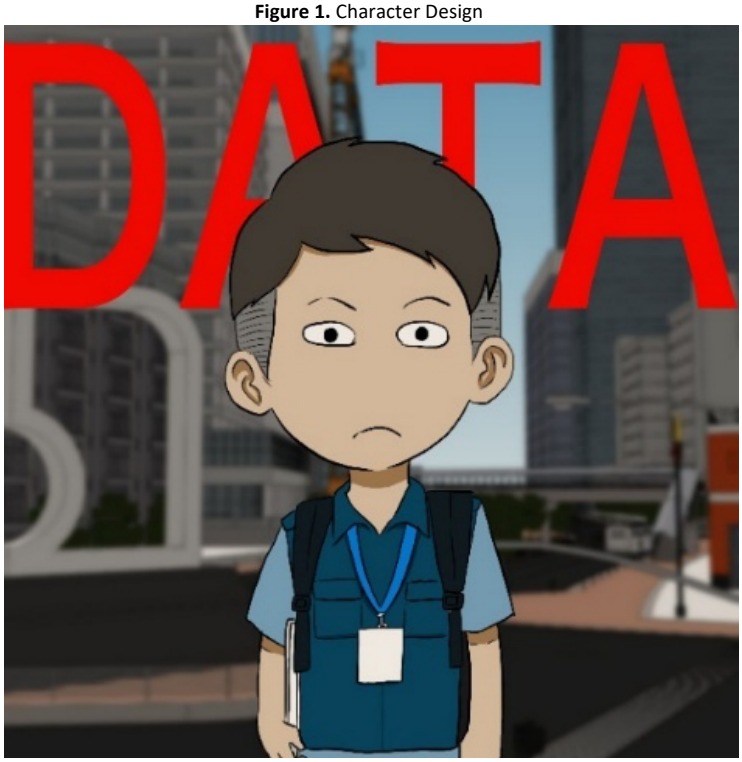
Story Script and Character

The first thing to do is create a great story concept. The Big Data comic series is designed to be a comic strip that fits social media formats. Each series will discuss different things about Big Data. Therefore, it is necessary to make a kind of syllabus at the beginning to determine what will be discussed in each series.

After determining the Big Data theme that has been discussed, it is necessary to create characters to present the story. Characters must be made as attractive as possible so that readers will like them. Characters must also provide an identity that is closely related to the data. Therefore, the characters are designed using the outfits of Indonesian census and statistical survey officers (Figure1).

The character is designed using the uniform of the 2020 population census officer. The theme chosen for the first series is "*The Presence of Big Data in the Post-Truth Society,*" and the second series is "*Definition of Big Data*." After the theme is selected, tis developed using the three-act storytelling theory: the first round is the introduction, the second round is the problem and how to solve it, and the third round is the solution (Field, 2005).

Figure 1. Character Design



Source: Indonesian Statistic Agency (2020)

There are two types of defined science communication: science outreach (typically conducted by professional scientists to non-expert audiences) and science 'inreach' (expert to expert communication from similar or different scientific backgrounds). Poliakoff & Webb (2007) mentioned that outreach is "any scientific communication that directly engages an audience outside of academia". Varner (2014) found that Personal relevance is essential for engagement, and factors that increase personal relevance depend on the knowledge, attitudes, and values of a specific public. In order to gain public attention and understanding, dialogue must be built in a colloquial style that follows the culture of Indonesian society at large so that people can relate and understand quickly. Dialogue must also be written carefully so as not to misconstrue the reader.

One writing technique in making comic strip scripts can increase general reader engagement, namely the use of humour. There are three theories of humour: the superiority theory, the incongruity theory, and the relief theory (Lintott, 2016). Superiority theory reveals that people derive pleasure from feeling when they see themselves as being superior to others (Cornett, 1986). Incongruity theory explains that humour results from unexpected or illogical connections, surprises or contradictions, i.e. incongruity (Banas *et al.*, 2011)(Cornett, 1986), and relief theory focuses more on humour and laughter, which release accumulated tension, energy, and stress (Banas *et al.*, 2011); (Lintott, 2016). Humour has often been recommended in science communication books for communicating science to the public (Baram-Tsabari Ayelet and Lewenstein, 2017).

Including positive humour in science articles may be a step in the right direction for better public engagement (Chan & Udalagama, 2021).

Comic

The second stage after making the script is making comic illustrations. The comic format is made in a comic strip format consisting of several portrait slides with a size ratio of 4:5. Conversations between characters are made to flow according to the draft that has been made. The conversation is inserted into the image of the sound balloon. The comic strip is made up of six slides. Humour can be inserted in the middle of the story or at the end of the story to become a punchline that gives a surprise effect to the readers.

Figure 2. The cover of the first edition Big Data Comic

Source: Indonesian Statistic Agency (2020

The cover of the first series of Big Data Comics appears on social media's first slide (Figure 2)ß(https://www.instagram.com/p/CRG01odj79d/);(https://www.facebook.com/permalink.php?story_fbid=2676100656015896&id=1394866840805957).

Figure 3. The cover of the second edition Big Data Comic

Cover of the second series of Big Data Comics that appears on the first slide on social media

(https://www.instagram.com/p/CRqs34RjZ_3/);(https://www.facebook.com/1394866840805957/photos/a.1394880347471273/2685646255061336/).

Figure 4. Slide 6 of Second Edition of Big Data Comic

Figure 4 is an example of a scene incorporating comedic elements into the story as a punch line. One of the characters analogises the many problems in his life with Big Data (https://www.instagram.com/p/CRqs34RjZ_3/);(https://www.facebook.com/1394866840805957/photos/a.1394880347471273/2685646255061336/).

Figure 5. Slide 5 of Second Edition of Big Data Comic

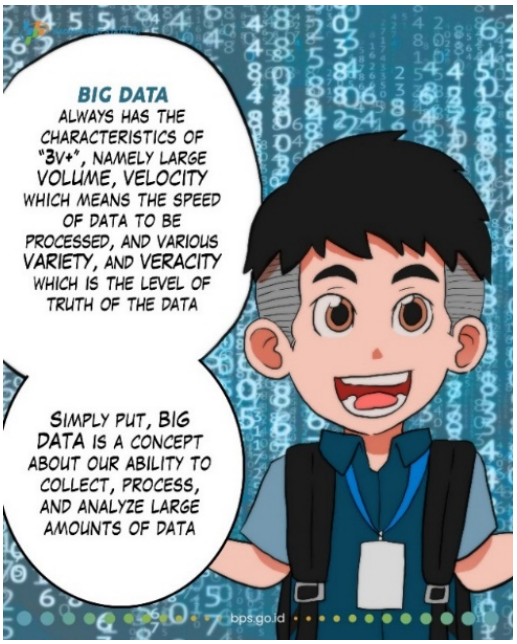


Figure 5 is an example of a scene that explains Big Data to the readers (https://www.instagram.com/p/CRqs34RjZ_3/);(https://www.facebook.com/1394866840805957/photos/a.1394880347471273/2685646255061336/).

Social Media

Social Media was chosen to be the media used in disseminating Big Data information through comics to the broader community. Based on We Are Social & Hootsuite (2021), there were 170 million social media users in Indonesia in January 2021. The number of social media users in Indonesia was 61,8% of the total population in January 2021. Social media users who continue to increase have great potential to be used as a communication tool to reach the community. Recently, both scientists and science communicators have issued numerous calls to the scientific community to engage in social media to both connect with other scientists (*in reach*) and to connect with the public (outreach) (McClain & Neeley, 2014).

Facebook

One of the most popular social media is Facebook. Witek & Grettano (2012) mentioned that Facebook and other social media significantly affect the 'how' information literate behaviours and practices. They said the most important thing learned through their research is that Facebook is a powerful contact zone for information literacy, but not always because the functionality explicitly encourages literate information practices.
Statistics Indonesia's official Facebook Fan Page has been created since 2014. On 4 August 2021, the page reached 122.740 followers. Statistics Indonesia used Facebook to promote various statistical activities and statistical publications. The public relations

department is responsible for filling out the content on the official Facebook Statistics Indonesia fan page in collaboration with the related subject matter.

Figure 6. Statistics Indonesia Official FB Fan Page

Front page of the official FB fan page of Statistics Indonesia (https://www.facebook.com/bpsstatistics).

Figure 7. Big Data Comic in Statistics Indonesia Official FB Fan Page

Big Data comic display on FB wall fan page statistics Indonesia (https://www.facebook.com/1394866840805957/photos/a.1394880347471273/2685646255061336/).

Instagram

Instagram is one of the popular social media applications that people use to upload photos and videos (Dubovik, 2013). Instagram is founded in 2010 (Bergström & Bäckman, 2013). On 9 April 2012, Facebook took over Instagram. What makes Instagram different from other social media is that Instagram applies a visual-based strategy (Hird, 2013)
Statistics Indonesia started to get to Instagram in 2017. As of 4 [A]ugust 2021, Instagram Statistics Indonesia has 207 000 followers. Same as Statistics Indonesia's official FB fan page, Statistics Indonesia used Instagram to promote statistics activity and publications.

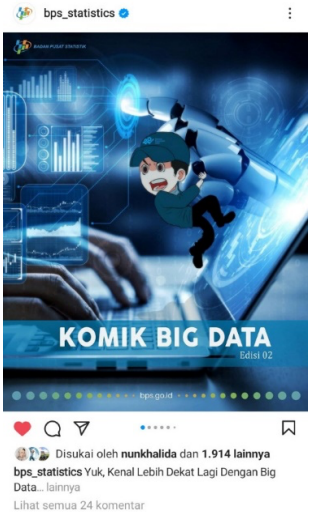
Figure 8. Statistics Indonesia Official Instagram

Front view of Statistics Indonesia Official Instagram as of 4 August 2021 (https://www.instagram.com/bps_statistics).

Figure 8 is a display from Instagram Statistics Indonesia. In appearance, Instagram is different from Facebook. Instagram looks more like a photo and video album arranged in a square shape.

Figure 9 is a Big Data comic displayed on Instagram Statistics Indonesia. Instagram users must swipe their fingers to the left to read the next slide. There are six slides in each issue of Big Data comics.

Figure 9. Big Data Comic display on Instagram Statistics Indonesia



Big Data Comic display on Instagram Statistics Indonesia (https://www.instagram.com/p/CRqs34RjZ_3/).

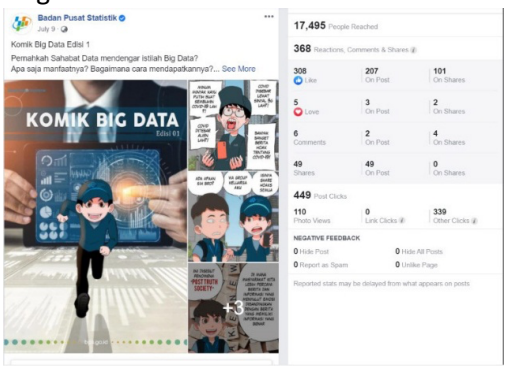
RESULTS

Facebook Fan Page

The characteristics of the audiences on the official FB BPS account are 62% male and 38% female. As much as 48.5% of the audience is in the age range of 25-34 years. 27.4% of the audience is in the age range of 18-24 years. The most significant percentage of followers is in the city of Jakarta, with a percentage of 5.2%.

The public well receives Big Data comics. Big Data comics are one of the favourite content on the official FB Fan Page of Statistics Indonesia. The first edition of Big Data comics was uploaded on 9 July 2021, while the second edition of Big Data comics was uploaded on 23 July 2021. The two-week interval allowed sufficient space between the first and second editions. Figure 10 shows the statistics from the Big Data Comic post issue 1, and Figure 11 shows the statistics from the Big Data Comic post issue 2 taken on 29 July 2021 from the FB fan page.

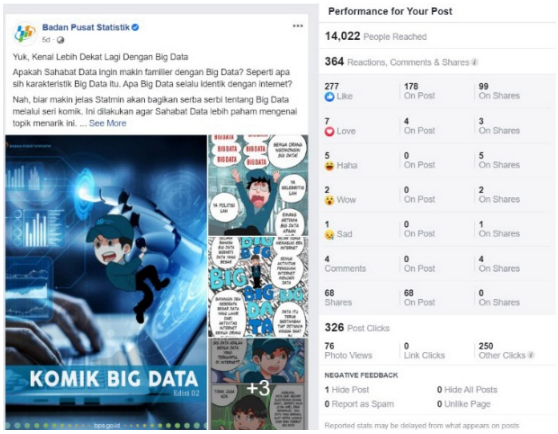
Figure 10. Statistic for Big Data Comic First Edition in Statistics Indonesia FB Fan Page



On the left side of figure 10 is the picture of 6 Big Data Comic first edition slides with captions. On the right side is the statistic for the visitor (https://www.facebook.com/permalink.php?story_fbid=2676100656015896&id=1394866840805957).

Figure 10 is the result of Statistics Indonesia FB fan page visitors from the first edition of the Big Data comic after 20 days (July 9th -29th, 2021). This post managed to reach 17,495 people. This comic managed to get 368 reactions from readers without any negative feedback. These reactions include 308 likes, 5 loves, 6 comments, and 49 shares.

Figure 11. Statistic for Big Data Comic Second Edition in Statistics Indonesia FB Fan Page



On the left side of figure 11 is the picture of 6 Big Data Comic second edition slides with captions. On the right side is the statistic for visitors (https://www.facebook.com/1394866840805957/photos/a.1394880347471273/2685646255061336/).

Figure 11 is the result of Statistics Indonesia FB fan page visitors from the second edition of the Big Data comic after 6 days (23 to 29 July 2021). This post managed to reach 14 022 people. This comic managed to get 364 reactions from readers and one negative feedback (hide post). These reactions include 277 likes, 7 love reactions, 5 'haha' reactions, 2 'wow' reactions, 1 sad reaction, 4 comments, and 68 shares.

Instagram

The characteristics of the audiences on the official IG BPS account are 60% male and 40% female. As much as 48.3% of the audience is in the age range of 25-34 years. 26.3% of the audience is in the age range of 18-24 years. The most significant percentage of followers is in the city of Jakarta, 14.2%.

Big Data comics were posted on Instagram simultaneously on the Facebook fan page, namely 9 July 2021 for the first edition and 23 July 2021 for the second edition. Figure 12

shows the statistics from the Big Data Comic post issue 1, and Figure 13 shows the statistics from the Big Data Comic post issue 2 taken on 24 July 2021 from Instagram.

Figure 12. Statistic for Big Data Comic First edition in Official Instagram of Statistics Indonesia

Figure 12 is an insight report provided by Instagram for the first issue of Big Data Comics (https://www.instagram.com/p/CRG01odj79d/).

Figure 12 is the acquisition of visitor statistics for the first Big Data series comic content on the official Statistics Indonesia Instagram account. The first Big Data series comic post on Instagram reached 44 497 Instagram accounts as of 24 July 2021. Compared to the number of visitors on the Statistics Indonesia Facebook fan page, the number of visitors more than doubled. 7% of the Instagram accounts reached were accounts that did not follow the Statistics Indonesia account. The impression hit 54 607. The first edition of Big Data Comics got 2921 likes, 57 comments, 235 shares, and 150 accounts that saved this post.

The first edition of Big Data Comics received many positive comments from regular visitors, academics, and regional BPS office accounts. In the comment section, an account username @liskamarlina said, “BPS is getting more innovative...”. There are many more comments from visitors who are happy with the innovation of educational Big Data comics. Visitors on the Instagram account of Statistics Indonesia are more active in comments than those on the Statistics Indonesia Facebook fan page.

Figure 13 is the acquisition of visitor statistics for the second Big Data series comic content on the official Statistics Indonesia Instagram account. The second Big Data comic post on Instagram reached 26 248 Instagram accounts in a day as of 24 July 2021. The number of accounts achieved is almost twice that of visitors to the 2nd edition of the

comic posted on the Facebook fan page. 7% of the Instagram accounts reached were accounts that did not follow the Statistics Indonesia account. The impression hit 32 519. The second edition of Big Data Comic got 1727 likes, 21 comments, 131 shares, and 98 accounts that saved this post just one day after it was posted.

Figure 13. Statistic for Big Data Comic Second edition in Official Instagram of Statistics Indonesia

Figure 13 is an insight report provided by Instagram for the second issue of Big Data Comics (https://www.instagram.com/p/CRqs34RjZ_3/).

In the comment section of the second edition of the Big Data comic, discussions about Big Data began to emerge. While in the first edition, comments were more dominated by appreciation, in the second edition, visitors who opened discussion questions began to appear. As written by the account @ihza_mahendra20, “why is it given the term 3v+ instead of 4v? even though there are 4 types of volume, velocity, veracity, and variety?”. Instagram provides facilities in the comments column to discuss with visitors. Big Data discussion is no longer only one-way but can also continue to be a two-way discussion in the comments column. The admin from the public relations department will work with the Big Data team to answer visitor questions.

Public response to Big Data comics is relatively high. Several accounts commented that they could not wait to read the next series. The Big Data comic series will continue at least until the eighth series. After that, it will be discussed again whether to continue Big Data as a theme or move to another theme.

DISCUSSION

Our research question was, “How much public engagement is with the Big Data information communicated through comics on social media?”. We can see from the statistical results reported by social media platforms that comics in conveying information about Big Data can provide much engagement on social media. Social media also helps

provide discussion facilities that make Big Data discussions two-way. The comic will be a good and effective way to build Big Data literacy in society. These stories, with the characters and their "real-life" situations, also contributed to a deeper understanding of messages by a wider audience through empathy (Igarashi *et al.*, 2020).

In this study, we know that there are many social media users, both FB and IG, who interact with Big Data comic content but do not give any response other than just looking. The number of social users who see the content but do not react to anything does not mean they have a neutral expression of Big Data comics. It can be neutral, but it can also be damaging.

Creating science-themed stories and Big Data takes more time than making regular comics. We must understand the context of Big Data and translate it into easy-to-understand language. We need to think hard to avoid being misleading. Even so, discussions with a team that are experts on Big Data will make the process of making story scripts easier to complete. While comic-based scientific storytelling received an excellent response, the most important thing is to have a group of professionals take care of the work and make the most of the characteristics of the story (Igarashi *et al.*, 2020).

CONCLUSION

The study shows that improving Big Data literacy through comics is a novel and noteworthy approach and has been widely accepted by people. Using social media to inform something can cause a positive discussion between users. This cannot be done with conventional communication media such as print media. Readers can have an active role in the content they have just read by asking or responding to it. Other readers can participate in responding by answering or responding to questions from other readers. It is from the reader's response that a good discussion is built.

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