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Development of Learning Media for Used Electronic Components Assisted by Livewire Simulator to Increase Student Creativity in Basic Electronics Material

Miftah[1*], Nurasyah Dewi Napitupulu[1], Muhammad Zaky[1], Ketut Alit Adi Untara[1]

[1] Physics Education, Faculty of Teacher Training and Education, Tadulako University, Palu, Indonesia.

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Corresponding Author:
Miftah
miftahfisika12@gmail.com

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Abstract: The purpose of this research is to develop learning media for passive electronic components assisted by Livewire simulator to increase student creativity in basic electronics material. This research was conducted in the Physics Education Study Program, Faculty of Teacher Training and Education, Tadulako University. Development research time for 8 months. The subjects of this research are physics education students who program basic electronics courses. The measured change is the validation value of learning media development from expert respondents and students. To increase student creativity is measured through a creativity questionnaire. This research is a type of research and development or known as Research and Development (R&D). This research uses several stages of research: (1) Potential and problems; (2) Data collection; (3) Product design; (4) Design validation; (5) Design revision; (6) Product trial; (7) Product revision; (8) Usage trial; (9) Product revision; and (10) Mass production. From the results of the study, the N-gain value of the pretest and posttest data was 0.47 or N-gain in the medium category. Therefore, it can be concluded that the development of used electronic component media can increase student creativity on the subject of basic electronics.

Keywords: Electronic components; Media development; Used goods

Introduction

Part developing learning media is something important by looking at the needs of achieving learning objectives. With the existence of learning media, students will more easily understand a formulation, theory or law of physics. Physics learning cannot be separated from mastering concepts, applying them in solving physics problems, and working scientifically (Puspitasari, 2019; Sukiminiandari et al., 2015). The purpose of learning media as a learning tool is to facilitate the learning process in class, improve the efficiency of the learning process, and help student concentration in the learning process (Astuti et al., 2017; Supardi et al., 2015). It is unique and interesting if the material used uses used materials as the main material in making media. In addition to the availability, the price of used materials can also be obtained relatively free of charge. On the other hand, there is a Basic Electronics course that requires students to be able to recognize the functions of the benefits and the main ingredients that make up electronic components well (Erfan et al., 2017). One of the development of electronic component learning media can be made from used goods.

At this time there are many utilizations of used goods that produce new goods that have great value, even in the marketing process also has a fairly high price (Laila et al., 2016). As research conducted by Suyamto (2022) and Pambudi et al. (2018) which utilizes used goods into electric generators in physics practicum and the development of teaching aids. Electronic components made from used goods such as straw scraps that can be made into resistors with a certain ohm value and used cans and plastics that can be used as parallel plate capacitors with a changeable farad value. The use of electronic devices from used goods has the intent and purpose, among others, to give students the freedom to make their own resistors and capacitors so that they will build creativity, motivation to learn because students create their own, assemble themselves and analyze the

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electrical circuits they have made. This is in line with research conducted by Fatmi (2019), Asmara (2019), and Laila et al. (2016) who have proven that the use of recycled materials or used goods as materials for making learning media can increase student creativity.

Creativity is an important aspect of teaching and learning because creativity can bring ideas or products that have not previously existed to solve a problem (Chalsum et al., 2023; Sucilestari et al., 2023). Creativity is the ability to imagine, interpret and express ideas and efforts that have the power to create new combinations of previously existing elements so as to improve the quality of students in their development (Ardian et al., 2016; Siswanto, 2018; Tirtiana, 2020). Students who have an adequate level of creativity will undoubtedly be able to produce teachers who have creativity, so that students in schools can actively think, develop, and produce creative ideas (Hartono et al., 2018).

On the other hand, the use of used goods as materials for making electronic components can foster a sense of responsibility and awareness to protect the environment because students can reuse used goods from waste into learning resources. In addition to the development of electronic learning media from used goods, to maximize learning, student learning activities need to be supported by using the LiveWare electronic simulation program.

Livewire program is a program that is an electronic simulation used to design to analyze, displayed in the form of animation to show the function or basic principles of electronic circuits (Oktavia, 2016). By using LiveWare electronic simulation, students will get a more precise and directed understanding of electronic circuits in basic electronics material and can see computer visuals of the voltage and current strength flowing in the electrical circuit of electronic components that they make themselves (Alit et al., 2017; Damid et al., 2021; Makhrus et al., 2021). With Livewire, the learning atmosphere in the classroom will be more interactive and provide more meaningful learning. Livewire has a simple and easy-to-use interface (Abidin et al., 2015).

With directed activities and through the available media, it is expected that there will be an increase in student creativity in learning basic electronics material.

Method

This research is a type of research and development or known as Research and Development (R&D), which is a research model used to produce certain products, and test the effectiveness of these products (Sugiyono, 2015). This research uses several stages of research: (1) Potential and problems; (2) Data collection; (3) Product design; (4) Design validation; (5) Design revision; (6) Product trial; (7) Product revision; (8) Usage trial; (9) Product revision; and (10) Mass production.

This research was conducted in the Physics Education Study Program environment, Faculty of Teacher Training and Education, Tadulako University. The time of this development research is approximately 8 months. The subjects of this research were physics education students who took applied physics courses.

The data collection technique used is in the form of a questionnaire or questionnaire and observation. The data analyzed in the development of learning tools and media are quantitative data and qualitative data. The analysis technique used to analyze the validation result data is the calculation of the average value. So that the formula for calculating the average value is obtained in equation 1.

$$X = Total\ score\ /\ Number\ of\ statement\ items \quad (1)$$

Assessment categories with the provisions in Table 1 (Widoyoko, 2012).

Table 1. Likert Scale Categories

Score value	Interpretation
3.25 < X ≤ 4.00	Very Good (SB)
2.50 < X ≤ 3.25	Good (B)
1.75 < X ≤ 2.50	Less (K)
1.00 ≤ X ≤ 1.75	Very Poor (SK)

The analysis of student respondent data is similar to the analysis of product assessment quality. The average score from the response questionnaire was then converted into qualitative form based on Table 2.

Table 2. Student Response Category Criteria

Score value	Interpretation
3.25 < X ≤ 4.00	Strongly Agree (SS)
2.50 < X ≤ 3.25	Agree (S)
1.75 < X ≤ 2.50	Less Agree (KS)
1.00 ≤ X ≤ 1.75	Disagree (TS)

For additional analysis in seeing changes in student creativity, it was analyzed using gain analysis, namely with equation 2.

$$g = \frac{S_{post} - S_{pre}}{S_{maks} - S_{pre}} x100\% \quad (2)$$

With N-gain categories: High: g > 70; medium: 30 ≤ g ≤ 70 and low g < 30.

Result and Discussion

In this research, the goal to be achieved is to develop learning media from used goods as material for

making electronic components with the help of a livewire simulator to increase students' creativity in basic electronics material and increase students' creativity in basic electronics material.

The procedure carried out is to collect electronic tools and materials to be developed with each circuit consisting of cables, circuit boards, transistors, capacitors, potentiometers, and tools in the form of digital multimeters to measure the current and voltage produced, there are 3 experiments carried out, namely experiments on making resistors, experiments on making capacitors, and experiments on the use of resistors and capacitors in electronic circuits.

Resistor Manufacturing Experiment

In this experiment, a resistor is made from carbon charcoal which is inserted into a used pipette and both ends are given a cable connection. After the resistor from this used charcoal was successfully made, the next measurement of the resistance was carried out using a multimeter.

Capacitor Manufacturing Experiment

In this experiment, capacitors were made using used zinc plates and used plastic. The plate is made with a size of 1 x 1 cm and after being made, measurements of the capacitor size are made using a capacity measurement multimeter.

Experiment on the Use of Resistors and Capacitors in Electronic Circuits

In this experiment, after the resistor and capacitor are produced, they are then applied to an electronic circuit. The current and volts that occur are displayed using LiveWare animation.

Research Results

Table 3. Research Results

Student Name	Pretest	Average	Description	Posttest	Average	Description
Nova Olivia Salatun	63	2.1	Less	88	2.9	Good
Rosnim	57	1.9	Less	74	2.5	Less
Andi Firdayanti	65	2.2	Less	69	2.3	Less
Ketut Anggun A.	70	2.3	Less	76	2.5	Less
Riska Tokio	67	2.2	Less	73	2.4	Less
Bachtiar	72	2.4	Less	73	2.4	Less
Dhimas Arif N.	69	2.3	Less	92	3.1	Good
Agung Pratama	66	2.2	Less	79	2.6	Good
Annisa Rahmayanti	69	2.3	Less	84	2.8	Good
Anisa Awali	65	2.2	Less	86	2.9	Good
Susmawati	64	2.1	Less	90	3.0	Good
Fina Apriani	68	2.3	Less	89	3.0	Good
Indah Putri Ramadani	73	2.4	Less	80	2.7	Good
Miftahul Khair M.	67	2.2	Less	84	2.8	Good
Amini Tobunggu	69	2.3	Less	94	3.1	Good
Nurma Yamalia	76	2.5	Less	97	3.2	Good
Muh. Wahid	85	2.8	Good	92	3.1	Good

Table 4. Gain Test Data Analysis

Student Name	Pretest	Posttest	Gain	Description
Nurma Yamalia	76	97	0.88	High
Amini Tobunggu	69	94	0.81	High
Dhimas Arif N.	69	92	0.74	High
Susmawati	64	90	0.72	High
Nova Olivia Salatun	63	88	0.68	Medium
Fina Apriani	68	89	0.66	Medium
Anisa Awali	65	86	0.60	Medium
Miftahul Khair M.	67	84	0.52	Medium
Annisa Rahmayanti	69	84	0.48	Medium
Muh. Wahid	85	92	0.47	Medium
Rosnim	57	74	0.40	Medium
Agung Pratama	66	79	0.38	Medium
Indah Putri Ramadani	73	80	0.26	Low
Ketut Anggun A.	70	76	0.20	Low
Riska Tokio	67	73	0.18	Low
Andi Firdayanti	65	69	0.11	Low
Bachtiar	72	73	0.04	Low

Discussion

This research is a development where what is developed is a learning media for used electronic components assisted by a Livewire simulator to increase student creativity in basic electronics material. All media developed have been validated which includes media expert validation, material expert validation and small group instrument testing. The results obtained are in accordance with the results of validation and test results where the results of media expert validation obtained a value of 3.60 and material expert validation obtained a value of 3.50. This research was conducted on Physics Education students at Tadulako University as a limited test with the results of a small group instrument test or limited test from students obtained 3.77. Meanwhile, the field test or wider test was conducted on students with a total of 17 people. Where pretest and postest data were taken on student creativity before and after the treatment of providing learning media.

Pretest data on the creativity of 17 students obtained an average of 68.53 or in the less category and after being given material with learning media used electronic components assisted by Livewire simulators to increase student creativity in basic electronics material, there was an increase in student creativity. Increased creativity can be seen from the results of posttest data analysis where out of 17 students obtained an average score of 83.52 or in the moderate category. The results of N gain pretest and posttest data also obtained data of 0.47 or N Gain in the moderate category.

The research results obtained are in line with the research conducted Cahyani et al. (2019) and Handayani et al. (2020) which has proven that the use of learning media assisted by livewire simulations is suitable for use and application in the learning process. This is of course in line with the theory put forward by Hamalik (1986) in Arsyad (2013) which states that the use of learning media in the teaching and learning process can generate new desires and interests, generate motivation and stimulation of learning activities, and even bring influence- psychological influence on students.

In this study, the objectives to be achieved are to develop learning media for used electronic components assisted by Livewire simulators to increase student creativity in basic electronics material and increase student creativity in basic electronics material.

In the implementation of the research conducted, students collect electronic tools and materials that they want to develop with each circuit consisting of cables, circuit boards, transistors, Capacitors, potentiometers, and tools in the form of digital multimeters to measure the current and voltage produced, there are 3 experiments carried out, namely resistor manufacturing experiments and capacitor manufacturing experiments.

In the resistor making experiment, students were guided to make a resistor from carbon charcoal which was inserted into a used pipette and both ends were given a cable connection. After the resistor from used charcoal is successfully made, then the measurement of the resistance is carried out using a multimeter. While in the experiment of making capacitors, students were guided to make capacitors using used zinc plates and used plastic. The plate is made with a size of 1 x 1 cm and after being made, a large measurement of the capacitor is made using a capacity measurement multimeter.

After students are able to make resistors and capacitors, then in dynamic electricity material, students conduct experiments on the use of resistors and capacitors in electronic circuits. In this experiment, the resistors and capacitors that have been produced are then applied to an electronic circuit. The current and volts that occur are displayed using LiveWare animation. The result or output obtained is a series of used electronic components assisted by the Livewire simulator as shown below (Figure 1):

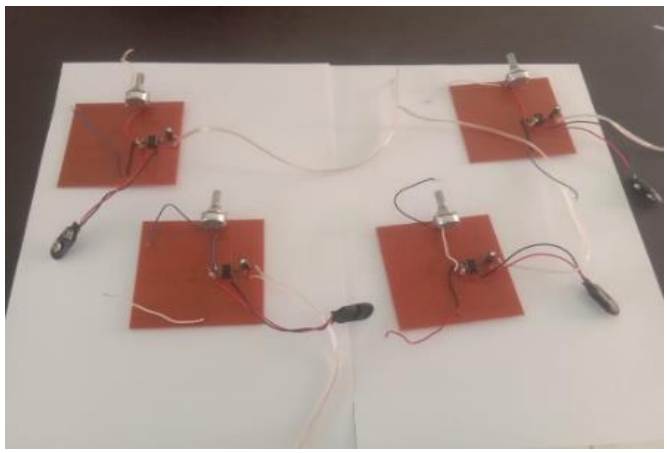

Figure 1. Series of electronic components from used goods with livewire simulator

In the implementation of this study, students were very enthusiastic and excited in using learning media for used electronic components assisted by Livewire simulators so that there was an increase in student creativity in basic electronics material.

Conclusion

The temporary conclusion from the results of data analysis is that the development of used electronic component media can increase student creativity on the subject of electronics. Temporary suggestions from the results of data collection are that students should try other electronic circuits using used materials so that

effectively in learning later they can develop valuable skills in the field of electronic technology.

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