



DEVELOPING MATHEMATICS COMICS THROUGH INSTAGRAM THEMED LOCAL CULTURE AS AN ALTERNATIVE LEARNING SOLUTION

Nana Apriana Nur Hidayah*, IAIN Salatiga, Indonesia

Winarno, IAIN Salatiga, Indonesia

Muhammad Istiqlal, IAIN Salatiga, Indonesia

*email: nanaapriana.19@gmail.com (corresponding author)

Abstract: This study aimed to explore mathematical comics learning media through Instagram social media with the theme of local culture as an alternative learning solution that is feasible to use in terms of validity, practicality, and effectiveness. This study used the ADDIE development model. Analysis, to determine the problem and solution. Design, that is designing learning materials and objectives; sketching names, figures, and characters; compiling a script; making a storyboard; creating Instagram feed content. Development is the process of finishing the manufacture of products. The implementation of the product validation test was carried out by two experts in mathematics education and tested by students and teachers in a Junior High School in Salatiga. Evaluation is carried out as the final version of the material for further research based on teacher and student responses. Data collection methods in this study are observation, interviews, questionnaires, literature study, and documentation. The results showed that comics with local characters can engage students in learning mathematics. First, they might be interested to know the local culture and then were realized mathematical thinking. The data showed an average validity of 4.15 with a valid category, average practicality of 4.27 categorized as practical, and an average evaluation test obtained a result of 8.5 so it was categorized as effective on student learning outcomes. Therefore, when creating comics for learning in social media, using local culture is suggested.

Keywords: *development, learning media, Instagram, math comics, local culture*

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INTRODUCTION

Today, the world has entered the industrial revolution 4.0 era since the beginning of 2015 (Setiawan & Poerbosisworo, 2021). The industrial revolution 4.0 entered the digital or virtual world, which is characterized by cyber-physical systems, in the form of human, machine, and data connectivity, known as IoT (Internet of Things). The history of the industrial revolution starts from 1.0, 2.0, 3.0, to Industry 4.0. The industrial phase is a real change from the existing changes. Industry 1.0 is characterized by mechanization

of production to support the effectiveness and efficiency of human activities; Industry 2.0 is characterized by mass production and standardization of quality; Industry 3.0 is characterized by mass adjustments and automation and robots-manufacturing flexibility. Industry 4.0 then comes to replace Industry 3.0 which is characterized by cyber-physical and manufacturing collaboration. (Hermann, Pentek, & Otto, 2016; Irianto, 2017). The digital revolution and the era of technological disruption are other terms for Industry 4.0. It is regarded as the digital revolution because of the proliferation of computers and the automation of records in all areas. Industry 4.0 is an era of technological disruption because automation and connectivity in a field will make the movement of the industrial world and job competition non-linear. One of the unique characteristics of Industry 4.0 is the application of artificial intelligence (Tjandrawinata, 2016).

To face the era of the Industrial Revolution 4.0, every individual must have the required skills to face the challenges in the future. This can be achieved through education with teacher educators who have qualified qualifications, are competent, and are able to create learning independently. During the National Work Meeting of the Indonesian Ministry of Research, Technology and Higher Education on January 17, 2018, formally new literacy ideas emerged, including data literacy, technology literacy, and humanism literacy. In addition to teaching old literacy, namely reading, writing and arithmetic, teachers must also be able to reinforce learning with new literacy. Thus, it will make students capable to compete with machines or artificial intelligence and reflect character education.

Social Media is part of the internet which is now attached and has become a style of everyday human life in the digital era or industrial revolution 4.0. The use of social media continues to increase every year. Indonesia is one of the countries with high social media users increasing every year.

Based on the data on internet and social media trends for 2020 in Indonesia in a report entitled "Essential Headline Data You Need to Understand the State of Mobile, Internet, and Social Media Use", there are 160 million active social media users out of the total population of 272.1 million (Kemp, 2020). Whereas, in accessing media, from a report entitled "Daily Time Spent With Media (Average Daily Time that Internet Users Aged 16 to 64 Spend With Different Kinds of Media And Devices)" users in Indonesia spend an average of time every day to use the internet for 7 hours 59 minutes, use social media for 3 hours 26 minutes, watch television for 3 hours 4 minutes, listen to music for 1 hour 30 minutes, and play games for 1 hour 23 minutes.

For the most active social media platforms in Indonesia, from data entitled "Most-Used Social Media Platforms (Percentage of Internet Aged 16 To 64 Who Report Using Each Platform in The Fast Month)", it shows that the number of YouTube user account is 88% of the population, WhatsApp 84%, Facebook 82%, and Instagram 79% of the total population (Junawan & Laugu, 2020). Regarding the Instagram users in Indonesia in 2020 there are 63 million users, 50.8% are female while 49.2% are male (Nurjaman & Hertanto, 2022).

It was supported by data from initial observations conducted by researchers on 29 Class VIII A students at State Junior High School at Salatiga which showed that the most social media already owned by the students was YouTube as much as 82.8%, Instagram 75.9%, others 37.9%, Facebook 31%, and Line 3.4%. For social media owned, 34.5% of students often use Instagram, 31% of students often open YouTube, 27.6% use other

social media, and 6.9% use Facebook, while no one chooses Line. Most students who have Instagram accounts as many as 89.7% spend the 1-3 hours a day.

The world of education needs to utilize social media as part of the learning process for students so that social media can be more useful and not only used as entertainment or seeking a sensation of happiness. According to [Manampiring \(2015\)](#), "Social media can help people in various aspects of needs, entertainment, education, health, self-expression, communication, and others". Meanwhile, according to [Rahmawati \(2016\)](#), Instagram is a photo sharing application that allows users to take pictures and provide filters and then posting them on social media, including Instagram.

Learning media functions to explain parts of the whole learning program that are difficult to explain verbally. Materials will be easier and clearer to understand if learning uses media ([Musfiqon, 2012](#)). According to [Hosnan \(2014\)](#) learning media are all means or forms of non-personal communication that can be used as to convey lesson information to students, and to attract interest and attention, so that the learning objectives can be achieved properly. [Listiyani & Widayati \(2012\)](#) argue that nowadays many types of media have been developed, especially those with visual and audio-visual aspects. One of the visual learning media is learning comics.

Comics are a form of visual communication that has the power to convey information in a popular and easy-to-understand manner, because the collaboration between text and images that compose the storyline is the strong point of comics. The pictures and the texts in comics make the story easy to understand. The pictures and texts make the comic easy to understand and the storyline makes the message or information easy to follow and remember. Moreover, the main readers of comics are young people aged 15 to 25 years. Therefore, comics allegedly have significant contribution in influencing and changing behavior in the early age group ([Marcel Bonneff \(1998\)](#) in [Maharsi \(2014\)](#)). According to [Daryanto \(2013\)](#) comics are defined as cartoons that express characters and apply a story in a sequence that is closely related to the pictures and is designed to amuse the readers.

Along with the time development, comics can be used as learning media. In the world of education, comic-based learning media can foster student motivation, level of student understanding, and student character values in learning mathematics. Currently, developing technology makes comics popular in the digital world. Comics today are not only made using tools such as paper and pencil but can be made using various applications on computers and Android smartphones. Even in print media, for now, comics can be distributed through social media, such as Instagram, using internet quota to publish them.

Mathematics is a scientific discipline in which one of the subjects has a higher level of difficulty and conceptual abstractness than other learning. According to James and James ([Suherman, 2001](#)), mathematics is the science of logic on shapes, composition, quantities, concepts related to others in large numbers which are divided into three areas, namely algebra, analysis, and geometry. However, there are also other groups who think that mathematics is a science developed for mathematics itself. Science is for science, and mathematics is a science developed for its own sake. Mathematics is the science of structures that are deductive or axiomatic, accurate, abstract, and rigorous.

According to [Ismail \(2011\)](#), what is meant by local culture is all the ideas, activities, and results of human activity in a community and in a certain location. The local culture is actually still growing and developing in the community and is agreed upon and used as a shared guide. Thus, local cultural sources are not only values, activities, and results of traditional activities or the ancestral heritage of the local community, but also all cultural components or elements that apply in society and are characteristic and or only develop in certain communities. Therefore, in this case the researcher is interested in developing math comics with local cultural themes which are disseminated via Instagram.

METHOD

The research and development used ADDIE model ([Morrison, 2010](#)). This model consists of five phases: analysis, design, development, implementation, and evaluation ([Arivina & Jailani, 2020](#)). The subjects of this study were students of Class VIII A at State Junior High School, Salatiga learning in the 4.0 era (odd semesters of 2021). The data collection methods in this study included observation, interviews, questionnaires, documentation, and literature study. Meanwhile, the instruments in data collection consisted of media assessment questionnaires by media experts, media assessment questionnaires by material experts, media assessment questionnaires by teachers, and student responses.

The devices used by researchers to make comics are pen tablets and laptops. Meanwhile, the software application used is the Krita and Photoshop applications. The comic stories developed by the researchers carried the theme of local culture (Javanese) which was limited to visual designs and examples of problems related to the comic stories. The material that the researchers used was number pattern Chapter I for Class VIII.

The types of data obtained are quantitative and qualitative. The quantitative data are in the form of scores of material expert validation, media expert validation, questionnaires from teachers and students, and student learning achievement tests. Meanwhile, the qualitative data are in the form of comments, criticisms, and suggestions or input for improving the media from experts, teacher, and students. The validity analysis was obtained from the validation by media experts and material experts to obtain an average total score of 2.50 to 4.00. The analysis of the learning media practicality is obtained from the practicality sheets filled in by students and mathematics teachers if the minimum score is categorized as good. The effectiveness analysis is obtained from the average student learning test results when the students have achieved KKM (Minimum Completeness Criteria), namely 75.

RESULTS AND DISCUSSION

The Development of Mathematics Comics Learning Media through Instagram with the Local Culture Theme as an Alternative Solution in Learning in the Industrial Revolution Era 4.0 is based on the steps of the ADDIE Research and Development model. In the Analysis stage, based on the interview with a math teacher, learning was currently being carried out online because the Covid-19 pandemic had not ended. As a result of

doing Distance Learning (PJJ), student participation in learning is lowered due to several factors such as limited internet quota, overloaded memory, preference to play online games than studying, and so on. The learning media used by teachers is still limited to the use of learning videos via YouTube. Then, the results of the observation conducted in class VIII A showed that 79.3% of students preferred learning using pictures/comics. The social media most often opened by students is Instagram. Students who have an Instagram account are 89.7%. Most students spend 1-3 hours a day opening Instagram and most of the students open Instagram to make posts, view posts, like posts from the accounts they follow.

Based on the students' responses regarding the learning experience of using social media, 93.1% said they had no experience. Meanwhile, the use of comic media, 96.6% also said they had never. Regarding the students' difficulties in learning Number Pattern material, 51.7% stated that they had no difficulties, 48.3% stated that it was difficult. From some of the students' answers which stated that it was difficult to learn the Number Pattern material, the most difficult part is finding the n th term (U_n) and looking for the number pattern formulas.

Therefore, during online learning it is necessary to carry out an innovation or solution so that learning continues to run smoothly, students also have motivation and interest in learning so that they can have more participation. Therefore, a solution was made by developing math comic learning media through Instagram with the local culture theme as an alternative solution in learning in the era of the industrial revolution 4.0. After determining the potential and problems in the field, the researcher collected various information related to the product being made, such as Math books for Grade VIII junior high school, references related to the subject matter of number patterns, references related to local Javanese culture in the Salatiga area and its surroundings which can be related to number pattern material, references related to the development of math comic learning media through Instagram, and references about learning in the digital era or industrial revolution 4.0.

After the analysis phase was carried out, the next was the design stage. At this stage, the researcher made a design for the contents of the comic story, namely the material for number patterns associated with local culture in Java. To develop the media, the researchers used hardware (laptops, pen tablets, mobile phones) and software (Krita Software, Photoshop, and the Instagram application).

Krita Software was used to design the product. The stage of designing the material and learning objectives is executed by determining basic competencies, competency achievement indicators, and learning objectives. Then, the learning material was made into math comic stories by incorporating material related to local culture (in Java) in the comic stories that are made with the examples of problems. Next, an evaluation was carried out to students to measure students' understanding of the number pattern material by utilizing math comics learning media through social media Instagram with the local culture theme.

Next is sketching names, figures, and characters in comic stories. At this stage, the researcher found an idea to make 3 characters in the comic story that would be made using the character's name, namely CoSinTan (Rico, Sinta, and Intan). The design of the characters and names can be seen in [Figure 2](#).



Figure 2. Designs for the names and characters of Rico, Sinta, and Intan

After that, the researcher developed comic story scripts along with examples of problems related to local culture (culture in Java). At this stage, the researcher developed the concept of the story along with examples of problems on paper first. The comic stories were made with the local culture theme in Java, namely about Plumpungan Salatiga Batik, Lurik Traditional Clothes, and the Tumpengan Tradition which were limited to designs, stories, and examples of questions. The design for the story concept that would be made in comics can be seen in Figure 3.



Figure 3. Plumpungan Salatiga Batik clothing design for Rico, Sinta and Intan characters



Figure 4. Storyboard

Indikator Pencapaian Kompetensi	Kompetensi Dasar	Kompetensi Inti
Paragraf awal Bab	Kata & Motivasi	5M
 <p>Nama: Rico Tinggi: 149 cm Berat: 48 kg Umur: 14 Sifat: baik, pandai, suka menolong</p>	 <p>Nama: Sinta Tinggi: 148 Berat: 47 Umur: 13 Sifat: Tegas, Berani</p>	 <p>Nama: Intan Tinggi: 147 cm Berat: 45 kg Umur: 14 tahun Sifat: Periang, Suka tantangan dan hal-hal baru</p>
COSINTAN SAUBAT PB Rico, Sinta, dan Intan Sinu Bareng Matematika Materi Pola Bilangan		

Figure 5. Instagram feed layout sketch

After developing the materials, story concepts, names, characters, and characters in the comics you have made, the next step was to create a storyboard, draw sketch to convey ideas. The results of the storyboard can be seen in [Figure 4](#). Sketching the layout of the contents of the Instagram feed aims to create the neat posts ([Figure 5](#)).

Development Stage. At this stage, the design made was then created. The following is the finishing process for making comics using Photoshop software ([Figure 6](#)):

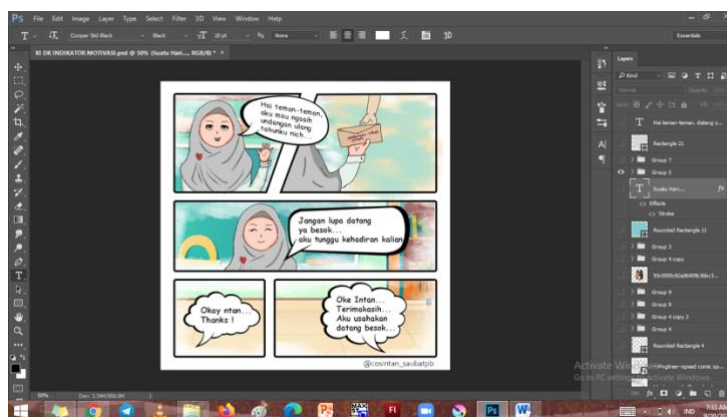


Figure 6. The finishing process of making comics using Photoshop software

The finished comic was then uploaded to the Instagram account. The Instagram account is @cosintan_saubatpb. The Instagram bio aimed to make others recognize the intention and purpose of creating the @cosintan_saubatpb account when visiting it ([Figure 7](#)).



Figure 7. Interface of Bio *Instagram*



Figure 8. Interface of *Instagram* feed layout

The instructions for use and how to read are in the Instagram story highlights. How to read the media use starts from the bottom of the Instagram feed in a zigzag pattern from right to left, then going up, or by scrolling from bottom to top (Figure 8). Each Instagram feed contains a maximum of 10 slides. How to read comics is the same as reading books in general, namely from left to right, and then down (Figure 9).



Figure 9. Procedures for reading comics through *Instagram*

The evaluation consisted of 10 multiple choice questions. Each correct answer obtains 10 points and wrong answer gets 0 point. This evaluation was made using Google Forms. The Google form link is in the Instagram Bio, so after students have finished reading and if there are those who still don't understand, they can discuss via the comment's column, then students can work on the evaluation sheet by clicking on the link in the Instagram Bio (Figure 10).



Figure 10. Google form link in *Instagram Bio*

Implementation Stage. At this stage, a validation test was carried out by media expert, material expert, math teacher, and a limited tryout on 27 Class VIII A students who had an Instagram account. The validation of media experts and material experts was carried out on September 7, 2021. The media expert in this study was one of the lecturers in Mathematics Education at UIN Salatiga. The results of the media validation were categorized as "Good" with a total score of 61 out of a maximum score of 75; then, the average of the total score was 4.07. The comments and suggestions provided by the media expert can become the basis for the revision.

The material expert this study was one of the Mathematics Education lecturers at UIN Salatiga. The validation carried out by the material expert was related to the relevance of the material. The results of the learning media developed were categorized as "Good" with a total score of 72 out of a maximum score of 85, then the total score was averaged to 4.23.

Therefore, learning media for math comics through Instagram with the local culture theme as an alternative learning solution in the 4.0 industrial revolution era was categorized as valid and can be tested. Furthermore, after the learning media was revised, the limited product tryout was carried out by considering the responses from the teacher and students to the developed learning media. The aim of conducting this tryout is to identify the practicality level of the learning media. This limited trial consisted of 1 math teacher and 27 Class VIII A students who had created an Instagram account.

The assessment by Mathematics teacher consisted of 15 indicators. The math teacher's response showed the "Very Good" category with a total score of 64 out of a max score of 75. Then, the average result was converted to a Likert scale of 1-5 so that the average score was 4.3 out of a max scale of 5. The comments and suggestions became the basis for the revision of the material and media.

Meanwhile, in the final assessment stage, two meetings were held, namely online and face to face with 27 Class VIII A students. At the first online meeting held on September 15, 2021, students learned how to use learning media developed by communicating through a WhatsApp group. After students tried the media, students were asked to work on practice questions using the Google form, the link for which is available

in the bio of the @cosintan_saubatpb Instagram account to measure whether students understand the material being taught or not. The practice or evaluation questions were completed until the next face-to-face meeting, (September 18, 2021) which lasts only 30 minutes. This assessment questionnaire consists of 15 indicators. The student responses showed that the learning media for math comics through Instagram with the local culture theme as an alternative solution in learning in the industrial revolution era 4.0 from the responses of 27 students was categorized as "Good" with a total score of 1715 from a maximum score of 2025, and then the average was converted to 4.23.

The evaluation on student learning outcomes was carried out using Google forms in the form of multiple choices, an objective test where the test has some possible answers, and only one of the choices is correct. This evaluation aims to determine students' abilities after being given math comic learning media through Instagram with the local culture theme as an alternative solution in learning in the industrial revolution 4.0. The results of the student learning evaluation/test obtained an average score of 8.5 and had reached the KKM (Minimum Completeness Criteria), namely 75. Therefore, the learning media was categorized as effective on student learning outcomes. Based on the data from the teacher's assessment and students, the learning media was categorized as practical and effective to use.

Evaluation is the final stage of the ADDIE development model. At this stage, the limited tryout was carried out; what was evaluated in this study was the implementation. At the implementation stage, comments and suggestions were obtained from media expert and material expert who showed that the development of comics as an alternative solution in learning mathematics in the industrial revolution 4.0 era could motivate students to explore mathematics based on their abilities so that the lesson became interesting, fun, and useful in everyday life. Also, the results of the teacher and student responses show that the learning media was good, interesting, and in accordance with the current development of students. At the evaluation stage, the suggestions from the mathematics teacher to add some materials regarding number patterns and geometric sequence became a concern for further research material.

CONCLUSION

This is Research and Development which produces a product, i.e. math comic learning media through Instagram with the local culture theme as an alternative learning solution in the era of the industrial revolution 4.0. The materials in this comic were Number Patterns for Grade VIII State Junior High School Semester I with the theme of local culture on the island of Java, namely Plumpungan Salatiga Batik, Lurik Traditional Clothing, and the Tumpengan tradition which is limited to designs and examples of stories. The research used the ADDIE development model (Analysis, Design, Development, Implementation, and Evaluation).

The Analysis phase was carried out to determine the problem and the right solution. The Design was conducted in several stages, namely: (a) Designing learning materials and objectives; (b) Sketching names, figures and characters; (c) Compiling the script along with sample questions; (d) Making story boards; (e) Making a layout for the contents of the Instagram feed. The Development stage was the realization of the previous

stage, where at this stage the finishing process was carried out to produce a media/product that had been designed.

The Implementation was the product validation test by 1 material expert and 1 media expert. After obtaining a valid category, it was then tested on a limited scale with students and teachers in Class VIII A at the State Junior High School, Salatiga. The Evaluation was the final revision stage for further research materials based on the comments and suggestions from the teacher and students. The results showed an average validity of 4.15 with a valid category, an average practicality of 4.27 (practical), and the average student learning outcomes/evaluation test obtained a result of 8.5, so it was categorized as effective on student learning outcomes.

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