The practicality of the quadratic function module by utilizing Autograph Software and Angry Birds game

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Abstract. The utilization of various learning resources makes students easier to achieve the learning objectives. The information-based and information-driven media-based learning module is a learning source that can help students understand quadratic function. This paper describes the practicality of a learning module of quadratic function that utilizes Autograph software and Angry Birds game. The data were obtained from the pilot study on the learning materials of quadratic function through a cooperative learning model, numbered heads together (NHT) with Autograph software and Angry Birds game. The pilot study was conducted to measure the practicality of the module that has been developed with the Plomp development model. The participants involved 30 students of grade 10 of MAN Model Banda Aceh, Indonesia. The research instruments used were the practicality score sheet and the module observation sheet. The result shows that the learning module of quadratic function utilizing Autograph software and Angry Birds game has fulfilled the criteria of practicality. The three experts stated that the module could be used in the classroom.

1. Introduction
Mathematics learning aims to train students to analyze and simplify the various problems encountered. Through the problems students are expected to foster logical, critical, creative, rational and dynamic thinking skills because problem-solving activities will give students the opportunity to propose ideas and strategies through cooperation [1]. The purpose of learning mathematics can be achieved maximally through the use of appropriate learning media close to students’ daily life, for example, the media-based information technology [2]. Currently, students are accustomed to using various communication tools such as computers and mobile phones. Both devices are used by students to communicate with people in their environment and to obtain information promptly [3].

The proximity of students with technology can be utilized by teachers to maximize the achievement of the mathematics learning objectives. This is because mathematics uses various images and graphics ranging from the simplest to the most complex. The utilization of technology can help teachers and students create images or graphics quickly. In addition, students prefer learning in the form of illustrations instead of oral. This situation can motivate students in learning mathematics [2,4]. Furthermore, the use of technology in mathematics learning can also enhance students’ creativity [5]. This can be achieved through the use of technology as a media of learning by taking into account various aspects of students. For instance, the technology used by teachers that appeals to students making them easier to understand the lessons conveyed by teachers.
Autograph is one of the mathematics software that acts as a learning media to help students do investigations so that students find new things related to the subject matter. Using the software, students can try more instances in a short time. The investigations gave the students the opportunity to discover, construct, and summarize mathematical principles, and thoroughly understand mathematical concepts [6]. The utilization of Autograph software in learning mathematics can improve students' ability [7]. Generally, the use of Autograph software as a media of learning mathematics can help teachers improve the effectiveness of learning [8].

The utilization of Autograph software can be more interesting if assisted with games that students like. Playing games could eliminate the feeling of boredom, stress, fatigue, etc. Games also can be utilized as a media to learn mathematics. The use of games as a media of learning can help high school students to learn better [9]. The learning using games makes students easier to understand concepts and create attractive learning [10].

Angry Birds is a game depicting an angry bird that tries to destroy the enemy fortress with various flying strategies. The flying bird path on Angry Birds game forms a parabola opening downward. The use of the game motivates and makes students easier to imagine motion paths of objects; so that, parabolic motion characteristics are easily understood [10]. Angry Birds game challenges students to find strategies to graph the track. It directs students to interact with projectile motion, connection, and motion apps. Also, this game plays an important role in supporting students' understanding of mathematics learning through an attractive display and the challenges of the game. Thus, Angry Birds can assist students in exploring mathematical concepts [11] and hardly gives negative impacts on students [12].

The quadratic function is a topic studied by junior high school students. In this topic, students are required to master many concepts and procedures such as multiplication, addition, substitution, and drawing function graphics well. Students often make mistakes in principle aspects, calculation, and drawing graphic [13]. The attempt to achieve the learning objectives of the quadratic function by utilizing the Autographic software and Angry Birds game can be maximized with the use of the module. Modules are part of teaching materials that are arranged systematically tailored to the needs of students who can be studied independently. The module is designed in such a way that it looks attractive and easy to understand by readers including the design, content, method, illustration, description, evaluation and reference [14,15].

The contents of the module of quadratic functions are tailored to different learning objectives and student abilities. The module needs to be adapted to the characteristics and circumstances of the students and is practically used as a learning resource in the classroom as well as at home. Students can actively learn through the module without the teachers’ assistance [15,16]. The purpose of this study is to measure the practicality of quadratic function module utilizing Autographs software and Angry Birds game.

2. Method
This research is part of development research on learning materials of quadratic function by using cooperative learning model of Numbered Heads Together (NHT) with Autograph software and Angry Birds game. The learning materials were considered valid, practical and effective by the experts. The development of learning tools is carried out stages of the Plomp development model that consist of preliminary research, prototyping, and assessment [17].

The learning materials developed consist of the quadratic function module, lesson plans, student activity sheet, and tests. The learning materials applied cooperative learning model of NHT utilizing Autograph software and Angry Birds game. This paper focuses on the practicality of the module. The indicator of the practicality is that at least two of the three experts recommend that the developed module be used in the mathematics classroom, and the level of implementation of the developed materials is considered appropriate or highly appropriate [18]. The data were obtained based on the pilot study on the learning materials involving 30 students of grade 10 of MAN Model Banda Aceh.
The implementation of learning was observed by three observers. The instruments used in this study were the expert practicality score sheet and the module observation sheet.

3. Results and discussion

The quadratic function module with Autograph software and Angry Birds game was developed to be the primary learning material or supporting material that can be used and understood by teachers, general readers, and students. The module was designed to facilitate low, moderate, and high-ability students in understanding quadratic function topic.

The systematically of the module begins with introductory material, main material, model, and the connection of the topics with Angry Birds game and Autograph software. Specifically, the module consists of cover, introduction, concept maps, and sub-topics of quadratic function with Autograph software and Angry Birds game.

The cover of the module represents the title, the topic, and the description of the contents. The cover also displays images of Angry Birds to give an idea of the use of the game in the contents of the module. The Autograph media is also featured on the cover to inform that the module utilizes the software as a learning media. The cover of the module is shown in Figure 1.

![Figure 1. The cover of quadratic function module with Autograph software and Angry Birds game](image)

The module begins with an introduction that discusses the information of module development and the support received during the development process. The content of the module starts with a concept map. The concept map displays sub-topics and their sequence. It aims to provide brief information regarding sub-topics that will be discussed in the module. The concept maps listed are adapted from students’ previous math module.

The sub-topics in the module include the introductory materials to determine coordinates of points in the Cartesian coordinate system, linear equation, function, and exercises. The sub-topic is continued to quadratic equation and function. The module content also describes the Angry Birds game and its relationship to quadratic functions. Then it is followed by a discussion on Autograph software, problem-solving of quadratic function using Autograph software, quadratic function solutions in Angry Birds context assisted by Autograph software, and advanced topics. The module content ends with a summary of the subttopics discussed. In detail, the module content is presented in Table 1.
Table 1. Table of content of the module.

| Chapter I | Introduction |
|------------|--------------|
| 1.1        | Determining coordinate of points in the Cartesian coordinate system |
| 1.2        | Linear equation |
| 1.3        | Function |
| 1.4        | Exercise |

| Chapter II | Quadratic Equation |
|------------|-------------------|
| 2.1        | The general form of a quadratic equation |
| 2.2        | Determining the roots of quadratic equations |
| 2.2.1      | Factorization method |
| 2.2.2      | Completing the perfect squares |
| 2.2.3      | ABC formula |
| 2.2.4      | Exercise |
| 2.3        | Discrimination of quadratic equations |
| 2.4        | Determining the formula for the sum and product of the roots of quadratic equations |
| 2.5        | Solving mathematical models and interpretations of problem solutions related to quadratic equations |

| Chapter III | Quadratic Function |
|-------------|--------------------|
| 3.1         | Quadratic function definition |
| 3.2         | Quadratic function graph |
| 3.3         | Mathematical model related to quadratic equations |
| 3.4         | Relationship of quadratic equations and quadratic functions |
| 3.5         | Determine the equation of a quadratic function through the coordinates of points |
| 3.5.1       | The function graph that intersects the x-axis at two points |
| 3.5.2       | Graph of function tangent to the x-axis |
| 3.5.3       | Graph of function with a peak point |
| 3.5.4       | Graph of a quadratic function with three arbitrary coordinates |

| Chapter IV | Angry Birds Game |
|------------|------------------|
| 4.1        | Angry Birds game |
| 4.2        | Angry Birds in relation to quadratic functions |

| Chapter V  | Autograph Software |
|------------|---------------------|
| 5.1        | Autograph knowledge |
| 5.2        | Autograph advantage |
| 5.3        | Autograph disadvantage |
| 5.4        | Autograph’s significance |
| 5.5        | Get to know the Autograph menu |
| 5.6        | Steps to use Autograph |
| 5.7        | Exercise |

| Chapter VI | Solve the Quadratic Function Problems by Utilizing Autograph Software |
|------------|-------------------------------------------------------------------|
| 6.1        | Graphing a quadratic function by utilizing Autograph |
| 6.2        | Graphing a quadratic function with the specified intervals by utilizing Autograph |
| 6.3        | Determining and graphing a quadratic function that intersects the x-axis at two points and through a certain point |

| Chapter VII | Quadratic Function, Autograph, and Angry Birds |
|-------------|-----------------------------------------------|
| 7.1         | Graphing quadratic functions assisted by Autograph |
| 7.2         | Problems with additional exercises with Autograph and Angry Birds game |

| Chapter VIII | Advanced Topic |
|--------------|----------------|
| 8.1          | Autograph for three-dimensional (3D) objects |
| 8.2          | Autograph for other topics |

Summary

References
The practicality of the quadratic function module with Autograph software and Angry Birds game was measured through the data obtained from experts and practitioners and the learning implementation in the classroom. The learning was conducted simultaneously that implement the quadratic function learning materials with Autograph software and Angry Birds game using the Numbered Heads Together (NHT) co-operative learning model. The learning consists of three sessions.

Experts agreed that the module cover describes the contents and characteristics of the module well. The cover of the module also attracts students to read and understand the contents. The preface was also stated to support the existence of modules. Experts also suggested that the contents of the module can facilitate students’ learning both with teacher guidance and independently. The steps displayed in the module are systematic and practical to students. The exercises also help the students develop their understanding and advanced problems can help them improve their understanding further.

Based on the experts’ recommendation, the use of the Angry Birds game helps students find the context of learning. Angry Birds game is used as a context that motivates students to recognize the importance of solving math problems so that the learning becomes meaningful for the students. The experts also stated that the use of Autograph software helps the students illustrate the problems given and at the same time check the truth of their answers. In general, the experts recommended that the quadratic module can be implemented in the classroom.

Furthermore, based on the observation result, the utilization of the module helped engage students in learning. The students looked enthusiastic to do activities instructed in the module. These activities helped the students understand the material being taught. The activities involved reading and understanding the description of topics in the module. The students also worked in a group which is one of the syntaxes in the NHT learning model. The students were also motivated to solve the problems with the familiar Angry Birds context. Students could understand the problems given because they were familiar with the context and character of Angry Birds.

The observers stated that the illustrations presented in the module are obvious to students. This is shown by the activity of understanding the images independently and in a group without waiting for the teacher's explanation. The observers also stated that the illustrations in the module support students’ problem-solving. The closeness between students and the illustration makes them easy to understand.

Moreover, the use of Autograph software helped students illustrate the problems on quadratic function topic. The Autograph software was also used by the students to check the answers they got. In general, the observation results show that the quadratic function module with Autograph software and Angry Birds game can be implemented in mathematics learning. The effectiveness of the module is considered very high.

This research is relevant to a study on the implementation of the Autograph-assisted linear programming module. The module of linear programming assisted by Autograph also met very high criteria. The module motivated students to interact in completing tasks [19]. The results of this present study are also relevant to other studies that conducted the implementation of the mathematical modules assisted with software. The utilization of software-assisted instructional modules helped the learning process in the classroom. Students enthusiastically performed various activities contained in the module. In addition to that, the atmosphere of fun learning and planned learning steps can be very well executed [20-22]. Another study found that the student activities in learning mathematics using Autograph were better than the student activities in the regular class without using Autograph. Thus, using Autograph are effectively used in teaching quadratic functions [23].

In general, it can be said that the utilization of Autograph-assisted module can maximize the quality of learning that teachers do in the classroom. The information technology-based media assistance improves students’ math performance. The students’ learning is also getting better by exploring various strategies. Students are more enthusiastic, independent and courageous in trying to find a solution to math problems [24].
The utilization of media-assisted module based on information technology on the implementation of learning helps to increase students' understanding of math concepts. Meanwhile, the use of the Angry Birds game assists students to achieve the learning objectives. This happens because students are motivated in imagining the motion picture of the object motion in the Angry Birds game [10]. Angry Birds is one of the games addictive to players without aware of the involvement of the mathematical elements in it [12].

4. Conclusion
The module of the quadratic function by utilizing Autographic software and Angry Birds game has fulfilled the criteria of practicality. That is, three experts stated that the module could be used in the mathematics classroom. Furthermore, based on the observations on the implementation of learning, it is found that the implementation of the module in the classroom was considered in the very high category.

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