Learning the Concept of Absolute Value with Hawgent Dynamic Mathematics Software

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ABSTRACT. Understanding the concept is one aspect that is needed and must be owned by students in learning mathematics. This research aims to make learning media assisted by hawgent dynamic mathematics software on understanding the absolute value in grade 10 Senior high school to help teachers explain the concepts and assist students in finding and understanding the basic concepts of absolute value topic. The development model used in this research is ADDIE development model. ADDIE is an abridgment of Analyze, Design, Develop and Evaluation. Researchers the learning media Hawgent can help students to understand and find the concept of absolute value. Based on several aspects, clearly and attractively with an average of 78.9% in the excellent category. It is concluded that the development of learning media Hawgent dynamic mathematics software can be used on the subject of understanding the concept of absolute value and with the help of this software it can help teachers explain the concept of absolute value and the students are also very interested in this ICT-based learning media. This conclusion is related to the validation results of media experts and material experts, where the validation results from media experts on the use of learning media are in good categories.

Keywords: Mathematics Learning, Mathematical Concept, Absolute Value, Hawgent Dynamic Software

ABSTRAK. Pemahaman konsep merupakan salah satu aspek yang sangat dibutukan dan harus dimiliki oleh siswa dalam pembelajaran matematika. Oleh karena itu, tujuan dari penelitian ini adalah membuat media pembelajaran berbantuan hawgent dynamic mathematics software pada materi pemahaman nilai mutlak pada SMA kelas 10 untuk membantu guru menerangkan konsep serta untuk membantu siswa dalam menemukan dan memahami konsep dasar pada materi pemahaman nilai mutlak. The development model used in this research is ADDIE development model. ADDIE is an abridgment of Analyze, Design, Develop and Evaluation. Siswa dan guru menganggap media pembelajaran Hawgent dynamic mathematics sebagai media yang dapat membantu untuk memahami dan menemukan konsep suatu materi berdasarkan beberapa aspek diatas dengan jelas dan menarik dengan rata-rata 78.9% dengan kategori baik. Disimpulkan bahwa pengembangan media pembelajaran Hawgent dynamic mathematics software dapat digunakan pada pokok bahasan pemahaman konsep nilai mutlak dan dengan bantuan software ini dapat membantu guru menjelaskan konsep nilai mutlak dan pihak siswa juga sangat tertarik dengan media pembelajaran yang berbasis TIK ini. Kesimpulan ini diikaitkan hasil validasi dari ahli media dan ahli materi, dimana hasil validasi dari ahli media pada penggunaan media pembelajaran ini dengan kategori baik.

Kata kunci: Pembelajaran Matematika, Konsep Matematis, Nilai Mutlak, Hawgent Dynamic Software
INTRODUCTION

Education is the most important for improving the quality of human resources so the people are required to continue to strive to learn (Dini, Wijaya, & Sugandi, 2018), understand, and master various disciplines to be applied in all aspects of life (Chatmaneerungcharoen, 2019; Surya, Zulfah, Astuti, Marta, & Wijaya, 2020), especially in the field of mathematics (Asamoah, 2019; Fitri, Sibuea, & Handayani, 2019; Jafar, Budayasa, & Juniati, 2018; Van den Heuvel-Panhuizen & Drijvers, 2014). Because mathematics as the mother of all knowledge and plays an important role in the world of education, it is often very difficult for students to understand the concepts (Landry, 2010; Rohendi, Septian, & Sutarno, 2018; Tabach & Trgalová, 2020).

Understanding the concept is one aspect that is needed and must be possessed by students in learning mathematics (Badraeni et al., 2020; Cunhua, Ying, Qunzhuang, & Wijaya, 2019; Hermita, Alpusari, Noviana, Kurniaman, & Islami, 2020). Such as the learning principle recommended by the National Council of Teachers of Mathematics (NTCM) that, "student must learn mathematics with understanding, actively building new knowledge from experience and prior knowledge" (Siagian, 2016; States, 2013) which means learning mathematics students must learn with understanding and actively build on new knowledge from previous experiences and knowledge.

In Bloom taxonomy, students' understanding of the concept is essential and is the main goal of educational institutions in general (Caniglia & Meadows, 2018; Heer, 2018). Therefore, we are required to strive to teach students well so that students understand the concepts of each mathematical topic in general and mathematics material well in particular. Furthermore, Learning mathematics is very difficult to understand, especially abstract material, which requires many methods to understand it (Earnest, Gonzales, & Plant, 2018).

Previous researchers' results have identified several things that cause student errors when they solve mathematical problems. The teacher only teaches students with methods that are often used and repeatedly used without the help of ICT-based learning media (T T Wijaya et al., 2020; Zulnaidi, Oktavika, & Hidayat, 2020), students often got difficulties, because the teacher does not explain the concept of the material on the subject being taught so that it creates difficulties in the process of understanding the concept of the topic (Duval, 2006).

Therefore, understanding mathematics concepts is one of the main steps students can prepare to receive and understand the next mathematical topics (T.T. Wijaya, Ying, & Purnama, 2020a). One of the mathematical concepts that is difficult for students to understand is the concept of absolute value. Absolute value is taught in grade 10, Senior high school. Students in understanding absolute value must be able to understand the elements that build absolute value deeply. Absolute value is nothing but the distance of a number to zero on a real number line (Goleman et al., 2019; Moulidiantina, n.d.). This concept is very important because it is the basis for building several concepts in basic calculus on the subject of limits.

For this reason, students must be taught the concept in-depth so that these students have a complete understanding. Learning mathematics at the secondary education level, specifically the material for understanding the concept of absolute value, aims to make students understand the concept. Students can explain the relationship between the elements that build an understanding of the concept of absolute value and so that students can achieve the goals that have been formulated in the mathematics learning implementation plan.

The developments in information and communication technology in this era have brought very important benefits for human life sustainability. On this occasion, we can design mathematics learning media as a learning aid that can be used to encourage students to learn mathematics in understanding mathematics materials. ICT can also help teachers explain abstract mathematics material so that students can easily understand it (Habibi, Yusop, & Razak, 2020; Pellegrino et al., 2014; Voithofer, Nelson, Han, & Caines, 2019).
Hawgent dynamic mathematic software is dynamic mathematical software with facilities to visualize or demonstrate mathematical concepts and construct mathematical concepts (T.T. Wijaya, Purnama, & Tanuwijaya, 2020; T.T. Wijaya, Sukma, Purnama, & Tanuwijaya, 2020). Based on the results of previous research, hawgent dynamic mathematics software has been proven to improve students' abilities and assist teachers in explaining the concept of a material (Chotimah, Wijaya, Aprianti, Akbar, & Bernard, 2020; Tan, Zou, Wijaya, Suci, & Dewi, 2020; T.T. Wijaya, Ying, & Purnama, 2020b; Tommy Tanu Wijaya, 2021). Many studies have been conducted using hawgent, but most of these studies have been conducted on geometry and less research has been conducted on the topic of algebra or absolute value using hawgent.

Based on the background of understanding the concept above, the researcher tried to make learning media assisted by hawgent on understanding absolute value in senior high schools to help teachers explain the concepts and assist students in finding and understanding basic concepts material understanding absolute values.

**METHOD**

The development model used in this research is ADDIE development model. ADDIE is an abridgment of Analyze, Design, Develop and Evaluation (Sari, 2018; Sumardani, Putri, & Sumardani, 2020; T.T. Wijaya, Ying, et al., 2020b). Below can be seen the ADDIE research development framework in Figure 1.

1. **Analyze**

   The main activities at this stage are several things that are the main points for analysis. First, to analyze students' difficulties in learning the subject of understanding the concept of absolute value (Bernard, Sumarna, Rolina, & Akbar, 2019; T.T. Wijaya, Jianlan, & Aditya, 2020). Second, analyzing the results of the former researchers on the same subject. The two main points of analysis are linked with methods that are often used and analyze the need to design innovative and creative learning methods and models to overcome these difficulties, it can be seen at the following stage.

2. **Design**

   At design stage the researcher design ICT-based learning media based on the problems analyzed initially, designing the Hawgent Dynamic Mathematics Software learning media on the material of understanding the concept of absolute value. And in the next stage, compile the media validation instrument and material validation instrument by the media and material experts. The learning media can be seen in the Picture 2.
3. Develop

At the development stage, learning media on the topic of absolute value were validated by validators. In this study there are 3 professors from Guangxi Normal University and 4 experts from Indonesia. The results of validation can determine whether the learning media can be implemented or still requires revision. Learning media can be used after the researcher makes perfect revisions to the learning media.

4. Implementation

In the implementation stage, the researcher implemented the design and methods that would be developed in real situations, namely in the classroom and observed the interactions between students and asked for feedback on the initial evaluation process from the students and teachers. In this study, the implementation was carried out in Indonesia by taking a SMA Putra Juang sample, Cianjur.

5. Evaluation

The evaluation stage is done at each stage to produce a perfect learning media product. This is the stage where the Hawgent Dynamic Mathematics Software learning media is being thoroughly tested through formative evaluation.

RESULTS AND DISCUSSION

1. Analyze

The evaluation stage is done at each stage to produce a perfect learning media product. This is the stage where the Hawgent Dynamic Mathematics Software learning media is being thoroughly tested through formative evaluation. At this analyze stage, there are two stages of analysis described by the researcher.

a. Statement of the teacher's difficulty when explaining the absolute value topic

The statement of the difficulties of teachers are, (1) the teacher lacks knowledge of ICT-based learning media so that they always use conventional methods that often neglect students in teaching and learning activities when teaching absolute value topic; (2) the teacher has very shortcomings in understanding the concept of absolute topic so it is difficult to find and explain the concept of absolute topic to students; (3), the teacher has never attended training on new learning media so that there is no ICT-based mathematics learning media used by the teacher to explain the concept of a material.

b. Statement of the teacher's difficulty when explaining the absolute value topic
There are several difficulties the students have are: 1) students find it difficult to find and understand the concept of absolute value; 2) students often experience errors when working on questions about absolute value; 3) students feel very deficient in understanding the concept of the subject of understanding the concept of absolute value.

From some of the teachers' and students' statements above, it can be concluded that many difficulties are often caused by a lack of knowledge about innovative learning media so that they often use conventional methods eventually result in student understanding of the conceptual understanding of a subject. Therefore, designing instructional media can help students and teachers in the teaching and learning process in the next stage.

2. Design

At this stage researchers design ICT-based learning media with Hawgent dynamic mathematics software as well as media creation steps with learning media story board that can be seen in Table 1.

<table>
<thead>
<tr>
<th>Visual</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="Diagram 1" /></td>
<td>There were two children playing in his front yard. From a stationary position to jump forward (pointing to the positive x axis), child A jumps forward 4 steps, child B takes 2 steps, from the result that the two children jump absolutely from a still forward position of 6 steps.</td>
</tr>
<tr>
<td><img src="image2.png" alt="Diagram 2" /></td>
<td>The two children continued to jump around in their front yard. The two children jump from a stationary position in different directions, child A jumps back (towards the non-positive x axis), 1 step, child B jumps forward (points to the positive x axis) 5 steps, of the number of jumps the two children even though they are in opposite directions but are fixed absolutely from a still position in different directions so that they still produce 6 steps by the two children.</td>
</tr>
<tr>
<td><img src="image3.png" alt="Diagram 3" /></td>
<td>The two children continued to jump around in their front yard. The two children jump from a stationary position to different directions, child A jumps forward (points to the positive x axis) 2 more steps, child B jumps back (points to the negative x axis), 4 steps, out of the total. Even though the two children jumped in opposite directions, they were fixed from a still position in</td>
</tr>
</tbody>
</table>
different directions so that they still produced 6 times more steps by the two children.

The next day the two children continued to play in their front yard. However, the two children jumped from a stationary position jumping backwards (towards the negative x-axis), child A jumped backwards 2 times more steps, child B jumped backward but took 5 times more steps from the jump. step back the two children all jump backward but absolutely from a still position to the back as much as 8 steps.

Conclusion, from the story of discovery and understanding of the concept with the help of Hawgent dynamic mathematical software based on Information Communication and Technology (ICT) above, it is concluded that from the jump results of the two children above even though jumping in opposite directions, stepping back (pointing to the positive x axis) and stepping back (leading to negative x-axis), but it is still absolute from rest to how far you want to go.

3. Develop

3.1 Media expert validation data

Learning media is validated by 3 professors from Guangxi Normal university and 4 experts from SMA Negeri 2 Karawang. The results of learning media and material validation can be seen in Table 2. The advice of media and material experts assessment on learning media is to change Hawgent dynamic mathematics software's language to English. So that everyone can use it. From the validation results, it can be concluded that learning media can be implemented.

<table>
<thead>
<tr>
<th>Aspect</th>
<th>Score</th>
<th>Category</th>
<th>Conclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Language</td>
<td>7.8</td>
<td>Good</td>
<td>Learning media language worth a trial with a revision</td>
</tr>
<tr>
<td>Text</td>
<td>8.2</td>
<td>Good</td>
<td>Learning media text worth a trial without a revision</td>
</tr>
<tr>
<td>Content</td>
<td>7.4</td>
<td>Good</td>
<td>Learning materials can be motivating in learning absolute</td>
</tr>
<tr>
<td>Design</td>
<td>7.8</td>
<td>Good</td>
<td>Learning design worth a trial with a revision</td>
</tr>
<tr>
<td>Animation</td>
<td>8.3</td>
<td>Good</td>
<td>Learning media animation worth a trial with a revision</td>
</tr>
<tr>
<td>Concept</td>
<td>7.9</td>
<td>Good</td>
<td>Learning concept worth a trial with a revision</td>
</tr>
<tr>
<td>Curriculum</td>
<td>8.6</td>
<td>Very good</td>
<td>Learning curriculum worth a trial without a revision</td>
</tr>
</tbody>
</table>

The evaluation stage is done at each stage to produce a perfect learning media product. This is the stage where the Hawgent Dynamic Mathematics Software learning media is being thoroughly tested through formative evaluation.

4. Implementation

The following are some statements of students and teachers who are considered to be the result of implementing Hawgent Dynamic Mathematics Software learning media. So it can be more clearly seen in Table 3.
Tabel 3. Students and Teachers Statements in Using Hawgent Dynamic Mathematics Software

<table>
<thead>
<tr>
<th>Aspect</th>
<th>Conclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design</td>
<td>Agree that the learning materials easy to use and interesting</td>
</tr>
<tr>
<td>Language</td>
<td>Agree that the language used is easy to understand</td>
</tr>
<tr>
<td>Contents</td>
<td>Agree that learning materials can be motivating in learning absolute</td>
</tr>
<tr>
<td>Text</td>
<td>Agree that text of learning is clearly to understand</td>
</tr>
<tr>
<td>Animation</td>
<td>Agree that animation of learning media is very attractive and interesting</td>
</tr>
<tr>
<td>Concept</td>
<td>Agree that the language used is easy and simple to understand</td>
</tr>
<tr>
<td>Curriculum</td>
<td>Agree that the according curriculum based learning is easy clearly</td>
</tr>
</tbody>
</table>

In Table 3, it can be seen clearly that students and teachers consider the learning media of Hawgent as a learning media that can help student to understand and find the concept of absolute value based on the above aspects.

Based on the results of teachers and students' statements regarding the operation or use of the media, it is seen at the implementation stage. Where, students' statements in observing the explanation of the discovery and understanding of the concept of absolute value are very satisfying and very helpful for students while there are several statements from the teacher that learning media is very helpful for the teacher, therefore, it is concluded that the use of technology-based learning media is very practical which can use both teachers and students (Mushipe & Ogbonnaya, 2019; Suan, Ying, & Wijaya, 2020; Zhang, Zhou, & Wijaya, 2020).

The results of this study compared to the results of previous study research on the same topic as using conventional methods, so the use of media learning is more than conventional methods because media learning has designs and animations that are interesting and very helpful to students understand the concept of a subject and also help teachers in explaining concepts to students, especially math lessons.

5. Evaluation

After the implementation stage of the Hawgent dynamic mathematics software learning media, there are some things that need to be evaluated like the stage of media learning design on the absolute value only use 2D system so it needs to be designed 3D system to be more interesting, and also has to make the video learning so that easy to access by students and teachers.

CONCLUSION

From several stages of using the method with the results and discussion, it can be concluded that the development of learning media Hawgent dynamic mathematics software can be used on the subject of understanding the concept of absolute value and with the help of this software it can help teachers explain the concept of absolute value and the students are also very interested in learning media based on this ICT. This conclusion is related to the validation results from media experts and material experts, where the validation results from media experts on the use of this learning media are in a sufficient category but need to be slightly revised and the validation results from material experts are also in a sufficient category and need a little revision as well so that in the future more feasible in its use. Based on the above conclusions, researchers recommended that each ICT-based media researcher be able to use this media in schools because this research is limited to creating or creating learning media.

REFERENCES


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