

ANCERMAT: LEARNING MEDIA OF MATHEMATICAL ANTHOLOGY DIGITAL TO IMPROVE PROBLEM SOLVING SKILLS

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ANCERMAT: LEARNING MEDIA OF MATHEMATICAL ANTHOLOGY DIGITAL TO IMPROVE PROBLEM SOLVING SKILLS

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Abstract

Teknologi yang berkembang pesat dan digitalisasi harus dimanfaatkan dalam bidang pendidikan. Penggunaan media pembelajaran berbasis digital sangat diperlukan bagi para guru. Keterbatasan media yang ada menjadi alasan utama dikembangkan media pembelajaran ANCERMAT (antologi cerita matematika) dan diharapkan dapat meningkatkan kemampuan pemecahan masalah siswa sekolah dasar. Penelitian ini bertujuan untuk mengetahui tahapan pengembangan media pembelajaran ANCERMAT (antologi cerita matematika), untuk mengetahui apakah memenuhi kriteria valid dan praktis, serta efektif. Metode yang digunakan adalah penelitian pengembangan. Analisis data meliputi analisis uji validitas, analisis uji kepraktisan, dan analisis efektivitas media ANCERMAT, menggunakan statistik deskriptif dan uji normalisasi Gain. Hasil penelitian menunjukkan bahwa media pembelajaran ANCERMAT memenuhi skor valid 4,53 dengan kriteria sangat tinggi dan memenuhi uji kepraktisan berdasarkan respon siswa mencapai skor rata-rata 4,41 dengan kriteria sangat baik. Berdasarkan hasil uji gain mencapai 0,580 dengan kriteria sedang dan memenuhi kriteria ketuntasan minimal pembelajaran dengan $t_{hitung} = 27,33 > t_{tabel} = 2,042$ artinya skor rata-rata tes keterampilan pemecahan masalah memenuhi kriteria ketuntasan minimal pembelajaran.

Kata kunci: ANCERMAT (antologi cerita matematika), media pembelajaran digital, keterampilan pemecahan masalah siswa sekolah dasar.

Abstract

Rapidly developing technology and digitalization must be utilized in the field of education. The use of digital-based learning media is very necessary for teachers. The existing limited media becomes the main reason why ANCERMAT (anthology of mathematical stories) learning media is developed and expected to be able to improve elementary school students' problem solving skills. This study aims to determine the stages of the development of ANCERMAT learning media (anthology of mathematical stories), to find out whether it meets valid and practical criteria, and effective. The method used was the development research. The data analysis comprised of validity test analysis, practicality test analysis, and analysis of ANCERMAT media effectiveness, using descriptive statistics and Gain normalization test. The results showed that ANCERMAT learning media met the valid score of 4.53 with very high criteria and fulfilled the practicality test based on the students' responses reaching an average score of 4.41 with very good criteria. Based on the gain test, it reached 0.580 with moderate criteria and met the minimum criteria of mastery learning with $t_{count} = 27.33 > t_{table} = 2.042$, meaning that the average score of the problem-solving skill tests met the minimum criteria of mastery learning.

Keywords: ANCERMAT (anthology of mathematical stories), learning media digital, elementary school students' problem solving skills.

INTRODUCTION

The educational paradigm in the industrial revolution 4.0 era has become the main topic to talk about in the field of education. As it is known that industrial revolution 4.0 is a trend in the industrial world, combining automation technology and cyber technology. The world changes as now entering the industrial revolution 4.0 era or the fourth world industrial revolution where information technology has become the basis in human life (Subekt, H., Taufiq, M., Susilo, H., Ibrohim, I., & Suwono, H., 2018). Obviously, the industrial revolution 4.0 has greatly affected the world of education. The utilization of information technology is needed to create creative, competitive, and innovative generations.

Monotonous learning activities are no longer happening in classrooms nowadays, neither teachers using out-fashioned teaching models, nor using non-IT-based- teaching media. If those do exist, it will absolutely make students tend to be bored in the classrooms, so in the end, the knowledge won't properly be received by the students. Therefore, teachers, as human resources playing main roles in learning and teaching activities, are necessarily supposed to always keep updated with their knowledge and adjusted to the development of IT.

One effort to do that, in the field of education, to adjust the Industrial Revolution 4.0 era is by utilizing IT advancement for learning. The very rapid development of applications on the internet and smartphones doesn't guarantee that the utilization of IT is a whole lot maximum in the education sector. Teachers still find themselves busy with teaching administrations and pay less attention to practical matters in learning and teaching. The effect of the industrial revolution is the use of the internet in various ways and is better known as the Internet of Things (IoT). Despite its gradual progress, slowly but surely, the world of education will change into betterment, such as the early use of virtual or online learning and teaching. Thus, it can truly be said that the learning and teaching process assisted by the use of technology and information becomes the initial step in implementing today's learning. Learning and teaching.

A process by utilizing information technology has begun to be developed to provide many benefits as stated by Fitriyadi, H (2013) that the use of information and communication technology offers so many opportunities so that it can lead to being better and more interesting learning experiences. This will be a significant challenge to change what technology promises into reality in the learning and teaching process. In a school environment, the improvement of human resource quality has been utmostly implemented. Teachers have often been provided with training and technical assistantship related to learning innovations, both about technology and media usage. However, the development of media is still insignificant. This happens because the teachers have limited time and lack of ability to use technology. Therefore, the learning and teaching process really needs a change in learning media by technological developments. Eventually, the teachers can make use of it in learning to make the students enthusiastic in learning.

Technological developments can also be seen from the existence of many applications which have been made. One of them is Ispring suite 8 application, an app which can be utilized in learning and teaching process. It is integrated in Microsoft PowerPoint. This app has many features and is easy to operate. In making information technology-based media, you can use ispring suite 8 application. One of the features is making a book-shaped media with an attractive out-look. In order to provide input and to meet the needs related to instructional media in the world of education, ANCERMAT or Anthology of Mathematical Stories can be used as an alternative learning media that can be selected since it is IT-based. ANCERMAT is presented with a variety of stories containing mathematical contents and developed along with ispring suite 8 app. The ispring suite app in learning has been used before. Among of which is the creation of a media developed with ispring suite 7 app by Sasahan, E. Y (2017) in developing interactive media in university classes. Ispring suite as an integrated tool in Microsoft PowerPoint makes this application easy to use for beginners.

Hypothetical Learning Trajectory (HLT) is an instrument that guides the process of conducting research design, as an extent to a thought experiment developed by Freudenthal. HLT consists of three components: learning objectives which define the learning targets (learning goals), learning activities, and hypotheses of the learning process to predict how students' thoughts and understanding will develop in the learning activities context. Hypothetical Learning-based model accommodates students' thinking levels and trains them to think critically in solving problems. Through this model, students are given opportunities to guess the solution of a problem based on their thinking abilities. After that, a small experiment or certain data collection is carried out to test the student's thinking. From this activity, the learning process of students runs very effectively and independently. As Wijaya's statement, A claims that the formulation of hypothetical learning trajectory serves as a guideline for the implementation of learning as well as an anticipatory action toward possible problems faced by students in the learning process. In learning, the duration of time is also very much considered as (Cahyaningtyas et al. 2020) learning is carried out for a long time for 7 hours a day according to international education standards. And looking at the complexity and size of the task in learning it is not surprising that excellent task planning and progress monitoring should be provided (Janssen et al. 2012).

Mathematics is still a hated and unpleasant subject at school. In fact, many junior high school students fail to enroll in high school math and science classes. It's not that they don't have abilities, but they have negative dispositions or negative perceptions of mathematics. (Kusmaryono et al. 2019). An appropriate learning model is needed for learning mathematics

in elementary schools that emphasizes or encourages students to really understand problems and know how to solve problems well so that all students really understand and there is no reason to rely on friends when given assignments by the teacher (Uliah, Kusumadewi, dan Islamiati 2017). Facing such problems, a solution is needed in the use of innovative learning that is more fun and interesting and can make students active in learning activities so that they understand the basic concepts of mathematics (Uliah and Sari 2018). Problem-solving skill is one of the targets in the 21st Century education. In the learning process, students are not only supposed to receive knowledge but also to apply it for solving problems. Based on sources from the Future of Jobs Report, the World Economic Forum, one of the ten soft skills required to face of the Industrial Revolution 4.0 is complex problem-solving. Problem-solving as the 21st-century learning framework, as stated by Wijaya, EY, et al (2016) that the 21st-century learning paradigm emphasizes critical thinking and problem-solving skills, in which students should think critically, laterally, and systemically, especially in the context of problem-solving. So, it can be concluded that problem-solving becomes important in educational targets. Based on the background explained above, media adjusted with the development of information technology and with the latest learning innovations should be developed and aimed at improving students' problem-solving skills.

Solving problem-based problems will train students' thinking skills. From this thinking, the process produces a solution using a certain strategy. As (Arifuddin 2018) states that problem-solving ability is an attempt to find a way out of a difficulty to achieve a goal that is not so easy to achieve immediately. Problem-solving skills are also based on a good understanding of concepts. Increased understanding of concepts can also improve problem-solving, one of the efforts to improve conceptual mathematics by developing learning media because it can stimulate student thought patterns through ideas from the conceptual material being studied (Walid et al. 2019). Learning media are very diverse, including those that are by technological developments, both printed and non-printed. Technological advances used in learning media have a powerful potential in transforming learning (Kusumadewi, Neolaka, and Yasin 2020). The application of technology in the learning process in schools has slowly begun to be applied in Indonesia. In line with the continued development of technology and the expansion of technological advances to the interior, although with limitations, learning can now be done through computers that are accessible to the internet (Arifin and Herman 2018). Learning media can increase effectiveness and efficiency in achieving learning goals. The use of media in the learning process can attract and motivate students. One of the media that teachers can use in learning is by using computer media which can act as an effective medium for students in improving learning outcomes (Hakim and Windayana 2016). The development of science and technology leads to increasingly significant changes and towards a practical era. In the education sector, the development of information technology. Exploring the management system as well as the learning system in the classroom, students will be more interested in using "contemporary" and familiar facilities with the students' daily situations (Putra, Wijayati, and Widhi 2017).

In problem-solving, there is also solving complex problems that accommodate various things such as human problem solving, expertise, decision making, and intelligence (Fischer, Greiff, and Funke 2012). Problem-solving skills are closely related to critical thinking skills. (Arifuddin 2020). However, the problem-solving presented in this study is related to problem understanding indicators, problem-solving plans, problem-solving, and re-checking for solutions. A literacy culture should be instilled in children immediately because a child's

reading hobby is greatly influenced during learning. If a child is fond of reading from an early age, it is believed that this hobby will carry over to adulthood (Ulia, Ismiyanti, and Setiana 2019). Practicing problem-solving through literacy activities packaged in the form of learning media developed by the development of digital technology is expected to be a valid, practical, and effective media innovation.

METHODS

The method used was Research and Development (R&D) with descriptive analysis, because this study developed a certain product and tested its effectiveness. The product mentioned was *ANCERMAT* learning media (anthology of mathematical stories) assisted with Ispring suite 8 application. In addition, a descriptive method was used to describe the results of data analysis obtained, concluded and then formulated in terms of suggestions or recommendations based on these data. The development of instructional media used a modified Plomp (1997) model that is, excluding the implementation Stage after the test, evaluation, and revision Stages completed. The activities done in the development include:

1. Initial Investigation Stage

The activities carried out were identifying, studying existing problems and examining the development of *ANCERMAT* (anthology of mathematical stories) learning media assisted with ispring suite 8 application.

2. Designing Stage

In this stage, the design of *ANCERMAT* (anthology of mathematical stories) learning media was developed with ispring suite 8 application in improving the problem solving skills of Elementary School Students.

3. Realization (Construction) Stage

At this stage, Prototype 1 (initial) was produced as the realization of the result of the model design. The result of this activity is called Prototype 1 *ANCERMAT* (anthology of mathematical stories) learning media.

4. Test, Evaluation, dan Revision Stage

At this stage, validation and prototype 1 testing were carried out. The type of instrument used in this stage was the validation sheet. In this activity, inputs from experts and practitioners were inserted in terms of the prototype 1 feasibility, which had previously been realized. Furthermore, an analysis of the validation result from the validators and the revision based on inputs and the following practicality and effectiveness tests were conducted.

This study was conducted in one of the elementary schools in Semarang City, Central Java, Indonesia. The instrument used in this study was Problem-Solving Test Questions in the form of essay, to find out the students' problem-solving skills. Besides, Validation Questionnaire on learning media was occupied to determine the validity of the *ANCERMAT* (Anthology of Math Stories) media by expert validators. Students' response questionnaires were also used to determine the students' responses after the implementation of learning process using *ANCERMAT* (anthology of mathematical stories) learning media assisted with ispring suite 8 app based on hypothetical learning trajectory (HLT) model. Based on the results of expert validation and the results of limited scale trials, the teaching material developed was revised

again and made improvements according to suggestions and input (Uliah et al. 2020). The data analysis was using descriptive statistical analysis comprising of counting the average, median, mode, variance and standard deviation. Furthermore, one sample t-test was used to determine the students' learning achievement based on the result of problem-solving tests. In the Validity Test, the validators gave an assessment result on the media. The validators' assessments were based on several categories according to the rubric of each indicator made by the researchers. The validation sheet contains the assessment data of each validator toward *ANCERMAT* (anthology of mathematical stories) media and then analyzed based on the average scores. The average scores of each validation were calculated by counting the average scores by adding up the validator scores in each aspect divided by the number of aspects of the assessment. A description of the average scores from the media assessment used on a five scale includes: $1.0 \leq \text{average} < 1.8$ means 'bad', $1.8 \leq \text{average} < 2.6$ means 'Poor', $2.6 \leq \text{average} < 3.4$ means 'fair', $3.4 \leq \text{average} < 4.2$ means 'good', $4.2 \leq \text{average} \leq 5$, means 'very good'. The Criteria in the validity test are that learning media was said to be valid if the average scores of each validator was in category 'good' or 'very good'.

Whereas in the Practical Analysis, the students' response questionnaire data were analyzed by finding the average scores of students' choice in accordance with the statement given. Students' response criteria were based on the average students' choice on the questionnaire sheets with each statement given a choice of scores 1, 2, 3, 4 or 5. The media was said to be practical if the teachers' responses were in 'good' or 'very good' category and the students' responses were also in 'good' or 'very good' category.

The Analysis of the students' problem-solving improvement was calculated using the normalized gain test. The magnitude of the improvement of pre and post learning was measured by referring to the normalized gain category (g) including $-1.00 \leq g < 0.00$ which interpreted decreasing, $g = 0.00$ interpreted no development, $0.00 < g < 0.30$ interpreted low, $0.30 \leq g < 0.70$ interpreted Moderate, $0.70 \leq g \leq 1.00$ interpreted High (Sundayana, 2016)

RESULTS AND DISCUSSION

Based on the stages of the *ANCERMAT* (anthology of mathematical stories) learning media development which have been carried out, it can be explained as follows:

1. Initial Investigation Stage

In the initial investigation stage, observation and interviews related to the students' problem-solving skills and Mathematics learning in Grade V were conducted. From the result of the initial investigation, it was obtained information that Mathematics learning process in the Elementary School has so far never made use of technology. There haven't been any innovations in the form of learning media used by the teachers. They have only made use of PowerPoint app. Also, the students' problem-solving skills were still low, this was based on the observation previously conducted when they were asked to work on the essay or stories related to problem-solving. They were still complaining, asking for the teacher's guidance, finding it difficult to finish and eventually, the scores of problem-solving did not reach the minimum completeness criteria. The result of initial investigation was used as a background for the development of *ANCERMAT* (anthology of mathematical stories) learning media to improve the students' problem-solving skills.

2. Designing Stage

At the design Stage, *ANCERMAT* (anthology of mathematical stories) learning media in terms of algorithm was made, assisted with ispring suite 8 app. This was aimed to improve the students' problem-solving skills. The app used was the combination of several programs, such as PowerPoint, MS Word, Visual Basic and Ispring Suite 8. The application design was interestingly made by putting the instruments inside. The design of *ANCERMAT* (anthology of mathematical stories) learning media was done through several stages, such as making algorithms, determining patterns and designs, preparing mathematical stories, and uploading mathematical stories, and combining stories in an application.

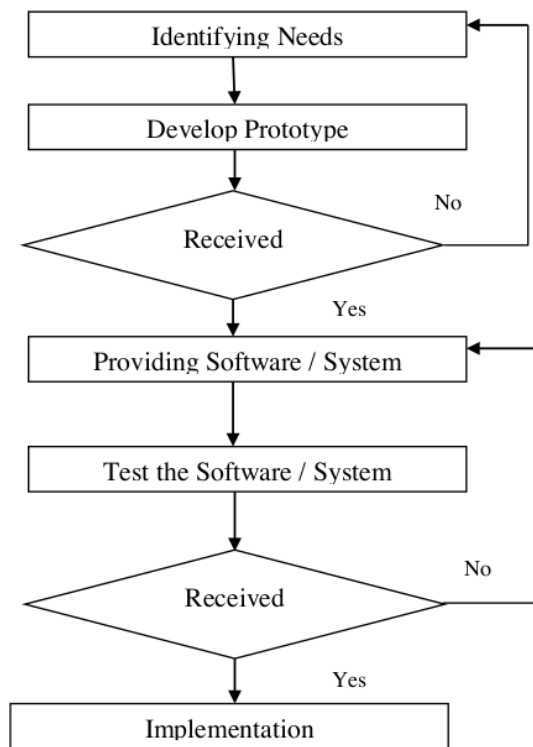


Figure 1. Algorithm for media development

3. Realization (Construction) Stage

At this stage, Prototype 1 was produced as a realization of the design result of the model. The result of this activity is called Prototype 1 of *ANCERMAT* learning media. The result of the design of *ANCERMAT* (anthology of mathematical stories) learning media was in the form of drafts which were needed to be re-checked whether the media was in accordance with the concept given or not. From the result of prototype 1 which has been revised based on the inputs of the validators, it is called *ANCERMAT* learning media.

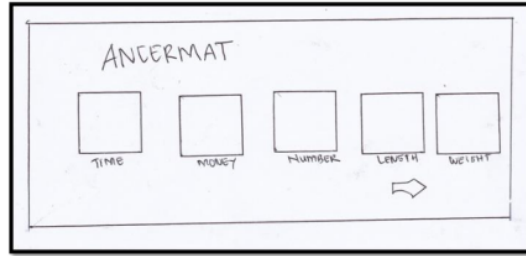


Figure 2 The Design of *ANCERMAT* Prototype

Indeed, the initial design required inputs from the validators. At this stage, the researchers provided inputs related to design and application contents which were synchronized with learning process using the Hypotetical Learning Trajectory (HLT) Model.

4. Test, Evaluation, and Revision Stage

In the test stage, evaluation and revision are repetitive processes related to the improvement of the product being developed. This test is called the expert validation test. The experts appointed were 2 class teachers and 3 lecturers of Elementary School Education Department. Whereas, the experts' validation related to the application resulted in a score of 4.51 with 'very good' criteria. At this stage, there was also a revision process before the valid criteria were obtained. The recapitulation of the revised prototype draft is as follows.

¹ Table 1. The Results of the Experts' Validation Revision

| No | Validators' Inputs | Revision |
|----|--|--|
| 1 | The writing on the app still looks small and unclear. | Zoom icon facility should be given on the app to magnify the screen. |
| 2 | The color used is too striking. | The colors in the design are made softer. |
| 3 | There is only 1 musical instrument that looks monotonous. | There should be additional music instruments on the app. |
| 4 | The story given is too long for children. | The story should be shortened but does not change the content. |
| 5 | the connection with the Hypotetical Learning Trajectory (HLT) Model has not concretely been seen | It will be developed during the learning prosses in the implementation of the Hypotetical Learning Trajectory (HLT) Model. |

After doing revisions based on the inputs from the validators, the researchers proceeded to the practicality and effectiveness stages of the *ANCERMAT* (anthology of mathematical stories) media.

The stages of the *ANCERMAT* (anthology of mathematical stories) Learning Media development are initial investigation, designing, construction, evaluation and revision. As explained earlier, each stage has a process with certain procedures. The *ANCERMAT* here is created by using Isping suite 8 app supported by Microsoft PowerPoint app. On the application, there are stories containing mathematical calculations. From the results of the application in mathematics learning in Grade V of elementary schools, any learning models can be used. The *ANCERMAT* (anthology of mathematical stories) is an applicable learning media. Since this study applies hypothetical learning trajectory (HLT) model, the learning steps used are in accordance with the stages of the learning model. The main elements in the hypothetical learning trajectory (HLT) model are learning objectives, learning processes and hypotheses. As Simon (Bakker, 2004) defines that HLT (Hypotetical Learning Trajectory) consists of three components, namely 1) learning objectives that define goals, 2) learning activities, and 3) hypotheses of the learning process to predict how students' thoughts and understanding will develop in learning. The *ANCERMAT* Learning Media has five menus containing stories in accordance with the themes on the selected menu. The five menus are Currency, Weight, Time, Number and Weight. The home page of the *ANCERMAT* (anthology of mathematical stories) can be seen as follows.



Figure 3: The home page of *ANCERMAT* display

The *ANCERMAT* (anthology of mathematical stories) app cover looks nice, funny and interesting for elementary school students. The learning process using digital-based learning media makes them more motivated to learn. This is shown when they use the *ANCERMAT* (anthology of mathematical stories) app. They are very enthusiastic about learning mathematics. They are very interested in learning application as a learning media which is appropriate to the present era, because children are very familiar with Android and smartphone applications. In Indonesia, the increasingly developing technology needs to be directed to the education sector. Computer is now an important part of education as a study conducted by Wood & Howley (2012) in US schools which shows that the use of computers for students will be more sophisticated and innovative in learning. The effect of technology media on social environment can be found everywhere, in today's world; the media has

become a way of life, the media informs us, comforts us, and connects us to the world [10]. The advent of technology into new media can potentially change education radically. Media technology is important to be understood by academics and practitioners as a good intention that will affect student behavior. Thus, *ANCERMAT* as one of the technological products developed in the field of learning is expected to have a good effect on students.

At the stage of the *ANCERMAT* (anthology of mathematical stories) learning media development, there are tests, evaluation and revision. Validity and practicality tests are available at this stage after construction stage. Validity test aims to determine whether the *ANCERMAT* (anthology of mathematical stories) learning media supported with ispring suite 8 app meets the valid criteria or not. To test the validity of the media, a validator is needed as a validation expert related to the content and construct of the media. The validation experts consist of 2 teachers and 3 lecturers. The aspects assessed on the validation sheet include aspects of format, language, content, conformity to the learning model, as well as the relationship of the material to the problem solving variables. During validity testing, the researchers show that the *ANCERMAT* (anthology of mathematical stories) application assisted with ispring suite 8 app as an assessment material. From the result of the expert validation questionnaires, the following recapitulation is obtained.

Table 2. Summary of the Expert Validation Results

| No | Aspects assessed | Validators' Average Scores |
|-----------|--|----------------------------|
| I | Format | |
| 1 | The app cover design is interesting | 4.20 |
| 2 | The choices of music and instruments in the app are interesting | 4.40 |
| 3 | Visually Interesting | 4.40 |
| 4 | The fonts and their sizes are Appropriate | 4.40 |
| 5 | The settings of layout, spacing, space and images | 4.40 |
| II | Language | |
| 1 | The structures are measured, corrected and adjusted with the EYD (perfected spelling rules in Indonesian language) | 4.40 |
| 2 | The sentences are adjusted with the students' cognitive thinking levels, reading skills, and ages. | 4.40 |
| 3 | The manual is clear | 4.60 |

| III Content | |
|--------------------|--|
| 1 | The app is adjusted with the materials 4.60 |
| 2 | The materials are adjusted with the students' age or groups 4.80 |
| 3 | The question tasks are adjusted the materials on the app 4.60 |
| 4 | The app is adjusted with Problem-Solving Skills; Problem-Solving based-app 4.60 |
| 5 | The app is in accordance with the stages of the hypothetical learning trajectory (HLT) model |
| a. | The app contains the stage, directing target to the learning objectives 4.40 |
| b. | The app covers the stage exploring the learning activities 4.80 |
| c. | The app leads the students to the hypotheses of the learning process 4.80 |
| 6 | The material contents of the app encourage the students' activities 4.40 |
| 7 | The app contents can stimulate the students to problem solving skills 4.80 |
| Total | |
| 77 | |
| Average | |
| 4.53 | |
| Category | |
| Very Good | |

From the table above, an average result of 4.53 is obtained. Based on the criteria, it is in 'very good' category. Even so, the validators also provide criticism for the media improvements. The researchers immediately respond them with revision so that it can be used for the next stages. After meeting the 'valid' criteria, then practicality test can be carried out. The practicality test in this study is based on the student response questionnaires. From the results of the questionnaires, the average score is 4.41 with 'very good' criteria. For more details, the recap can be seen in the following table.

Table 3. The Recapitulation of Student Response Results

| No | STATEMENTS | Average Scores | Criteria |
|---------------|---|----------------|-----------|
| 1 | I know how to use the <i>ANCERMAT</i> (anthology of Mathematical short stories) app | 4.33 | Very Good |
| 2 | The <i>ANCERMAT</i> app has an interesting design | 4.63 | Very Good |
| 3 | The <i>ANCERMAT</i> app uses interesting music and instruments | 4.30 | Very Good |
| 4 | I can clearly read the story or writing on the <i>ANCERMAT</i> | 4.03 | Good |
| 5 | I like Math subject using computer applications, such as the <i>ANCERMAT</i> | 4.57 | Very Good |
| 6 | I understand the Mathematical story on the <i>ANCERMAT</i> app | 4.37 | Very Good |
| 7 | I can plan to answer problem-solving questions based on the Mathematical story of the <i>ANCERMAT</i> | 4.60 | Very Good |
| 8 | I can solve the problem presented in the <i>ANCERMAT</i> app | 4.60 | Very Good |
| 9 | I don't feel bored with learning mathematics | 4.30 | Very Good |
| 10 | Learning Mathematics is more fun for me | 4.40 | Very Good |
| Average Score | | 4.41 | Very Good |

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Based on the table above, it can be concluded that the students give good responses to the *ANCERMAT* (anthology of mathematical stories). From the average results, the highest scores are in the statements dealing with the *ANCERMAT*'s interesting design and its benefits in improving problem-solving skills, both on understanding problems and even problem-solving itself. The students play an active role in learning. The use of IT-based media indeed gives its own impression for students. As the research conducted by Hadi S.S (2013) related to application based-learning, claiming that students can better understand the material and be more interested and favorable in learning by using three-dimensional models for the material enrichment. Learning media is also as a helping tool in teaching and learning activities (Nugrahani, 2007). This tool can represent something that cannot be conveyed by teachers to the fullest, so that students' difficulties in learning can be overcome by using learning media.

Therefore, teachers should always use media, especially the ones interesting to students. Since by using media, the material presented will easily be understood and digested by students. Also, it becomes easy to convey the material. As Umiyati (2015) argues that teachers are required to be more creative and innovative in designing and using learning media in creating an active, creative, effective and fun learning atmosphere.

In this study, the *ANCERMAT* (anthology of mathematical stories) learning media assisted with Ispring suite 8 application is applied in Grade V using hypothetical learning trajectory (HLT) model. The stages of learning activities include an introduction which comprises of learning objectives delivery, core activities consisting of learning activities and hypotheses of the learning process and final activities. Before using the *ANCERMAT* (anthology of mathematical stories), the students are given hypothetical learning trajectory (HLT) learning. They are trained in how to construct hypotheses from an activity. Then they test the hypotheses which have been made with the ongoing learning process.

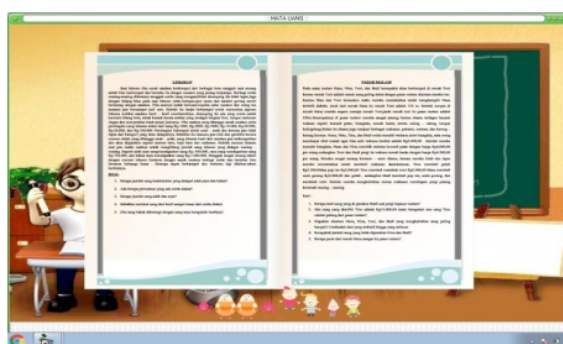


Figure 4 The *ANCERMAT* media Display

In this activity, the use of *ANCERMAT* is as a media in presenting problems. The *ANCERMAT* (anthology of mathematical stories) contains stories which comprise of mathematical calculations. The delivery technique to students is by directing the questions first, the students then predict, look at the readings in the *ANCERMAT* with the aim to check whether the prediction is right or wrong, and they can eventually give their reasons. The problem-solving skills of elementary school students are initially still low as seen from the pre-test score given. The average score obtained has not reached the minimum criteria of mastery learning yet, which is 65, but the average score only reaches 60.33. More details can be seen in the following table.

Table 4. The Recapitulation of Problem-Solving Test Results

| No | Description | Pre-test | Post-test |
|----|--------------------|----------|-----------|
| 1 | Average | 60.33 | 83.33 |
| 2 | Median | 60.00 | 83.5 |
| 3 | Mode | 60.00 | 80 |
| 4 | Standard Deviation | 5.4 | 3.7 |
| 5 | Variant | 29.5 | 14.00 |

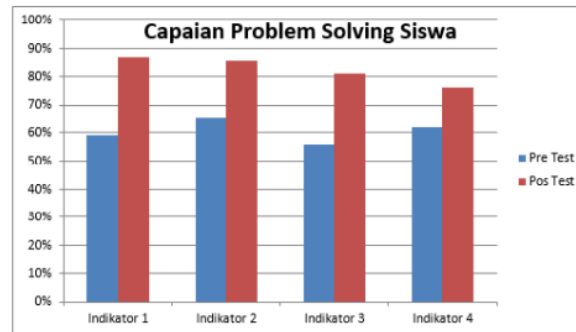
After being analyzed, the students still cannot understand the problems, neither planning for solution. They straightly go to problem-solving, but it's still incorrect. There are also students who can solve problems but are not careful enough. Some are still unable to re-check the results of problem-solving they find. Thus, based on the pre-test results, it is necessary to develop learning innovations in the form of learning media that can improve the students' problem-solving skills.

In the hypothetical learning trajectory (HLT) model, there is a hypothetical learning flow which means a conjecture of a series of activities that children go through in solving a problem or understanding a concept. And, learning flow is a series of activities which are actually traversed by children in solving a problem or understanding a concept. During the implementation of hypothetical learning flow test, it may undergo a number of changes or improvements. The flow obtained is based on a number of revisions called 'learning flow'. So, learning flow is "the result of revisions of the hypothetical learning flows based on the events occurring during learning process". This certainly affects the students' problem-solving skills (Nurdin, 2011). The indicators of students' problem-solving achievement in the hypothetical learning trajectory (HLT) model are as follows.

Table 5. The Indicators of The Problem-Solving Achievement

| No | Indicators | Pre-test | Post-test |
|----|---|----------|-----------|
| 1 | Understanding the problem | 59% | 87% |
| 2 | Planning to problem-solving | 65% | 86% |
| 3 | Solving the problem | 56% | 81% |
| 4 | Re-checking the results of the solution | 62% | 76% |

Changes in problem-solving skills between pre and post learning process using the *ANCERMAT* seem significant. The difference between the pre-test and post-test and the achievement of each indicator is very clear. This increase possibly occurs because of digital-based learning media. The previous research has been carried out by Kalelioglu, F., & Gülbahar, Y (2014) who has taught computer programming to elementary school students because it is considered an important competency to develop problem-solving skills in addition to logical reasons. It turns out to be true, because students like studying and have their problem-solving skills trained and improved them. The achievements of each indicator can be seen in the following figure.



Graph 1. The Graphic Achievement of the Problem Solving Indicators

The improvement in problem-solving skills is obtained from the data processing using n-gain. From the normalized gain test results, the class average obtained a gain value of .580 with moderate criteria.

Besides conducting the normalized gain test, analysis was also done using one sample t-test from the data of students' problem-solving skills. One sample t-test was used to compare students' problem-solving skills with minimum criteria of mastery learning of $y \geq 65$. Based on the calculation of the data obtained $t_{count} = 27.33 > t_{table} = 2.042$, thus H_0 is rejected and H_1 is accepted. So, it can be concluded that the average score of the students' problem-solving skills test more than 65 is correct.

Students are enthusiastic in learning, it can be seen when they are having a discussion, communicating, asking questions and so on. Their confident and independent attitude emerges. This is also because of the trajectory learning, which consists of learning activity components which on its application serve as a learning flow in problem solving and is a process (Chuang, Y.C., 2002). They don't feel no fear of making a mistake, especially in operating the *ANCERMAT* app. This atmosphere is very influential on students' problem solving skills as stated in a research conducted by Parkinson, M., & Creswell, C (2011) which concluded that students with high levels of worry make problem-solving skills, self-confidence and perception lower. Therefore, it needs a learning atmosphere that makes students' self-confidence in solving problems increase so that their problem-solving skills also increase.

From the discussion that has been presented, it can be stated that the *ANCERMAT* (anthology of mathematical stories) learning media assisted with Ispring suite 8 app meets the valid, practical and effective criteria to be applied to the hypothetical learning trajectory (HLT) model and therefore, it can improve the problem-solving skills of elementary school students.

CONCLUSION

The stages of the *ANCERMAT* (anthology of mathematical stories) learning media development are supported by Ispring suite 8 app on hypothetical learning trajectory (HLT) model which consist of initial investigation, designing, construction, evaluation and revision tests. *ANCERMAT* (anthology of mathematical stories) learning media assisted by Ispring suite 8 app meets valid and practical criteria. With the validity test, the average score is 4.53 with valid criteria. And practically based on the students' responses, it reaches an average score of 4.41 with 'very good' criteria. The *ANCERMAT* (anthology of mathematical

stories) learning media assisted by Ispring suite 8 app on the hypothetical learning trajectory (HLT) model can improve the problem-solving skills of elementary school students based on the gain test reaching .580 criteria and meeting the minimum criteria with $t_{count} = 27.33 > t_{table} = 2.042$ means that the average score of problem-solving ability tests has met the minimum criteria.

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