

# The influence of the learning approach of Science Technology Engineering and Mathematics (STEM) on attitudes and learning outcomes in class XI students of SMA Negeri 5 Halmahera Utara for material rea

---

**Submission date:** 07-Jun-2023 11:24AM (UTC+0700) by Djefry Tani

**Submission ID:** 2110782943

**File name:** Tani\_KI\_The\_influence\_of\_the\_learning\_approach....pdf (326.77K)

**Word count:** 2265

**Character count:** 12014

PAPER · OPEN ACCESS

## The influence of the learning approach of Science Technology Engineering and Mathematics (STEM) on attitudes and learning outcomes in class XI students of SMA Negeri 5 Halmahera Utara for material reaction rate

To cite this article: A S Manis *et al* 2021 *J. Phys.: Conf. Ser.* **1968** 012012

View the [article online](#) for updates and enhancements.

### You may also like

- [Critical study of stem-based learning in order to develop century skills 21](#)  
S. Muslim, A. Fathoni, N. Kusumawati et al.
- [Preface](#)
- [The influence of STEM \(science, technology, engineering, and mathematics\) learning approach on students' learning outcomes on newton's law concept](#)  
N S Utami and A Nurlaela



**245th ECS Meeting**  
San Francisco, CA  
May 26–30, 2024

**PRiME 2024**  
Honolulu, Hawaii  
October 6–11, 2024

Bringing together industry, researchers, and government across 50 symposia in electrochemistry and solid state science and technology

Learn more about ECS Meetings at  
<http://www.electrochem.org/upcoming-meetings>

**ECS** Save the Dates for future ECS Meetings!

# The influence of the learning approach of Science Technology Engineering and Mathematics (STEM) on attitudes and learning outcomes in class XI students of SMA Negeri 5 Halmahera Utara for material reaction rate

A S Manis\*, D Tani and W A R Rombang

Pendidikan Kimia, FMIPA, Universitas Negeri Manado, Minahasa, Indonesia

\*manisaplritson@gmail.com

**Abstract.** The purpose of the study was to determine the effect of the Science Technology Engineering and mathematics (STEM) learning approach on attitudes and learning outcomes on the reaction rate material. This research was conducted at SMA Negeri 5 North Halmahera in the 2019/2020 school year. The research method used is descriptive research design with a pre-test and post-test control design. 30 students of Class XI MIA 1 were randomly selected to be assigned as research sample. Data on student attitudes towards learning chemistry were obtained through a questionnaire of initial test and final test of 20 items and data learning outcomes were obtained through the pre-test and post-test of 15 objective items. The results of the study obtained an average score of student attitudes towards chemistry after using the STEM learning approach of 93, 73 higher than before using the STEM approach 49.73 while the average score of learning outcomes after using the STEM learning approach was 78.33 higher than learning outcomes before using the STEM approach of 37.83. Based on the research findings, this show that there is an effect of the STEM learning approach on students' attitudes and learning outcomes on the reaction rate material.

## 1. Introduction

Science and technology are very influential on the progress of a country [1]. In line with the above, countries need qualified human beings who are able to identify and can use science and technology to develop their own technology [2]. But in reality, many countries have experienced a decrease in the number of students who choose to study science and technology, even in the United States and some European countries [3]. In line with the above, a learning approach is needed that can increase students' interest, motivation, attitudes, and thinking abilities. One method or approach that is able to develop higher order thinking skills is the STEM approach [4].

STEM can integrate science, technology, engineering / design, and mathematics which are usually carried out in problem solving activities in assignments, tests, and exams, it even has a positive effect on student learning outcomes [5]. The STEM approach can make the learning atmosphere more relevant and attractive to students, and this contributes to deepening students' understanding of the teaching content



Content from this work may be used under the terms of the Creative Commons Attribution 3.0 licence. Any further distribution of this work must maintain attribution to the author(s) and the title of the work, journal citation and DOI.

Published under licence by IOP Publishing Ltd

applied in the environment through techniques or technology, besides that STEM can also improve thinking attitudes and skills as well as student learning outcomes [6]. The STEM approach can prepare students to compete for the global economy of the 21st century [7].

There are three STEM learning approaches that can be applied, namely; (1) the silo approach, an approach that emphasizes the opportunity for students to gain knowledge rather than technical skills; (2) embedded approach, namely an approach that emphasizes the mastery of knowledge through real-world conditions and ways that can be done to solve problems in the social, cultural and functional spheres; (3) an integrated approach, namely an approach that emphasizes combining various STEM fields and making them one subject [8].

The purpose of this study was to determine the effect of the STEM learning approach on attitudes and learning outcomes in class XI students for the material reaction rate.

## 2. Methods

This research is a descriptive study with a pretest and posttest control group design research design. In this research design, the comparison of attitudes and learning outcomes from the pretest and posttest values was seen and analyzed descriptively. The treatment given has an effect if there is a significant difference between the pretest and posttest values.

⊕E	Y1	X	Y2
----	----	---	----

Figure 1. Research design.

Information:

E : A sample taught by approach STEM

Y1 : Pretest Value (before learning)

Y2 : Posttest scores (after learning)

X : Learning using an approach  
STEM

⊕ : Random

The population of this study were all class XI IPA SMA Negeri 5 Halmahera Utara odd semester 2019/2020. Class XI IPA 1 as a research sample with a total of 30 students and carried out learning using the STEM approach.

The research procedure carried out includes several stages; (1) the preparation stage in the form of; literature study, preparation of Learning Implementation Plans (RPP), preparation of research instruments and test the validity and reliability of the items in class XII IPA students who have received material reaction rates; (2) implementation stage in the form of; giving pretest questions, learning using the STEM approach, giving posttest questions, documenting the implementation of learning; (3) the final stage is; data analysis and discussion of results.

The method of data analysis consisted of test instruments in the form of validity and reliability tests, for data were analyzed descriptively.

## 3. Results and discussion

### 3.1. Research result

This research was conducted at SMA Negeri 5 Halmahera Utara in class XI IPA 1 and was conducted from September to October in the 2019/2020 school year. This study uses a STEM learning approach.

### 3.2. Research instrument test

3.2.1. *Validity test.* Test the validity of the attitude questionnaire and pretest and posttest questions using the Pearson Product Moment correlation formula with the Microsoft excel program where of the 25 attitude questionnaire questions 5 were declared invalid and only 20 were valid, and of the 20 pretest and posttest questions that were declared valid only 15 and 5 questions. invalid question. Therefore, the researcher only used 20 questions for the attitude questionnaire and 15 questions for the pretest and posttest.

3.2.2. *Reliability test.* Reliability test using KR-20 analysis with Microsoft Excel program. The test results obtained that the value for the attitude questionnaire was 1.020 and the pretest and posttest scores were 0.842 so it could be said that the attitude questionnaire items and the pretest and posttest questions used were reliable.

### 3.3. Data retrieval

The data taken in this study are data on student attitudes and learning outcomes on the reaction rate material. After carrying out this research, the following attitudes and learning outcomes were obtained;

**Table 1.** Student attitude data.

	N	Min	Max	Mean	Std. Deviation
<i>Pretest</i>	30	42	69	49.93	5.82
<i>Posttest</i>	30	89	97	93.73	3.69

Based on Table 1 above, where the average score of students' attitudes before learning using the STEM approach was 49.93 and the average increased after learning using the STEM approach was 93.73. The student learning outcomes obtained are as follows table 2;

**Table 2.** Learning outcome data.

	N	Min	Max	Mean	Std. Deviation
<i>Pretest</i>	30	15	60	37.83	13.80
<i>Posttest</i>	30	55	95	78.33	8.74

Based on Table 2 above, where the average score of student learning outcomes before using the STEM approach was 37.83 and the average increased after learning using the STEM approach was 78.33.

### 3.4. Discussion

This study used a pretest and posttest control group design where only one class was used as the research sample. In line with the objectives of this study, namely to determine the effect of the STEM learning approach on attitudes and learning outcomes on the reaction rate material, based on the research objectives and the results obtained where STEM affects students' attitudes and learning outcomes on reaction rate material. This is evidenced by the pretest and posttest mean scores which are very significant both in student attitudes and learning outcomes.

In line with the above, of course this is influenced by the activities of students who are more directly involved in the learning process, where at the Science stage the teacher asks questions according to material related to daily life so that this can encourage interest and curiosity about the material to be studied. Then at the technology stage students play a more active role in learning, where students are asked to search for material being studied using computers, lab tops, or cellphones. After that the material that has been sought is sent back to the WhatsApp or Facebook group which has been provided by the teacher.

At the engineering stage, students were divided into groups to discuss material factors that affect the rate of reaction that each group has shared including temperature, surface area, concentration, and catalyst. In addition, at this stage each group was given the task of making a simple practicum related to the material and utilizing tools and materials that are often encountered in everyday life. Then at the mathematics stage, students are required to be able and critical in solving problems in mathematics. In this case, the reaction rate is closely related to mathematics.

In line with research results, From the scores of student learning outcomes and attitudes that have been obtained, there are 9 students whose attitude scores have increased but their learning outcomes have not reached the completeness criteria or have decreased. Of course, there are several factors that influence so that the value of their learning outcomes decreases, including the 9 students lack of skills in mathematics, as evidenced by several calculation questions their answers are wrong, as well as the limitations of having cellphones and lack of skills in using technology. On the other hand, there were 21 students who had similarly improved attitudes and learning outcomes.

In line with research findings Of course there is the influence of the STEM learning approach on student attitudes and learning outcomes and there is a relationship between student attitudes and learning outcomes, we can see the comparison of 30 students whose attitudes and learning outcomes both increase, namely as many as 21 students and their attitude values increase but the result value learning decreased by 9 students. This is also evidenced by the average difference between the pretest and posttest scores between student attitudes of 43.8 and learning outcomes of 40.5.

This is also in line with a research conducted by one of the researchers that there is an influence on student attitudes and learning outcomes using the STEM learning approach [9].

#### 4. Conclusion

In line with the results of the research and discussion, it can be concluded that the STEM learning approach affects students' attitudes and learning outcomes in the reaction rate material. This is indicated by the difference in the mean score of attitudes and learning outcomes which are very significant between the pretest and posttest.

#### References

- [1] United Nations Educational, Scientific and Cultural Organization (UNESCO) 2010 Education for all, Global Monitoring Report. 2010, Retrived From: <http://www.unesco.org/new/en/education/themes/leading-the-international-agenda/efareport/reports/>
- [2] Kennedy T J and Odell M R L 2014 Engaging Students in STEM Education *Sci. Educ. Int.* **25**(3) 246–258
- [3] Osborne J and Dillon J 2008 *Science Education in Europe: Critical Reflections (A Report to the Nuffield Foundation)* (London: King's College)
- [4] Fan S C and Yu K C 2015 How an Integrative STEM Curriculum Can Benefit Students in Engineering Design Practices *Int. J. Technol. Des. Educ.* **27**(1) 107-129
- [5] Becker K and Park K 2011 Effect of Integrative Approaches among Science, Technology, Engineering, and Mathematics (STEM) Subjects on Students' Learning: A Preliminary Meta-Analysis *J. STEM Educ.* **12** 23–37
- [6] Kuenzi J J 2018 Science, Technology, Engineering, and Mathematics (STEM) Education: Background, Federal Policy and Legislative Action, Congressional Research Service. 2008, Retrieved June 6, 2015. From: <http://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=1034&context=crsdocs>.
- [7] Hynes M M and Santos A D 2007 Effective Teacher Professional Development: Middle School

- Engineering Content *Int. J. Eng. Educ.* **23**(1) 24–29
- [8] Roberts A and Cantu D 2012 Applying STEM Instructional Strategies to Design and Technology Curriculum. USA: Department of STEM Education and Professional Studies Old Dominion University 110-118
- [9] Nailul K, Abdurrahman, and Ismu W 2018 Implementation of STEM Learning Approach to Improve Critical Thinking Ability of High School Students on Sound Wave Material *JRKPF* **5**(2)



# The influence of the learning approach of Science Technology Engineering and Mathematics (STEM) on attitudes and learning outcomes in class XI students of SMA Negeri 5 Halmahera Utara for material rea

---

## ORIGINALITY REPORT

---

15%

SIMILARITY INDEX

15%

INTERNET SOURCES

13%

PUBLICATIONS

6%

STUDENT PAPERS

---

## MATCH ALL SOURCES (ONLY SELECTED SOURCE PRINTED)

---

8%

★ A Susanto, S W Danoebroto. "Designing STEM-based AjarMat activities for the study from home program", Journal of Physics: Conference Series, 2021

Publication

---

Exclude quotes Off

Exclude bibliography On

Exclude matches < 2%