*Indonesian Journal of Elementary Teachers Education (IJETE)*
*p-ISSN: 2615-2606 & e-ISSN: 2615-7853*
*Volume 1, Number 2, November 2020*
*https://journal.uniku.ac.id/index.php/ijete*

# DEVELOPING MATHEMATICS LEARNING MATERIALS ABOUT FLOW RATE USING INTERACTIVE POWERPOINT FOR FIFTH GRADE STUDENTS

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**Citation:** Ferryka, P. Z., & Suwartini, S. (2020). Developing mathematics learning materials about flow rate using interactive powerpoint for fifth grade students. *Indonesian Journal of Elementary Teachers Education*, 1 (2), 57-66. DOI: 10.25134/ijete.v1i2.3673.

**Received:** 07-14-2020 **Accepted:** 11-12-2020 **Published:** 11-23-2020

## *ABSTRACT*

*The purpose of this study was to examine the effectiveness of mathematics learning application media for the fifth-grade elementary school students about the flow rate. The research was designed to develop learning material using interactive PowerPoint media. The study was conducted at Barenglor 4 Elementary School. This study used the Research and Development (R&D) method by employing four procedures development which include: (a) exploration, (b) the development of the draft/prototype, (c) test try products and revisions, and (d) final validation. The research subjects were fifth-grade students at Barenglor 4 Elementary School. A total of 48 students were separated into two groups. There were 24 students in the experimental group and 24 students in the control group. The independent sample t-test was used to analyze the data with a significance level of 0.05. The researcher used expert judgment both academicians and practitioners. The results of the study showed that the learning tools were reviewed by the experts of material, media, and evaluation about the aspects of syllabi, lesson plans, instructional media, and assessing for learning outcomes categorized as "Very Good". The application of learning tools, in general, can be reached with the "Very Good" category. Then, the difference in the final results between the control class and the experimental class after using a thematic-integrative learning tool with $p<0.05$.*
***Keywords**: mathematics learning; flow rate; interactive powerpoint.*

## INTRODUCTION

Education is something that always improves. It must be able to follow the development of science, technology, and art. Education plays important role in the development of a country or nation. In Indonesia, the education managers and stakeholders always make various efforts in improving the quality of students' learning by optimizing available sources. Development in education must be carried out continuously so that it remains relevant and contextual, in accordance with the times. This was done on the basis of guidelines for the preparation of curriculum at the elementary and secondary school level (BSNP, 2006).

Learning in elementary schools includes several subjects, one of which is mathematics. Mathematics has an important role in various disciplines that underlie the development of modern technology, in advancing the power of human thought. Innovations in the world of education, including in various fields, must be done, one of which is through the development of learning tools, both from aspect of implementation strategy and from learning application media as well.

According to Arsyad (2007: 7) the development of instructional media aims to facilitate communication and interaction between teachers and students. The better communication and interaction between teacher and student, the faster the learning objectives are achieved. The function of learning media is for facilitating teaching activities so that teaching material can be easily understood by students. Therefore, the learning media used must be applied effectively and determined selectively in a subject being taught.

Various tools can be used by a teacher to deliver lessons for the students. The tool can stimulate students' vision and hearing to avoid mere verbalism. The more senses involved the more quality of learning will be better. Experts have a unidirectional view of it. One of the most widely used images as a basis for theoretical use of media in the learning process is the Dale's Cone of Experience. Below is the picture of it:

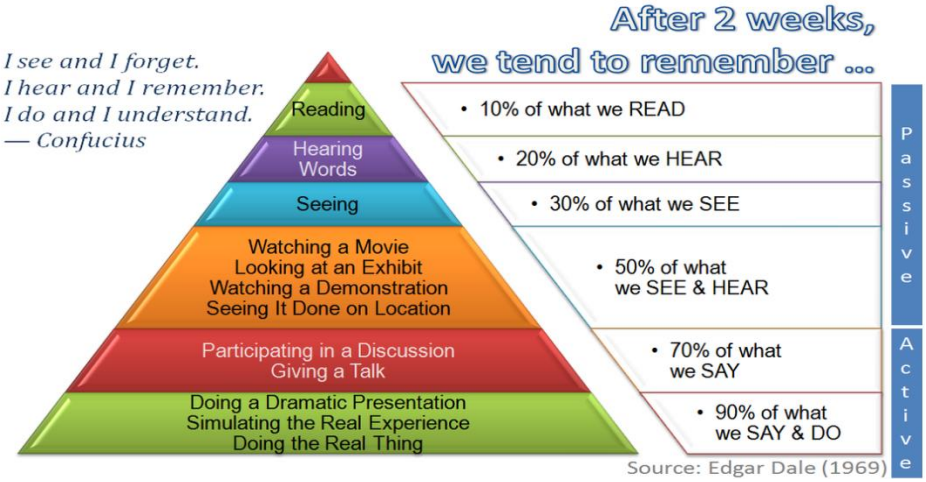


**Figure 1.** Dale's Cone of Experience

The basis for developing cones is not based on the level of difficulty but it is based on the level of abstractness. Direct experience will give a full and meaningful impression about the information and ideas contained in that experience.

Based on analysis of needs in observations and interviews conducted by the researchers to the Mathematic teacher of fifth-grade at Barenglor 4 Elementary School, some obtained results indicated that the teachers do not understand about the learning devices used

in the study. They only use learning tools in the form of handbooks from the government. The materials delivered by the teachers are only limited to the ability possessed.

Mathematics teachers require a medium of learning that is interactive because the learning process is still dominated by teachers, and there is also limited time, due to many activities organized by the school, that is used by them in implementing the learning process.

The problems found at Barenglor 4 Elementary School will certainly hamper the purpose of mathematics learning, because it is not running optimally. Therefore, the problem must be overcome immediately. However, the teacher is required to develop learning devices as well so that learning in the class can run smoothly as to give positive maximal results. According to an expert, learning device is defined as a number of materials, tools, learning media, instructions, and guidelines that will be used in learning activities, (Suhadi, 2007, p.3).

The development of new technologies and interest in their application in the teaching-learning process have led to the emergence of new didactic methodologies, which aim to get the most out of the tools. In this methodology, learning device becomes very important.

Wood et al (2005) states about technology integration in the classroom that "Providing meaningful interventions will enhance the possibility of successful integration of technology for the teachers and the students that they teach". It is relevant with Ferryka & Fembriani (2018) that state about sociocultural in thematic-integrative learning that "Teachers carry out learning activities in accordance with social and cultural values contained in the environment around students. The use of sociocultural-based integrative thematic learning makes the learning process meaningful".

Technology integration is the use of technological tools in the area of general content in education to enable students to apply computer and technology skills to learning and problem solving. In general, the curriculum encourages the use of technology and not the other way around. Technology integration is defined as the use of technology to enhance and support the educational environment. The integration of technology in the classroom can also support classroom teaching by creating opportunities for students to complete assignments on computers rather than with plain pencil and paper. In a larger sense, technology integration can also refer to the use of integration platforms and APIs in school management, to integrate different applications, databases, and SaaS (Software as A Service) programs used by an educational institution. data can be shared in real-time across systems on campus, supporting student education by improving data quality and access for faculty and staff (Wikipedia/Retrieved 2020-11-20).

The material taken in research and development is limited in the field of mathematics about flow rate. The purpose of this research and development is to produce and find out the effectiveness of mathematics learning devices about flow rate material in fifth-grade elementary school students by using interactive PowerPoint.

Microsoft PowerPoint is a presentation program created by Robert Gaskins and Dennis Austin at a software company called Forethought, Inc. It was released on April 20, 1987, initially only for computers based on the Macintosh Operating System. Microsoft acquired PowerPoint about $ 14 million three months after it appeared. This was Microsoft's first significant acquisition, and Microsoft established a new business unit for PowerPoint in Forethought's Silicon Valley (Wikipedia).

PowerPoint was originally designed to provide visuals for group presentations in business organizations, but has become very widely used in many other communication situations, both in business and beyond. The impact of this much broader use of PowerPoint has been experienced as a strong change across society, with strong reactions including

suggestions that it should be used less, it should be used differently, or should be used better (Wikipedia).

Microsoft PowerPoint is an appropriate software for creating visual presentations that can interpret various media, such as videos, animations, images and sounds. Inside Microsoft Power Point there are menus that allow users to create and develop learning media that are more interesting, more interactive and more enjoyable. By using Microsoft Power Point, then, it is expected to be able to overcome the problems encountered in learning mathematics in fifth-grade students of Barenglor 4 Elementary School.

## RESEARCH METHOD

### Research Design

This research was conducted by using research and development (R&D) processes. Research and development (R&D, R + D), known in Europe as technology research and development (RTD), is a series of innovative activities undertaken by companies or governments in developing new services or products and enhancing existing ones. Research and development is the first stage of developing a potential new service or production process.

R&D activities differ from one institution to another, with two main models R&D departments are either managed by engineers and tasked with developing new products directly, or working with industrial scientists and assigned to applied research in scientific or technological fields, which can facilitate future product development. R&D differs from most corporate activities in that it is not intended to generate immediate profits, and generally carries greater risk and uncertain returns on investment. However, R&D is very important to gain a bigger market share through the marketisation of new products (Staff, 2003).

According to Sugiyono (2010: 297), research and development are research methods used to produce certain products and test the effectiveness of these products. The product developed in this research is an instructional media with interactive multimedia using Microsoft Power Point. This R&D study was conducted using the procedural of 4D (Define, Design, Develop, and Disseminate) model. Hamdani (2011: 27) states that "The 4D development model is a learning device development model that was developed by Thiagarajan, Semmel, & Semmel. The product development processes were divided into several steps: (1) exploration, (2) the development of the draft/prototype, (3) test try products and revisions, and (4) final validation".

Before the product was implemented to the large group of students, the product trial was conducted with limited subjects. The product trial was conducted in three phases: preliminary trials; main trials; and limited trials. The preliminary test was carried out by assessment from the experts' judgment both academicians (lecturers) and practitioners (teachers). The main test was conducted by implementing the product to one group of students in experimental design using the *one-shot case study design*. Limited testing was done by implementing the product in experimental design with control and experimental groups using the *nonequivalent control group design*.

### Participant

The participants of this research were fifth-grade students of 4 Barenglor Elementary School. They were 48 students separated into two groups. The first group consists of 24 students selected for the experimental group. An experimental group (sometimes called a treatment group) is a group that receives a treatment in an experiment. The "group" is made up of test subjects (people, animals, plants, cells etc.) and the "treatment" is the variable you

are studying (https://www.statisticshowto.com/experimental-group/, Retrieved 2020-11-20). The other group as many as 24 students were selected for the control group. Members of a control group receive a standard treatment, a placebo, or no treatment at all (Bailey, R. A., 2008). There may be more than one treatment group, more than one control group, or both there were four students involved as the participants on limited trial phase. In the operational product trial phase, there were 24 students involved.

## Data Collection

The data were collected by using interviews, expert questionnaires, observations, tests, teacher' and students' questionnaires. Data collection instruments in this research and development were done by using interview guidelines, learning appropriateness assessment sheet, observation sheets, tests, students' and teacher's questionnaire sheets. These instruments were used to collect the data at the exploration stage, product development stage, product trials, and final revisions and validations. The validation of learning tools was assessed by experts on evaluation, experts on learning materials, practitioners, and research colleagues. The validation sheet was used to measure the validation of the syllabus, the lesson plan, the learning media, and the learning achievement test.

## Data Analysis

The data were collected through interview guidelines, product assessment sheets, observation sheets, tests and questionnaires were analyzed in qualitative and quantitative statistics to revise the products developed. The data analysis processes were conducted in three stages flow rate: (1) tabulating all data obtained from the validator for each component and grading item available in the assessment instrument, (2) calculating the average total score of each component, and (3) changing the average score to a score of five criteria.

According to Azwar (2011, p.163) the scores obtained were then converted to criteria by referring to the following Table 1.

**Table 1.** Converting the Average Interval of Scores into Criteria

| Score | Score Interval | Category |
|---|---|---|
| **A** | X> X i +1.8 Sbi | Very good |
| **B** | X i + 0.6 Sbi<X ≤X i + 1.8 Sbi | Good |
| **C** | X i -0.6 Sbi<X≤X i + 0.6 Sbi | Pretty good |
| **D** | X i -1.8 Sbi<X≤X i-0.6Sbi | Not good |
| **E** | <X≤X i + 1.8 Sbi | Not good |

Information:

Xi : Mean / average ideal score
= ½ (maximum score + minimum score)

Sbi : Ideal standard deviation
= 1/6 (maximum score - s minimum score)

X : Score obtained

In this research, a minimum "B" category of product feasibility was determined. Thus, the results of the material expert assessment / flow rate material learning tool with interactive PowerPoint, evaluation experts, practitioners, and peers give the final result B, so the development product is feasible to be used as a mathematics learning tool for flow rate material with interactive PowerPoint. However, if the results of data analysis do not meet the category B in this study, then, they will be taken into consideration for revising the learning tool before being tested.

Determination of the effectiveness of mathematics material learning tools for flow rate uses interactive PowerPoint, in the results of research and development in operational product trials seen from the achievement of the effectiveness aspects determined based on the analysis of limited trial data consisting of two aspects of assessment. These aspects are in the form of completeness of student learning outcomes and differences in the effectiveness of the control class and experimental class. The researcher used pretest and posttest to measured its.

## RESULTS AND DISCUSSION

The results in this research and development at the literature study for researcher implements a study of concepts or the theories relating to learning mathematics about flow rate by using interactive PowerPoint in grade 5 elementary school students. The study consisted of a 2013 Curriculum Guide for elementary students.

Researchers conducted a document study by analyzing learning tools such as syllabus, lesson plans, learning media and learning outcomes tests used by fifth-grade teachers at Barenglor 4 Elementary School. The teachers have not prepared lesson plans every day. This is because they do not have much time to prepare each day. The fifth-grade teachers of Barenglor 4 Elementary School do not understand the learning tools comprehensively about the 2013 Curriculum. So, the difficulties in developing tools of learning will be used in the learning process. The learning tool used is only the teacher handbook provided by the government and as another supporting book is the KTSP 2006 textbook. That is because the limitations of books or resources that are available on the learning of mathematics and materials lessons presented in the book the teacher also still correspond with the science. At the same time, primary sources can become limited because they lack the perspective that comes with a more separate view of rules.

The data obtained from the preliminary study is used to develop learning devices using interactive PowerPoint. The instruments are used in research and developments based on lattice on the theoretical basic that is used to develop learning software products. Data from the feasibility assessment results are converted to a scale of five that looks like the following Table 2.

**Table 2.** Scores for The Assessment of Learning Tool Products into a Five Scale

| No | Learning Devices | Score Interval | Grade | Category |
|---|---|---|---|---|
| **1** | Syllabi | $X > 96.6$ | A | Very Good |
| | | $78.2\ X \leq 78.2$ | B | Good |
| | | $59.8 < X \leq 59.8$ | C | Pretty Good |
| | | $41.4 < X \leq 59.8$ | D | Not Good |
| **2** | Lesson Plan | $X \leq 41.4$ | A | Very Good |
| | | $X > 41.4$ | B | Good |
| | | $X > 159.6$ | C | Pretty Good |
| | | $128.2 < X \leq 159.6$ | D | Not Good |
| **3** | Learning Media | $78.2 < X \leq 159.6$ | A | Very Good |
| | | $59.8 < X \leq 96.8$ | B | Good |
| | | $41.4 < X \leq 59.8$ | C | Pretty Good |
| | | $X \leq 41.4$ | D | Not Good |
| **4** | Learning Achievement Test | $X > 58.8$ | A | Very Good |
| | | $36.4 < X \leq 58.8$ | B | Good |
| | | $25.2 < X \leq 36.4$ | C | Pretty Good |
| | | $X \leq 25.2$ | D | Not Good |

Based on table 2 the conversion score of learning product are: (1) syllabus gets an average value of 98.5 categorized as "very good", (2) Lesson plan according to the expert gets an average value of 160.0 categorized as "very good" , (3) Learning media get a score of 97.0 categorized as "very good", (4) test of learning outcomes get a value of 59.0 categorized as "very good". Thus, the learning tools developed in research and development are feasible to be used in learning in elementary schools.

Students, in the experimental class, who use interactive PowerPoint learning tools in mathematics learning in flow rate material have higher average scores than those in the control class who use the normal learning tools. The difference in the achievement of improvement and student learning outcomes in this class is used t-test analysis, which previously performed prerequisite tests in the form of normality and homogeneity. Following are the results of student learning scores on operational product tests presented in Table 3 and Table 4.

**Table 3.** Summary of Student Learning Outcomes Value Data on Operational Product Tests in the Control Class

| Details | Pretest | Posttest | Standard Gain |
|---|---|---|---|
| **The highest score** | 84.3 | 87.7 | 5.14 |
| **Lowest value** | 70.0 | 76.0 | 6.74 |
| **Average** | 77.4 | 82.5 | 5.13 |
| **Standard deviation** | 4.17 | 1.98 | 3.31 |

**Table 4.** Summary of Student Learning Outcomes Value Data in Operational Product Tests in Experimental Classes

| Details | Pretest | Posttest | Standard Gain |
|---|---|---|---|
| **The highest score** | 87.3 | 94.7 | 8.79 |
| **Lowest value** | 74.0 | 77 , 0 | 3 , 74 |
| **Average** | 77.4 | 85 , 5 | 8.6 3 |
| **Standard deviation** | 4.18 | 4 , 98 | 3.5 1 |

The results of normality or homogeneity test for the level of significance $\alpha = 0.05$ or 0.01 at significance of this data is obtained at 0.213. This figure is greater than the probability of 0.05, thus $H_0$ is received or the data distribution is normal. While the homogeneity test results in this data obtained 0.472 significance results greater than the probability of 0.05. Thus, Ho is received; meaning, the data are homogeneous.

The results of the calculation of independent sample t-test for the two groups in terms of increasing student learning outcomes show the value that $t_{calc}$ of 3.85 with a significance level of 0.0001. Because $t_{calc} > t_{table}$ then Ho is rejected. then it can be concluded that there are significant differences in the improvement of student learning outcomes that follow learning using ordinary learning tools with learning outcomes of development.

Bos (2009) states that the interactive math object format allows for interplay, conjecturing, testing of the conjectures, and trying the emerging idea in a new context. So, the choice and use of technology need to be a deliberate choice based on a deeper understanding of the variety of functions, strengths, and weaknesses, and what makes technology-driven mathematical objects cognitively and mathematically reliable.

Research and development have various limitations. This research only limited to the material flow rate. The learning tools developed are only about syllabus, lesson plans, media,

and learning achievement tests which do not necessarily have good flexibility if developed with other aspects.

## CONCLUSION AND RECOMMENDATION

This study concluded that the developed learning tools can be used in learning in elementary schools. The evaluation results of subject matter experts, media experts, and expert evaluation of aspects of the syllabus, lesson plan aspect, the aspect of instructional media, and aspects of test results categorized as "very good". Learning tools in the form of: (1) syllabus get an average value of 98.5 categorized as "very good", (2) lesson plan according to experts get an average value of 160,0 categorized as "very good", (3) learning media get a value of 97.0 categorized as "very good", (4) a test of learning outcomes get a value of 59.0 categorized as "very good". The effectiveness of learning on the syllabus, lesson plans, learning media, and learning outcomes tests are good. The syllabus made makes teachers faster in delivering material comprehensively. The lesson plans that are made make teachers faster in preparing learning activities so that they can deliver learning materials in a structured and planned manner. The learning media developed can facilitate the teacher in explaining the learning material. The developed learning outcomes test can facilitate the teacher in evaluating students' abilities. The average achievement of learning outcomes has increased, the experimental class has increased higher than the control class seen from the *pre-test* and *post-test* scores.

The recommendation from this research is PowerPoint using of learning the development tools can be used by teachers in developing interactive learning interactions for students. While the process of learning can be used as an alternative in implementing learning innovations to improve the quality of learning. It is to suitable with the student conditions. The dissemination of the results of the development of this learning tool can be pursued through socialization through other schools both for elementary and MI (Madrasah Ibtidaiyah) in Klaten, not only limited to schools where the trial is only. There is also an opportunity for researchers to study more about the development of learning tools using interactive PowerPoint for basic competencies and other material by conducting research and development steps.

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