



(RESEARCH ARTICLE)



Developing learning media of statistics stake props on mean, median, and mode materials for eighth graders at SMP Negeri 9 Gorontalo, Indonesia

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Abstract

This R&D (Research and Development) research explores the development of the learning media of statistics props on mean, median, and mode materials for eighth graders at SMP Negeri 9 Gorontalo. It refers to the Four-D development model, covering four stages, i.e., Define, Design, Develop, and Disseminate. As regards validation, material and media experts gave scores of 93.8% and 93%, respectively, in the Very Valid category. Learning media of statistics stake props on mean, median, and mode materials were very practical to be used by students, as demonstrated by teacher responses, at a percentage of 100%. The learning media were also considered effective, based on student responses and learning tests, which came with an increase in scores. Before using the learning media, 16 students scored 64.4 on average (below Minimum Completeness Criteria) in the Poor category, and 16 others scored 72.3 (above Minimum Completeness Criteria) in the Acceptable category. After using the learning media, eight students scored 74.38 on average at the Acceptable criteria, 20 scored 84.67 on average at the Good criteria, and four scored 94.38 on average at the Excellent criteria. Based on student response questionnaires, the percentage of using learning media of statistics stake props on mean, median, and mode materials achieved more than 89.71%, indicating very positive student responses. Grounded on the results, we could infer that learning media of statistics stake props on mean, median, and mode materials were valid, effective, and reliable to use.

Keywords: Prop Media; Learning Media; 4D Development Model; Statistics Stakes

1. Introduction

According to Cocroft in Mulyono (2012:204), mathematics has to be delivered to students as they will always apply it in all life aspects. Additionally, mathematics is considered an essential skill because one can deploy it to present information by all means, enhance logical thinking skills, carefulness, and financial awareness, and afford satisfaction with solving challenging issues.

However, as a matter of fact, in mathematics learning, students still confront many difficulties, considering the abstract nature and object of mathematics. As a result, students have little understanding of it and lack enthusiasm for learning mathematics. Another causing factor is that students have no interest in how teachers deliver materials in the learning process, causing them not to achieve the Minimum Completeness Criteria defined. For example, as pointed out by the results of the reflection by mathematics teachers at SMP Negeri 9 Gorontalo determining the Minimum Completeness Criteria of 70 for mathematics learning subject, 40% of students scored under Minimum Completeness Criteria, and 60% of others scored above the Criteria.

Teachers play the key role in creating a conducive and fun learning atmosphere to direct students to realize the goals optimally by delivering attractive and quality learning using learning media. Using props as learning media is one of the

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innovative methods to deliver learning materials, especially in mathematics learning, in that, as defined by Ruseffendi in Sundayana & Rostina (2016:7), props can explain or visualize mathematical concepts.

Commonly, germane to their use in learning, props only emphasize conceptual understanding and rationalizing, but they can be modified or developed by integrating a range of elements in them, e.g., local cultures and wisdom, such as Gorontalo local wisdom, sustaining local cultures.

Grounded on our observation and experiences, among props used to deliver statistics materials are statistics boards, used to explicate the concepts of mean, median, and mode. Nevertheless, the props cannot address particular problems in connection with the output of two numbers behind the comma or decimal numbers and do not incorporate local cultural elements, which, in this case, are Gorontalo ones, with them. Our field observation presents results that mathematics teachers do not use the props at the school and that students understand the delivered materials, but when teachers provide examples with a slight modification on the problem, students come with confusion. The reason is that several teachers at the school deliver mathematics materials by encouraging students to merely memorize and implement the formulas. When implementing the formulas, students experience difficulties, not to mention that learning media supposedly assisting students in understanding mathematics at the school are only whiteboards, student worksheets, and package books.

Highlighting the field condition, new learning media which can improve mathematical understanding skills and introduce Gorontalo local wisdom to students are imperative. The learning media we develop are statistics stakes, which adapt positive aspects and add another aspect, i.e., Gorontalo local distinctiveness, by limiting the materials only to mean, median, and mode of single data with outputs in the form of two decimal numbers. We integrate Gorontalo local cultures and wisdom in the learning media, with which we incorporate specific forms and colors, each of which bears cultural meanings which must be sustained and is aligned with customs and wisdom applicable in Gorontalo.

Predicated on the explanation, we carry out research titled “Developing Learning Media of Statistics Stake Props on Mean, Median, and Mode Materials for Eighth Graders at SMP Negeri 9 Gorontalo.” We aim to make practical learning media which are effective to be used in mathematics learning, especially mean, median, and mode materials.

2. Method

This R&D (Research and Development) research used a qualitative approach and referred to the 4-D product development model by Thiagarajan in Trianto (2011), composed of four development stages, namely Define, Design, Develop, and Disseminate. We used three instruments to collect research data, which were expert validation sheets, student response questionnaire sheets, and teacher response questionnaire sheets, and analyzed the collected research data qualitatively.

3. Results

3.1. Expert Validation

3.1.1. Material Expert Validation

The material expert validation sheet contained 13 question items with a score validation range of 1-4: 4 = Excellent, 3 = Good, 2 = Poor, and 1 = Very Poor. Based on material expert validation, the mean score of the material suitability aspect of the learning media of statistics stake props on mean, median, and mode materials was 93.8%, showing that the materials were **valid**.

3.1.2. Media Expert Validation

The media expert validation sheet contained 13 question items with a score validation range of 1-4, i.e., 4 = Excellent, 3 = Good, 2 = Poor, and 1 = Very Poor. Grounded on media expert validation, the mean score of the media suitability aspect of the learning media of statistics stake props on mean, median, and mode materials was 93%. It stated that the media were **valid**.

3.2. Limited Test

The limited test was conducted on six ninth graders, one of whom gave a comment/suggestion that the stakes should be lengthened. We improved our stakes grounded on the comment/suggestion and used the deliverable of the small

group test to revise Draft II, bringing about Draft III. The six students were given response questionnaire sheets to identify their responses to statistics stake prop media. Predicated on the responses, the media scored 96.91%.

3.3. Large Scale Test

3.3.1. Student Responses

The large group test was performed on 32 students from the VIII-A class. Student responses were categorized as **practical** if the response percentage of each aspect assessed was 70% at the minimum. Analysis results acted as our consideration to create good and quality statistics stake prop media and enable teachers and students to use them continuously. Table 1 suggests the results of student response data analysis.

Table 1 Student Responses

No.	Percentage (%)					
	SS	S	R	TS	SS + S	R + TS
1	53.3	30.0	16.7	0	83.3	16.7
2	23.3	63.4	13.3	0	86.7	13.3
3	16.7	53.3	30.0	0	70.0	30.0
4	30.0	56.7	13.3	0	86.7	13.3
5	30.0	56.7	13.3	0	86.7	13.3
6	26.7	70.0	3.3	0	96.7	3.3
7	30.0	70.0	0.0	0	100.0	0.0
8	43.3	56.7	0.0	0	100.0	0.0
9	26.7	70.0	3.3	0	96.7	3.3
10	16.7	63.3	20.0	0	80.0	20.0
11	23.3	76.7	0.0	0	100.0	0.0
Mean Percentage					89.71	10.29

Data in Table 1 demonstrate that the mean score of students' minimum responses for practicality was 89.71%, exhibiting that our statistics stake prop media on mean, median, and mode materials were very practical.

3.4. Teacher Responses

The teacher response questionnaire sheet contained seven question items. According to teacher responses, the learning media were categorized as **practical** if the response percentage of each assessed aspect was 70% at the minimum. The analysis results served as our consideration to develop good and quality statistics stake prop media, hence helping teachers and students use them as learning media continuously. Table 2 indicates the results of teacher response data analysis.

Table 2 Teacher Responses

No.	Percentage (%)					
	SS	S	R	TS	SS + S	R + TS
1	100	0	0	0	100	0
2	100	0	0	0	100	0
3	100	0	0	0	100	0
4	100	0	0	0	100	0

5	100	0	0	0	100	0
6	100	0	0	0	100	0
7	100	0	0	0	100	0
Mean Percentage				100	0	

Data in Table 2 point out that the mean score of teachers' minimum responses for practicality was 100%, showing that our statistics stake prop media on mean, median, and mode materials were very practical.

3.5. Learning Model Effectiveness

Learning objective achievement, which, in this case, was learning completeness, was measured using a pre-test and a posttest, the first of which was undertaken before learning using statistics stake prop media on mean, median, and mode materials. Table 3 presents the pre-test results.

Table 3 Student Pre-Test Results

Competency	Number of Students	Mean Score
Excellent (91-100)	-	-
Good (81-90)	-	-
Acceptable (70-80)	16	72.3
Poor (< 70)	16	64.4

Table 3 shows that 50% of students did not fulfill Minimum Completeness Criteria in the Poor category, while 50% of others met the Criteria in the Acceptable category. After using statistics stake prop media, students were given a posttest to identify any change in their learning outcomes. Table 4 states the posttest results.

Table 4 Student Posttest Results

Competency	Number of Students	Mean Score
Excellent (91-100)	4	94.38
Good (81-90)	20	84.67
Acceptable (70-80)	8	74.38
Poor (< 70)	-	-

Table 4 suggests an increase in student learning outcomes, in which out of 32 students, 100% fulfilled Minimum Completeness Criteria: four were categorized as Excellent, 20 were categorized as Good, and eight were categorized as Acceptable. Based on the results, we inferred that our statistics stake prop media on mean, median, and mode materials promoted student learning outcomes effectively.

4. Discussion

Developing these statistics stake prop media used the 4-D model (Define, Design, Develop, and Disseminate), the first of which called for a preliminary analysis of the issues existing in learning activities at SMP Negeri 9 Gorontalo and the importance of developing prop media to cope with the issues. Our observation results demonstrated that the limited learning media teachers used made students understand materials only from available package books. The lecturing method teachers used frequently developed boredom and passiveness in students.

Teachers were not the only learning sources, and, considering their roles as motivators, were required to plan and create other learning sources, engendering a conducive learning environment. Learning message transmitters teachers

designed in a planned way were the other learning sources, or what we called learning media. We, therefore, developed prop media to present exciting content, which prevented students from feeling bored and thus fostered their interest in the learning process and allowed them to attain learning objectives.

In the design stage, we made the design of statistics stake prop media products on mean, median, and mode materials based on the deliverables of the previous analysis stage and associated them with Gorontalo local cultures, especially *Pahangga*. Additionally, in developing the products, we also included content adjusted to student characteristics, and, as regards the products' efficiency of use, we stressed the aspect of how they could draw student interest in paying attention to learning. Materials included in the products were adjusted to basic competencies and indicators of achievement.

Statistics stake prop media used the *Pahangga* model, by which artificial beads were colored by Gorontalo's main colors, i.e., red, yellow, green, and purple. Red beads represented ones, yellow beads represented tens, green beads represented tenths, and purple beads represented hundredths. These color-differed beads were envisaged to draw student interest in focusing on and engaging with the learning process.

Based on the test for learning media effectiveness, pre-test and posttest results differed significantly. In the pre-test, several students did not fulfill Minimum Completeness Criteria, while in the posttest, all students met the Criteria, most of whom were categorized as Good. Teacher and student response questionnaire sheets also exhibited a mean percentage above 85%, leading us to the conclusion that our statistics stake prop media on mean, median, and mode materials were practical to use and effective to enhance student learning outcomes significantly.

5. Conclusion

Grounded on the research results we had elucidated, the following conclusions were drawn.

The statistics stake prop media on mean, median, and mode materials, developed using the 4-D model, were valid, as indicated by the validation scores of 93.8% and 93% given by material and media experts, respectively.

As pointed out by student and teacher response questionnaire results, the statistics stake prop media on mean, median, and mode materials scored above 85%, namely 89.71% and 100%, respectively, presenting very positive responses, showing that the props were practical to use.

The statistics stake prop media on mean, median, and mode materials were considered effective by learning test results. Before using the props, out of 32 students, 16 fulfilled Minimum Completeness Criteria in the Acceptable category, and 16 others did not in the Poor category. After using the props, out of 32 students, 100% met Minimum Completeness Criteria, in which four were categorized as Excellent, 20 were categorized as Good, and eight were categorized as Acceptable.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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