

CONFERENCE OF EUROPEAN STATISTICIANS

Expert Meeting on the Dissemination and Communication of Statistics

13-15 September 2022, Online

BUILDING BIG DATA LITERACY THROUGH DIGITAL COMIC

Maulana Faris¹, Setia Pramana^{1,2}

¹Statistics Indonesia, Jl. Dr. Sutomo 6-8, Jakarta, 10710, Indonesia

²Politeknik Statistika STIS, Jl. Otto Iskandardinata no 64C, Jakarta, 13330, Indonesia

*Corresponding author: maulana.faris@bps.go.id; setia.pramana@stis.ac.id

Abstract

The Internet creates a new space full of information. Every second of what we do on the internet leaves a collective internet trace that gives birth to an insight into policy making. We see how the economy moves massively through online shopping, online transportation, and even public opinion figures on social media. All these digital traces become big data. Big data is a compass for policy makers regarding current socio-economic movements. However, ordinary people are still unfamiliar with the term big data. Before people can take advantage of big data insights produced by the National Statistical Office (NSO), they must first understand what big data is. Building awareness about a new data to the general public is not an easy thing. One of the methods used by Statistics Indonesia (BPS) is to make comics. Comics are one of the most popular communication media among ordinary people, especially teenagers and children. Comics are published in digital form on BPS social media. In the first edition, Big Data comics on Facebook managed to reach 17,495 accounts and 44,497 accounts on Instagram. The use of big data literacy comics posted through social media triggers a lot of active discussion from the public. Research shows that increasing big data literacy through comics is a new and noteworthy approach that has been widely accepted by society.

Keywords: *Big Data, Comic, Digital Communication*

topics: S3 Statistics Made Easy

Introduction

The COVID-19 pandemic has forced internet usage to be optimized. The limitations that we get during the pandemic make us very dependent on the internet but on the positive side the use of the internet is very developed, especially in data collection. People make the internet a basic need to do anything such as shopping, looking for entertainment, issuing opinions, even looking for a life partner. Every second of our activities on the internet leaves a trail that will collectively be collected into big data. We can take the big data and then process it into important information for policy makers. Doug Laney (2001) describes big data into 3 V dimensions, namely Volume, Velocity, and Variety. Volume describes to the size of data, velocity describes to 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 (Mayer-Schönberger & Cukier 2013).

BPS 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 in the Midst of 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 update information about big data BPS can be found in <https://bigdata.bps.go.id/>.

Big data is a solution for collecting data in this pandemic era, but the problem is how to make common people understanding big data. NSO needs a communication strategy to increase the awareness about big data. We need to communicate big data as good as when communicating other statistic products. Communicating statistics is a fundamental and legitimate responsibility as part of the transparency and accountability objectives of institutions engaged in official statistics and to crowd out low quality statistics and cyclical sentiment based policy strategies (Nyman, 2017). According to Faris (2022) big data must be communicated well and clearly to help people understand the use of big data as a reliable source of information.

BPS uses various visual approaches in introducing big data and one of them is comic. Visual narratives, such as comic is becoming increasingly popular as a tool for science education and communication. Combining the benefits of visualization with powerful metaphors and character-driven narratives, comics have the potential to make scientific subjects more accessible and engaging for a wider 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 and Boomer (2011) or Spiegel et al (2013). Existing studies have focused on stereotypical perceptions of comics, such as their ‘humorous’ nature and their 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 a wide variety of registers and styles and successfully engaged audiences of all ages (Farinella, 2018). Yuniarti & Faris (2018) conducted

research on comics as a statistical education tool in 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 that were 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 C and MacDonald (2020) mentioned that today many science communicators are using social media to share scientific information with citizens, but, as research shown, fostering conversational exchanges remains a challenge. Plowman and Wilson (2018) said that practice of public relations increasingly includes the use of social media, it is only natural that strategic communication process in form their use.

This study proposes a communication strategy for building big data literacy using science comic. This research will see how comic science can build public awareness about big data through social media. This research can be the basis for further research on building public literacy in various sciences through comics.

Research question:

How far comics can help in increasing public awareness of big data?

METHOD

The methodology in this study will use science comic in building 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.

1. *Storytelling and Comic*

Every comic needs a good story in the process of making it as well as science communication. Storytelling, an effective method for scientific communication, has been used not only for a general audience, but also 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. The goal is to improve the effectiveness of science communication.

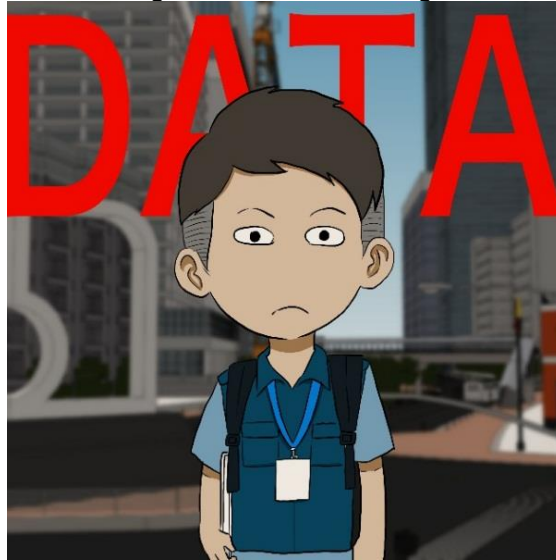
On this research, we used retrospective auto-ethnography, based on our own observations and experiences. In auto-ethnography, the self becomes the subject of critical inquiry, and a reflexive and ongoing narrative unravels in discerning contrapuntal voices and experiences (Cervantes-Soon, 2014; Chavez, 2012). We will show the development process of making the comic and analyze the responses from the reading public in official social media of Statistics Indonesia.

1.1. *Story Script and Character*

The first thing to do is to create a grand concept of the story. 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 in presenting 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.

Figure 1. Character Design



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 in the second series is “Definition of Big Data”. After the theme is selected, it is developed using three-act storytelling theory, namely 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, 1984).

There are two types of defined science communication, namely 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 and Webb (2007) mentioned that outreach as “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 easily. Dialogue must also be written carefully so as not to misconstrue the reader.

There is one writing technique in making comic strip scripts that 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 humor results from unexpected or illogical connections, surprises or contradictions, i.e. incongruity (Banas et al., 2011; Cornett, 1986), and relief theory focuses more on humor 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 (e.g. Baram-Tsabari and Lewenstein, 2017). The inclusion of positive humour in science articles may be a step in the right direction for better public engagement (Chan and Udalagama, 2021).

Basically, the making of the story consists of three acts. The first act is introduction, the second act is conflict, and the last act is resolution. Similarly, in writing scientific papers or

journals, we must also start with the introduction, then the conflict, and finally the solution to the conflict. After making the story divided into each act, then each round will be divided into several scenes and each scene has a dialogue from its character. The dialogue that is built starts from the need for setting up to enter the information to be conveyed to the reader. The use of language is very important to build the atmosphere in the comic story. If we want to reach our teenage readers, we must use the everyday language they usually use.

1.2. 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. Humor 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.

Comics can be drawn either through manual or digital image media. For comics that are drawn manually on paper, they need to be scanned to become digital files to be posted on social media. For digital comics, there are several free and paid software available for making comics. Researchers used the Clip Studio Paint software for the iPad version. From the draft of the story that has been made, it is then transformed into pictures according to a predetermined scene. The area of each scene is delimited by panel lines to delimit each scene.

There are many types of comic drawing styles. There are comic artists who take a realistic approach to give a real impression, but there are also those who make it very cartoonish which gives an entertaining effect even though it is not real. There is no need to limit yourself to making very detailed and good pictures because there are many comics that are drawn simply but can attract more readers. Images are just a medium to convey a message. The type of image is chosen to support the idea of the story to be conveyed.

The background in each panel does not have to be drawn many times. In this study, the background uses 3D which is then saved as a JPEG extension through the Google Sketchup application. Some backgrounds use 2D backgrounds provided by the Clip Studio Paint application for free with various adjustments. We can also combine photos to become a background that gives a combination effect between the cartoon world and the real world.

After the drawing is complete, proceed with coloring. The use of colors can be taken from the palette which can be downloaded for free via the internet. The choice of color tone is very important to affect the mood of the reader. The use of soft colors also makes the reader's eyes comfortable when reading comics on their devices.

Giving text is done separately after all images are finished. In this study, giving text using Adobe Photoshop. The font used is expected to use a font that gives a relaxed impression. There are many free fonts that can be downloaded on the internet. The use of fonts that seem relaxed gives a comfortable effect to the reader. But we can use the bold junis font to create the title.

After all the steps are complete, save the comic in Jpeg or Png format. To make it easier to read, files from multiple pages can also be compiled into one pdf file. It will easier to share as one file. then the big data literacy comic is ready to be presented to the readers.

Figure 2. The cover of first edition Big Data Comic



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

Figure 3. The cover of second edition Big Data Comic



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

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



Figure 4 is an example of a scene that incorporates comedic elements into the story as a punch line. One of the characters analogizes the many problems in his life with big data.

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

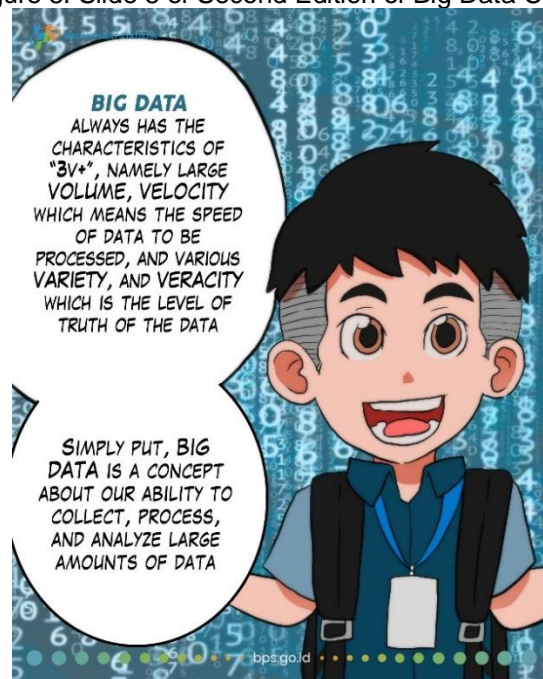


Figure 5 is an example of a scene that explain big data to the readers.

2. Social Media

Social Media was chosen to be the media used in disseminating big data information through comics to the wider community. Based on Hootsuite and We are Social (2021), there were 170 million social media users in Indonesia per January 2021. The number of social media users in Indonesia was equivalent to 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 that can 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 (*inreach*) and to connect with the public (*outreach*) (McClain and Neeley, 2014).

2.1. Facebook

One of the most popular social media is Facebook. Witek and Grettano (2012) mentioned that Facebook and other social media are having significant effects on the “how” information literate behaviors and practices. They said that the most important things learned through their research is the fact that Facebook is a powerful contact zone for information literacy, but not always because the functionality explicitly encourages information literate practices.

Statistics Indonesia official Facebook Fan Page has been created since 2014. On August 4th 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 related subject matter.

Figure 6. Statistics Indonesia Official FB Fan Page



Front page of the official FB fan page statistics indonesia

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



Big data comic display on FB wall fan page statistics Indonesia

2.2. 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 (Bergstrom & Backman, 2013). Since April 9th, 2012, Facebook took over Instagram. What makes Instagram different from other social media is that Instagram is applying a visual based strategy (Hird, 2013).

Statistics Indonesia started to get to Instagram since 2017. As of 4th august 2021, instagram Statistics Indonesia has 207 000 followers. Same as Statistics Indonesia official FB fan page, Statistics Indonesia used Instagram to promote statistics activity and publications.

Figure 8 Statistics Indonesia Official Instagram

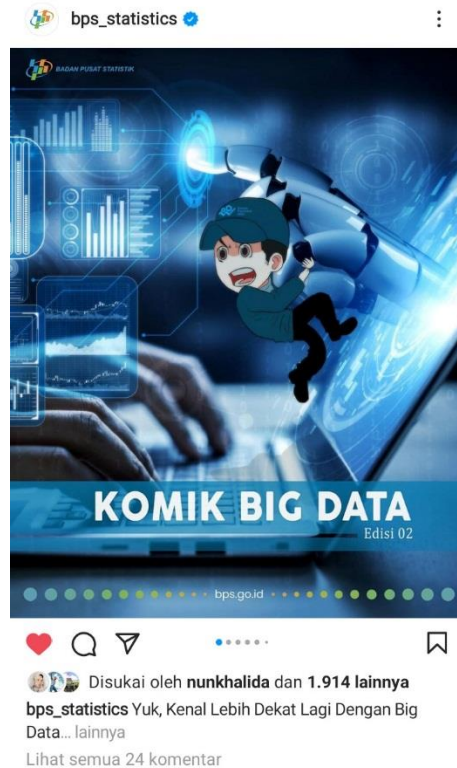


Front view of Statistics Indonesia Official Instagram as of August 4th 2021

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 display on Instagram Statistics Indonesia. To read the next slide, Instagram users are required to swipe their finger to the left. 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

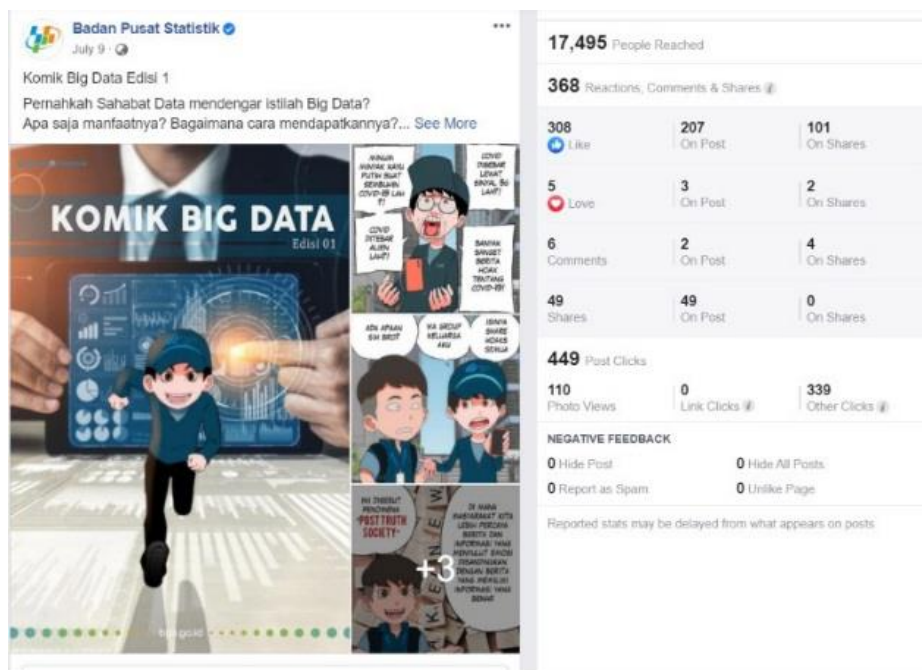
RESULT

1. 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 largest percentage of followers is in the city of Jakarta with a percentage of 5.2%.

Big Data comics are well received by the public. Big Data comics are one of the favorite content on the official FB Fan Page of Statistics Indonesia. The first edition of Big Data comics was uploaded on July 9th, 2021, while the second edition of Big Data comics was uploaded on July 23rd, 2021. The two-week interval was chosen to allow 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 July 29th, 2021 from FB fan page.

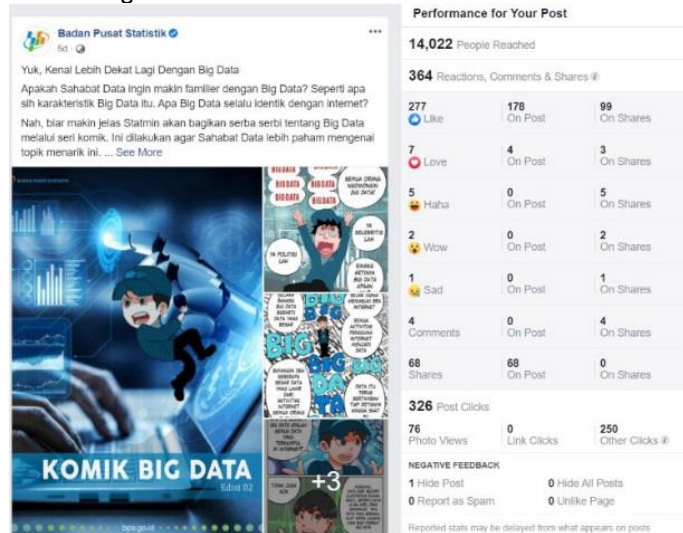
Figure 10. Statistic for Big Data Comic First Edition in Statistics Indonesia FB Fan Page



On the left side of figure 10 is the picture of 6 slides of Big Data Comic first edition with the captions. On the right side is the statistic of visitor.

Figure 10 is the result of Statistics Indonesia FB fan page visitor from the first edition of 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 and 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 slides of Big Data Comic second edition with the captions. On the right side is the statistic of visitor.

Figure 11 is the result of Statistics Indonesia FB fan page visitor from the second edition of big data comic after 6 days (July 23rd – 29th, 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.

2. 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 largest percentage of followers is in the city of Jakarta with a percentage of 14.2%.

Big Data comics were posted on Instagram at the same time as the Facebook fan page, namely July 9th, 2021 for the first edition and July 23rd, 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 July 24th, 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.

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 managed to reach 44 497 Instagram accounts as of July 24th, 2021. When 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 a lot of positive comments from regular visitors, academics, to regional BPS office accounts. In the comment section, account with username @liskamarlina said that “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 managed to reach 26 248 Instagram accounts in a day as of July 24th, 2021. The number of accounts achieved is almost twice the number 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 in 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.

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 began to appear who opened discussion questions. 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 be able 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 in answering visitor questions.

Public response to big data comics is quite high. Several accounts commented that they couldn't 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.

LESSON AND DISCUSSION

Our research question was “How far comics can help in increasing public awareness of big data? We found that visual storytelling using comic can success increase awareness the readers about big data content that we served. social media also helps provide discussion facilities that make

big data discussions a two-way discussion. 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 gaining a deeper understanding of messages by a wider audience through empathy (Igarashi et al, 2020).

Creating science-themed stories as well as big data takes more time than making regular comics. We must really 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 a very good 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

This research shows how digital comics help get relatively good engagement from the public. Comics have become the preferred communication medium by many parties and make information about big data available to the public without people feeling like they are learning. The use of social media also helps in reaching a wider audience. The comment column on social media helps build further discussion about big data material in comics.

REFERENCES

- Banas, J. A., Dunbar, N., Rodriguez, D. and Liu, S.-J. (2011). 'A review of humor in educational settings: four decades of research'. *Communication Education* 60 (1), pp. 115–144. <https://doi.org/10.1080/03634523.2010.496867>.
- Baram-Tsabari, A. and Lewenstein, B. V. (2017). 'Preparing scientists to be science communicators'. In: Preparing informal science educators: perspectives from science communication and education. Ed. by P. G. Patrick. Cham, Switzerland: Springer, pp. 437–471. https://doi.org/10.1007/978-3-319-50398-1_22.
- Bergstrom, T. & Backman, L. (2013). How the utilization of Instagram builds and maintains customer relationships. *Marketing and PR in social media*. <http://urn.kb.se/resolve?urn=urn:nbn:se:su:diva-9041>
- Cervantes-Soon, C. (2014). The US-Mexico border-crossing Chicana researcher: Theory in the flesh and the politics of identity in critical ethnography. *Journal of Latino/Latin American Studies*, 6, 97-112.
- Chan, A. and Udalgama, C. (2021). 'Exploring the use of positive humour as a tool in science communication: do science and non-science undergraduates differ in their receptiveness to humour in popular science articles?'. *JCOM* 20 (04), A06. <https://doi.org/10.22323/2.20040206>.
- Cornett, C. E. (1986). Learning through laughter: humor in the classroom. Bloomington, IN, U.S.A.: *Phi Delta Kappa Educational Foundation*.
- Doug Laney, (2001) "3D Data Management: Controlling DataVolume, Velocity, and Variety", Gartner, file No.949. <http://blogs.gartner.com/doug-laney/files/2012/01/ad949-3D-Data-Management-Controlling-Data-Volume-Velocity-and-Variety.pdf>
- Dubovik, O. (2013). Instagram as instrument of marketing. *Majesty of Marketing*, 39. <http://mk.nmu.org.ua/ua/npd/majesty2013/majesty2013.pdf#page=39>
- Enos R D, Fowler A and Havasy C S 2017 The negative effect fallacy: A case study of incorrect statistical reasoning by federal courts *J. Empir. Leg. Stud.* 14 618–47
- Farinella, Matteo. (2018). The Potential of Comics in Science Communication. *Journal of Science Communication*. DOI : 10.22323/2.17010401
- Faris, M. (2022). Comic for Developing Big Data Literacy. *Ultimacomm: Jurnal Ilmu Komunikasi* 14(1).doi: 10.31937/ultimacomm.v14i1.2470
- Faris, M and Pramana, S. (2020). Preparing a Big Data Utilization Communication Strategy. *IOP Publishing*. DOI : 10.1088/1742-6596/1863/1/012077
- Field, S. (1984). Screenplay: The foundations of screenwriting. *New York: Bantam Dell*.
- Francois, Karen., Monteiro, Carlos., Allo, Patrick. (2020). *Statistics Education Research Journal*, 19(1), 194–205, <http://iase-web.org/Publications.php?p=SERJ>
- Gray, J., Gerlitz, C., & Bounegru, L. (2018). Data infrastructure literacy. *Big Data & Society*, 5(2). <https://doi.org/10.1177/2053951718786316>
- Hird, C. (2013). Social media marketing: A best practices analysis of selected destination magazines. <http://digitalcommons.calpoly.edu/rptasp/54>
- Hosler, J. and Boomer, K. B. (2011). 'Are Comic Books an Effective Way to Engage Nonmajors in Learning and Appreciating Science?' *CBE — Life Sciences Education* 10 (3), pp. 309–317. <https://doi.org/10.1187/cbe.10-07-0090>
- Igarashi, Y., Mizushima, N. and Yokoyama, H. M. (2020). 'Manga-based risk communication for the COVID-19 pandemic: a case study of storytelling that incorporates a cultural context'. *JCOM* 19 (07), N02.<https://doi.org/10.22323/2.19070802>.
- Javaid, M., Haleem, A., Vaishya, R., Bahl, S., Suman, R., & Vaish, A. (2020) Industry 4.0 technologies and their applications in fighting COVID-19 pandemic. *Diabetes & Metabolic Syndrome. Clinical Research & Reviews*, 14(4), 419-422. <https://doi.org/10.1016/j.dsx.2020.04.032>
- Martin C and MacDonald BH. (2020). Using Interpersonal Communication Strategies to Encourage Science Conversations on Social Media. *PLoS ONE* 15(11): e0241972. <https://doi.org/10.1371/journal.pone.0241972>
- Mayer-Schönberger, Viktor & Kenneth Cukier. (2013). Big data: A revolution that will transform how we live, work, and think. *New York: Houghton Mifflin Harcourt*.
- McClain C and Neeley L. (2014). A critical evaluation of science outreach via social media: its role and impact on scientists. *F1000Research*, 3:300. doi: 10.12688/f1000research.5918.1
- Nymand, Andersen. (2017). Preparing a Statistics Communication Strategy. *UNECE*.https://unece.org/fileadmin/DAM/stats/documents/ece/ces/ge.45/2017/Strategy_Per_Nymand-Andersen_paper.pdf
- Plowman, K. D., & Wilson, C 2018 Strategy and Tactics in Strategic Communication: Examining their Intersection with Social Media Use. *International Journal of Strategic Communication*. 12:2, 125-144, DOI:10.1080/1553118X.2018.1428979
- Poliakoff E, Webb TL.(2007). What factors predict scientists' intentions to participate in public engagement of science activities? *Science Communication* 29: 242–263

- Riedlinger, M., Metcalfe, J., Baram-Tsabari, A., Entradas, M., Joubert, M. and Massarani, L. (2019). 'Telling stories to build collaboration between science communication scholars and practitioners'. *JCOM* 18 (05), N01. <https://doi.org/10.22323/2.18050801>.
- Sander, I. (2020). What is critical big data literacy and how can it be implemented?. *Internet Policy Review*, 9(2). DOI: 10.14763/2020.2.1479
- Spiegel, A. N., McQuillan, J., Halpin, P., Matuk, C. and Diamond, J. (2013). 'Engaging Teenagers with Science Through Comics'. *Research in Science Education* 43 (6), pp. 2309–2326. <https://doi.org/10.1007/s11165-013-9358-x>.
- Tatalovic, M. (2009). 'Science comics as tools for science education and communication: a brief, exploratory study'. *JCOM* 8 (4), A02. URL: <https://jcom.sissa.it/archive/08/04/Jcom0804%282009%29A02>.
- Varner, Johanna. (2014). Scientific Outreach: Toward Effectiveness Public Engagement with Biological Science. *BioScience*. DOI: 10.1093/biosci/biu021
- We Are Social & Hootsuite. (2021). Digital 2021 Local Country Headline Report. Accessed in 3 August 2021. <https://wearesocial.com/digital-2021>
- Witek, Donna & Grettano, Teresa. (2012). Information Literacy on Facebook: an analysis. *Reference Service Review* Vol. 40 No. 2. Pp 242-257. Emerald Group Publishing Limited. DOI : 10.1108/00907321211228309
- Yuniarti and Faris, M. (2018). Comics for Statistics Literacy-Understanding Seasonal Adjustment Figures. *Asia-Pacific Economic Statistics Week 2018*. <https://communities.unescap.org/asia-pacific-economic-statistics/apes-2018-featured-papers>.

Appendix (First chapter of Big Data Comic)



**DRINKING
EUCALYPTUS
OIL CAN CURE
COVID-19?!**

**COVID-19
SPREAD
USING 5G
SIGNAL?**

**COVID-19
SPREAD BY
ALIENS?**

**THERE'S
A LOT OF
FAKE NEWS
ABOUT
COVID-19**

YO BRO,
WHAT'S UP?

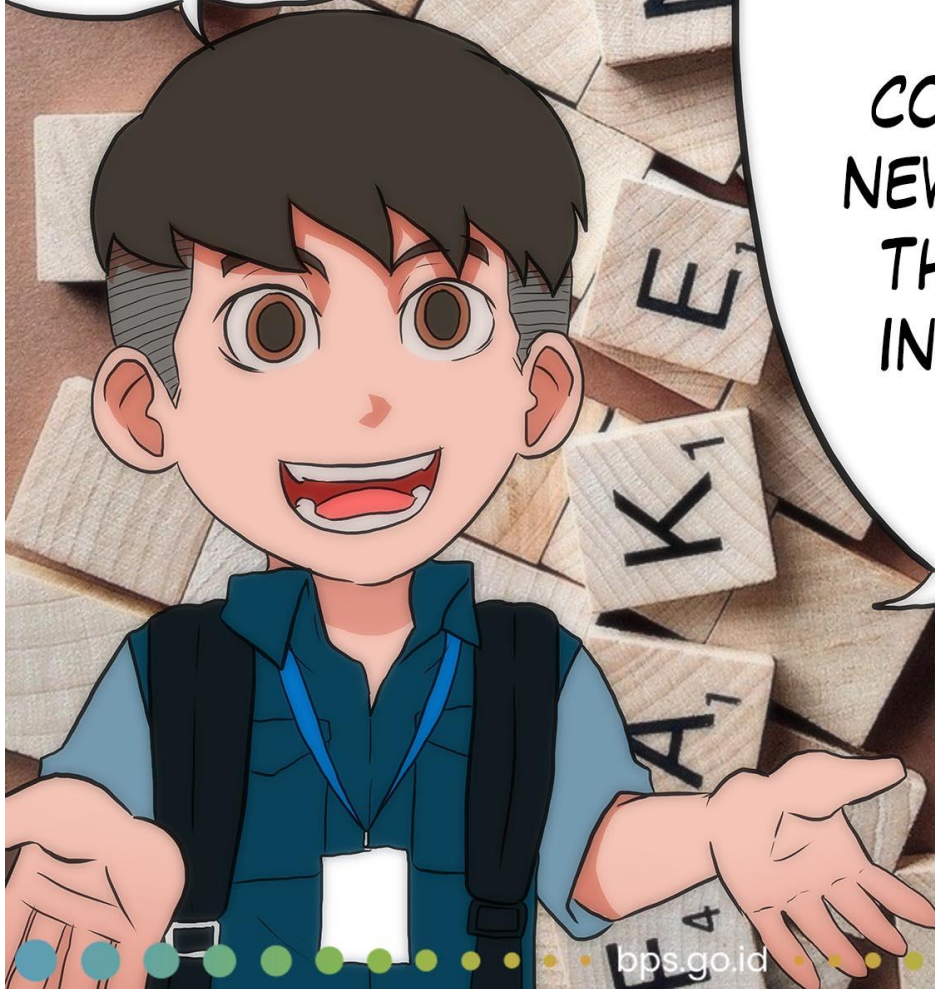
THIS IS ABOUT
MY FAMILY
WHATSAPP
GROUP

THE
CONTENTS
SHARE
ABOUT
HOAXES



THIS IS CALLED
"POST TRUTH
SOCIETY"
PHENOMENON

...WHERE
OUR SOCIETY
TRUSTS NEWS
AND INFORMATION
THAT IGNITES
EMOTION
COMPARED TO
NEWS THAT HAS
THE CORRECT
INFORMATION



IN THE END
THERE WILL BE
CHAOS IN
PUBLIC

WE MUST BE ABLE
TO BE A COMPASS
FOR
PUBLIC

YES, I NEVER
BELIEVED THAT
VACCINES
COULD MAKE
US TITANS

TO FIGHT THAT,
WE MUST BE
ABLE TO BUILD
DATA LITERACY
IN SOCIETY



DURING A
PANDEMIC LIKE
NOW, THE
GOVERNMENT
AND THE PUBLIC
NEED FAST AND
ACCURATE
INFORMATION
TO SEE THE
SOCIO-ECONOMIC
CHANGES THAT
ARE HAPPENING

ONE OF THE
SOURCES OF
INFORMATION
THAT WE CAN
USE IS

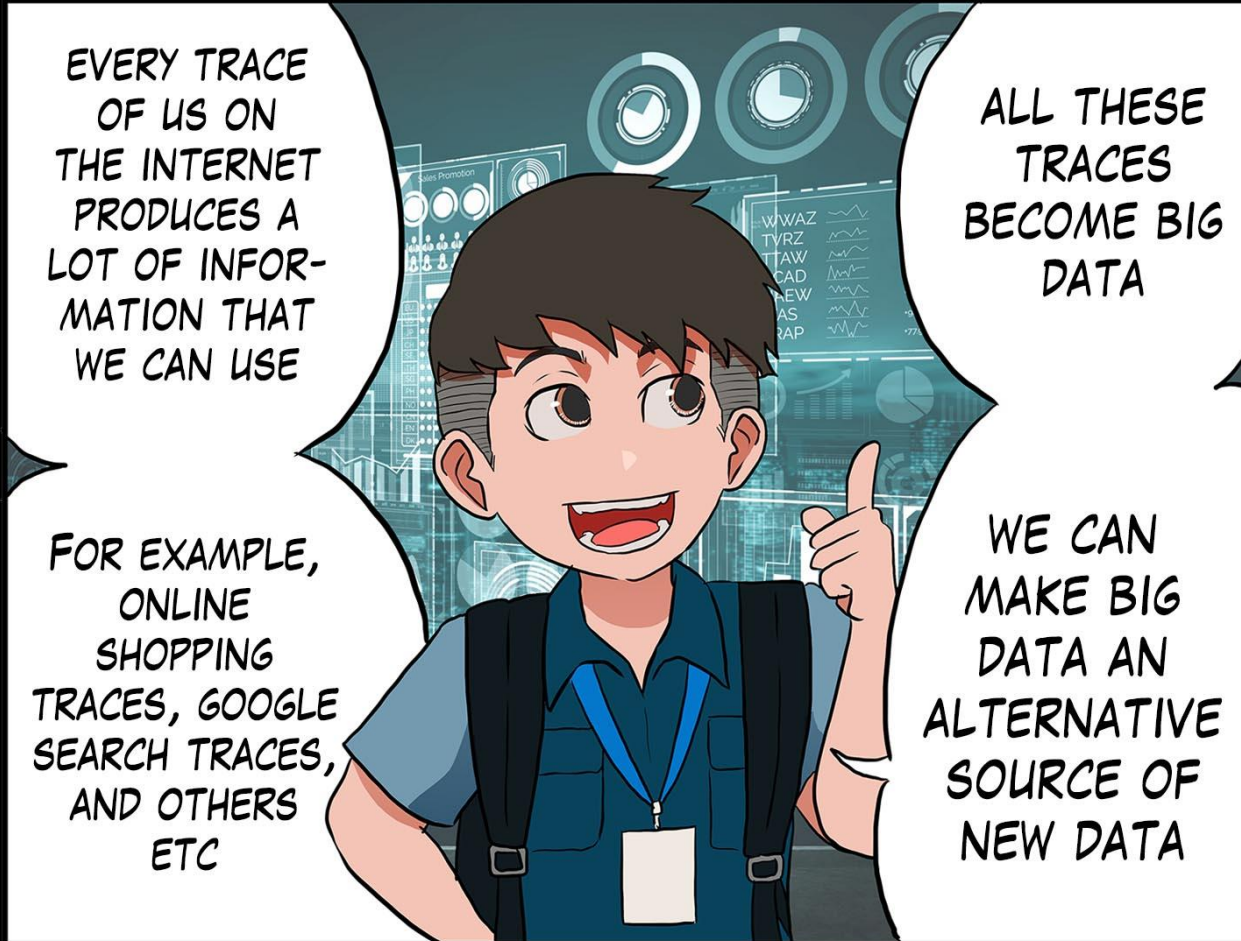
**BIG
DATA**





WHERE IS
THE SOURCE
OF BIG
DATA?

FROM ALL
TRACES
OF OUR
ACTIVITIES
ON THE
INTERNET



EVERY TRACE
OF US ON
THE INTERNET
PRODUCES A
LOT OF INFOR-
MATION THAT
WE CAN USE

ALL THESE
TRACES
BECOME BIG
DATA

FOR EXAMPLE,
ONLINE
SHOPPING
TRACES, GOOGLE
SEARCH TRACES,
AND OTHERS
ETC

WE CAN
MAKE BIG
DATA AN
ALTERNATIVE
SOURCE OF
NEW DATA