Learning Motivation In Chemistry Learning

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Abstract

This study aims to develop STEM student worksheets. The research method used is research and development (R&D) using the ADDIE model stages. Determination of the research sample using random sampling method with research subjects are students of class XI IPA 1 SMA Swasta BPK 1 Penabur Bandung. The results showed that students' science process skills increased significantly and were significantly different from the pretest based on the T- test. Students' science process skills increased in each indicator with an average N-gain score of 37 belonging to the medium category. Students' motivation to learn science is high with an average score of 87.38% belonging to the very good category

Keywords: Science Learning Motivation; SPS; STEM; Student Worksheets

Introduction

The goal of this research is to provide STEM student workbooks. The ADDIE model stages were employed in the research and development (R&D). The research sample was determined using a random sampling approach, with research participants being students from class XI IPA 1 SMA Inshafuddin Banda Aceh. Based on the T- test, the results demonstrated that students' science process abilities improved greatly and were significantly different from the pretest. Students' science process abilities improved across the board, with an average N-gain score of 37 falling into the medium group. Students are highly motivated to learn science, with an average score of 87.38% falling into the very good category.

According to national exam results from 2015 to 2019, SMA Swasta BPK 1 Penabur Bandung has issues, particularly in chemistry instruction. Several factors influence student learning results. These elements are divided into two categories: internal and external (Ekowati, 2019). Students may become bored with less diversified learning approaches. Learning model variations can boost learning motivation (Hasan et al., 2019). Improving student learning outcomes is inextricably linked to increasing learning motivation (Ekowati, 2019). The amount of engagement in the learning process might reflect a student's motivation to study (Lukita & Sudibjo, 2021).

Because science process skills are the foundation of scientific inquiry and intellectual development for learning science concepts (Wahyuni et al., 2017), developing concepts, developing facts (Siahaan et al., 2017), and developing a sense of responsibility (Elvanisi et al., 2018), students must own them. Learning to apply methods science, technology, engineering, and mathematics (STEM) is one endeavor to improve science process abilities, because STEM activities may educate students to design, experiment, build engineering products, and decrease mistakes (Sari et al., 2020).

Teachers must be innovative in producing instructional resources that may actively lead students in discovering their grasp of learning topics. Problem-solving exercises are one of the learning qualities that might help build creative thinking skills. The STEM method to learning can help students solve issues by merging science, technology, engineering, and mathematics (Astuti et al., 2021). Teaching resources, such as student worksheets, are required to help the learning process. A student workbook is one type of instructional material that may be made. This workbook has pages that are intended to

improve cognitive skills and incorporate numerous learning components. The student workbook is a document that provides students with information or instructions for participating in learning activities that entail practicing or applying acquired knowledge toward specified goals. 2021) (Kuswidyanarko, Rohana, & Jannah).

Student worksheets can be used in conjunction with a learning strategy. One of them can be used in conjunction with the STEM method. The STEM method meets the curricular standards established in 2013 (Ramli et al., 2020). Students can grasp concepts and link them to everyday life using the STEM method, which makes learning more enjoyable. (Herak, 2019). STEM student worksheets can be used to help students improve their scientific literacy. STEM student worksheets have been shown to influence learning results (Sulistiyowati et al., 2018). Even though STEM student worksheets can improve learning outcomes, no STEM student worksheet has been discovered whose learning creates floor cleaning formula products as one of the creative learning so that students' enthusiasm to learn science can be increased.

Method

This study employs the Research and Development (R&D) approach, which is a sort of research aimed at developing, deepening, or expanding existing (educational) knowledge (Arifin, 2011). The STEM student worksheet with the STEM project to build floor cleaning formulae was developed in this study.

The ADDIE model (Analysis, Design, Development, Implementation, and Evaluation) is used throughout the development stages of this research. A pre-experimental strategy was adopted in this investigation. The One Group Pretest-Posttest Design was utilized in this study to compare the findings before and after therapy (Sugiyono, 2012). Needs analysis sheets, student worksheet evaluation sheets, SPS exam questions, and a science learning motivation questionnaire were used as study tools..

Students from BPK 1 Penabur Private High School Bandung's class XI IPA 1 participated in this study. Investigation of research subjects employing a random sample approach, meaning by giving each student an equal chance to become a subject in this study. A computer program was used to examine student worksheet feasibility data as well as students' enthusiasm to learn science.

$$P = \frac{\text{Score Obtained}}{\text{Max Score}} \text{x } 100\ \% \quad (1)$$

The SPS exam was evaluated using the t-test to determine whether there were any significant changes before and after studying with the STEM student worksheet. The n-gain test was also used to compare student SPS before and after therapy on each SPS indicator. The Statistical Package for the Social Sciences (SPSS) tool was used to perform the N-gain and t-tests.

Result and Discussion

STEM student worksheet creation

STEM student worksheets were created utilizing the ADDIE model phases (Analysis, Design, Development, Implementation, and Evaluation). The following ADDIE phases were used in this study:

Analysis

A requirements analysis questionnaire and teacher interviews were used to conduct the various rounds of analysis. As a result of a lack of supporting facilities, instructors seldom utilize worksheets in learning, STEM worksheets are never used, and teachers rarely undertake practicums. In addition, the teacher stated that he required STEM student workbooks. As a result, this study created worksheets for STEM students to help teachers overcome challenges caused by a lack of material preparation for practicums.

Design

Table 1. STEM concepts in student worksheets

STEM Aspect	STEM Concepts
Science	Chemistry related to the concept of solution
Technology	Make a floor-cleaning formula
Engineering	Design procedures for making floor cleaning formulas and ways to prove the formula's success
Mathematics	Calculate the amount of material used to make floor cleaners, calculate costs, and calculate the selling price

This stage creates STEM student workbooks and project ideas that are STEM-related. Floor-cleaning kits are the products of STEM study in this student worksheet. Table 1 depicts the STEM idea in student workbooks. The floor-cleaning kits created in the STEM student worksheet include four alternative formulae. It is intended to make pupils more engaged in their studies.

Development

The development stage begins with expert validators validating student worksheets. The validator evaluates the STEM student worksheets based on a variety of evaluation factors such as material factors, learning components, presentation, language, physical appearance, illustrations/drawings, and the completeness of the details mentioned in the validation sheet brought by two validator experts. According to Arikunto's eligibility score description (2013), the validation findings of STEM student worksheets earned an average value of 83.75% with a very good category. As a result, the created STEM student worksheets can be used with adjustments based on the expert validator's recommendations.

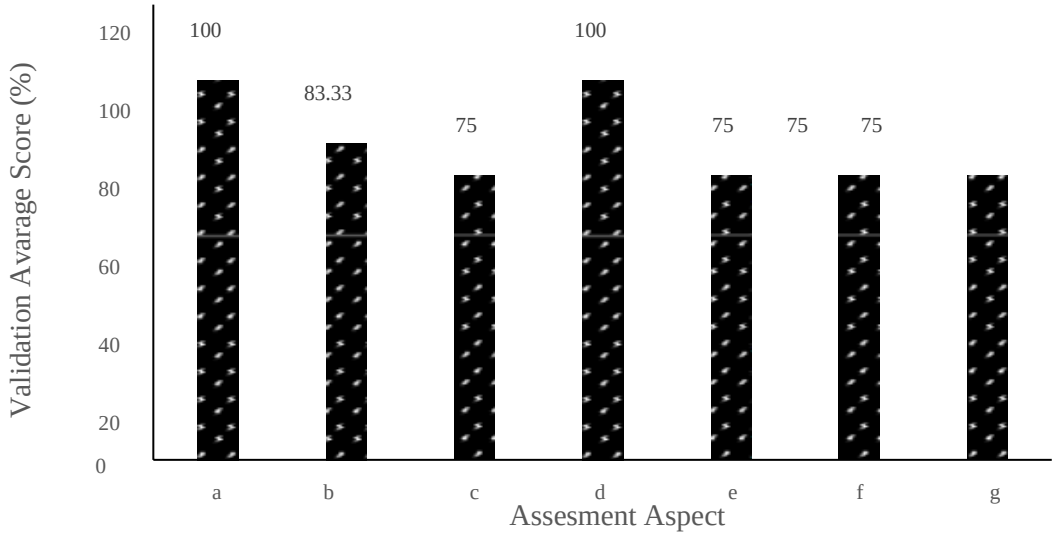

Figure 1. Student Worksheet Validator Results: (a) Material, (b) Learning Components, (c) Presentation, (d) Language, (e) Physical Appearance, (f) Illustrations/drawings, (g) Completeness of Components

Implementation

The STEM student worksheet was implemented in this research over the course of two meetings. The students were separated into four groups during the first meeting based on the number of formulae designed on the student worksheet. Students talk about how to make floor cleaners, such as what sort of formula to use, what each component does, and how to establish methods for creating floor cleaning kits. Students created floor cleaners according to previously defined processes in the second meeting, demonstrated the success of the floor cleaning kit on ceramics, and compared the level of cleanliness of ceramics cleaned with a floor cleaning kit and pottery cleaned without a floor cleaning kit..

Table 2. Floor Cleaning Kit Formulas

Group	Formula
1	Dish soap, vinegar, soda, water
2	Dish soap, caustic soda, water
3	Dish soap, chlorine, water
4	Dish soap, salt, vinegar, water

Figure 2. Shows the effectiveness of the students' floor cleaning solution on difficult-to-clean ceramics.

Figure 2. Comparison of ceramic samples: (a) dirty ceramics that are difficult to clean, (b) ceramics that have been cleaned with a floor-cleaning formula

Evaluation

The production of STEM student worksheets is evaluated after the learning process employs the generated STEM student worksheets. The SPS test and questionnaire analysis were used to assess students' willingness to learn science..

Science Process Skills

The disparities in scientific process skill pretest and posttest scores show that science process abilities have improved. Statistical test stages were used to obtain data on SPS pretest and posttest values. The normality test ensures that the data is regularly distributed so that it can be examined using parametric statistics, namely the t-test. The SPSS program was used to perform the normalcy test. The normality test at the significant level = 0.05, as shown in Table 1, indicates that the data is regularly distributed because the significance is greater than 0.05. Parametric statistics, specifically the t-test, can

be used to assess research data..

Table 3. Pretest and posttest Normality Value Test

Normality test						
Category	Kolmogorov- Sminrnov			Shapiro-Wilk		
	Statistic	df	Sig	Statistic	df	Sig.
Pre-Test	137	20	200	959	20	.521
Post-Test	192	20	051	953	20	.421

The posttest average value is 64.33> 43.00, which is higher than the pretest average value. Based on significant testing, the T-test result is negative. If the t-test is negative, the difference in value in this study is substantially different from t-test -8.894, which is less than t-table 2.093, based on the parameters in the t-test.

Table 4. Tests of Students' Science Process Skills

Activity	N	Average	Sd	t_{test}	df	t_{table}
Pre-Test	20	43.00	10.47	-8.894	19	2.093
Post-Test	20	64.33	11.90			

The Averange SPS score rose from 43 to 64.33 points. A value of 37 is obtained via the n-gain test is in the moderate range. Each indicator showed an increase in the acquisition of SPS student scores. Mahjatia's (2020) research backs up the conclusions of this study.

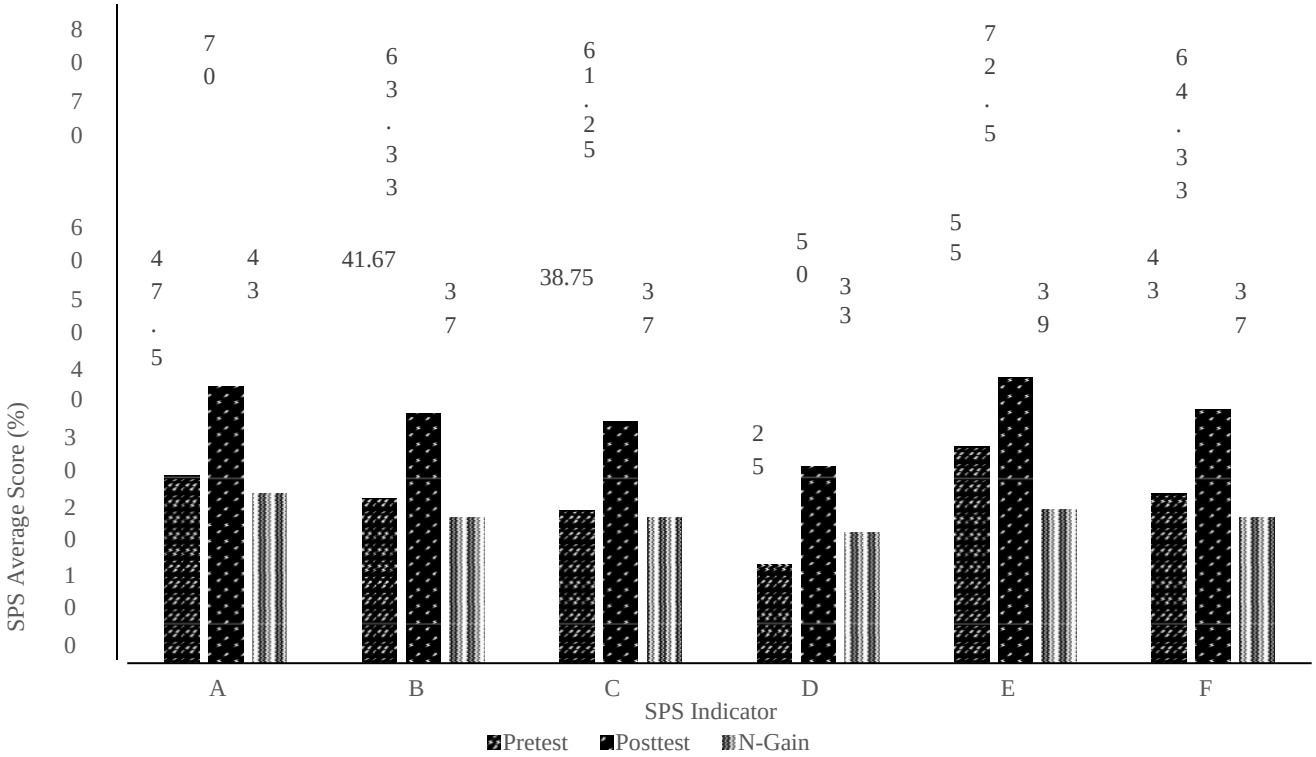

Figure 3. Percentage of Science Process Skills Tests (%); (A) Formulating Hypotheses, (B) Planning Experiments, (C) Conceptual Concepts, (D) Making Observations, (E) Interpreting Data, (F) Averages.

In this study, the indicator for generating a hypothesis has the biggest rise compared to other indicators, with a value of 47.5 growing to 70 with an N-gain value of 43, which falls into the medium range. This demonstrates the positive influence of STEM student worksheet learning on students' capacity to construct hypotheses. STEM student worksheets enable students to perform experiments,

which can increase students' capacity to construct hypotheses (Salsiah, 2015).

Science Learning Motivation

This study examined motivation to learn science using five indicators: the desire and want to achieve, the urge and need to study, the dreams and goals for the future, the presence of interesting learning activities, and the presence of a suitable atmosphere..

According to Purwanto's evaluation description (2013), students' enthusiasm to learn science after learning using STEM student worksheets is very good, with an average proportion of 87.38 in the very good category. The presence of a want to study as well as a drive to succeed is an indication of motivation to learn science that achieves the greatest average percentage when compared to other indicators. A suitable learning environment is the indication with the lowest proportion. According to conversations with the chemistry instructor at BPK 1 Penabur High School in Bandung, school facilities for chemistry study are inadequate, particularly for practical activities. Practicum activities are seldom carried out in schools due to a lack of preparation of the necessary resources, which discovered that overall learning with STEM student wordksheets was extremely good, and the SPS rose with each meeting

Table 5. Assessment of Students' Science Learning Motivation

Motivation Indicator	Total Value	Percentage
There is a will and desire to succeed	1335	89
There is a drive and a need to learn	425	85
There are hopes and aspirations for the futures	173	86,5
There are exciting activities for learning	354	88.5
There is a conducive learning environment	247	82.33
Average		87.38

Motivation is critical in motivating students to actively engage in STEM topics and pursue STEM jobs (Bayanova et al., 2022). Implementing STEM student worksheets in chemistry classroom improves students' motivation to learn science. A form of the learning strategy is STEM student worksheets with learning tasks to create floor cleaning products. One of the factors of improved student motivation is variation in learning approaches (Aziz & Shaleh, 2019). Because learning motivation is essential in learning activities, learning motivation is an influencing component that can affect students' thinking (Arslan, 2017). According to the findings of Sugiyanto et al.'s (2020) study, learning motivation has a considerable influence on learning outcomes.

Conclusion

STEM student worksheets designed to promote science process abilities and students' enthusiasm to learn science via the creation of floor cleaning kits had an average score of 83.75.

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