The Effect of Stem-Based Learning Module on Students Learning Outcomes and Motivation in General Chemistry Courses

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ABSTRACT	
Keywords: Module; STEM; Learning Outcomes; Motivation; General Chemistry.	This study aims to determine the effect of STEM-based learning modules on learning outcomes and student motivation in general chemistry courses. This research is a quantitative research. This research was conducted at the Faculty of Teacher Training and Education, University of HKBP Nommensen Pematangsiantar in September 2021-January 2022. The type of research used was a quasi-experimental design using a Non-Equivalent Control Group pre-test-post-test design. Data collection methods used were multiple choice tests to measure learning outcomes and questionnaires to analyze learning motivation. The results showed that the use of STEM-based modules had an effect on student learning outcomes and motivation in general chemistry courses. The increase in learning outcomes in the experimental class can be seen from the large percentage of students who get high N-Gain scores in the experimental class, which is 67.8% compared to the percentage of students who get high N-gain scores in the control class. class that reaches 20%. The use of STEM-based learning modules can increase students' learning motivation, namely learning motivation as much as 76% in the very high category, 9% in the high category, and 15% in the medium category, and none of the students have learning motivation in the low and very high low categories. . The conclusion of this study is that there is a very significant influence through STEM-based learning modules on student learning outcomes and motivation in general chemistry courses.

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A. INTRODUCTION

Life 21st century no avoid the various competition, one determinant in power competitive the that is ability to application knowledge new to creating something innovation with digital technology. because that, participant education need to supply core mastery of knowledge through Education (Karim, 2021). In activities education at school where is the activity process of learning is a very important activity important for students. Success or whether or not in reach education learning that seen from a power teacher in the process of delivering learning. In the learning process, the teacher plays a role important for can channel existing knowledge in herself to participant teach (Asrizal et al., 2022). What education? Interpreted as activity somebody in the guide and teach child going to

growth and development optimally to stand up alone and responsible answer. Ideal education no only oriented to the past and present , but is a process of anticipating and discussing the future with moderate situation happening in society Rachmawati et al., (2017); Sukmawijaya et al., (2019) .

Along development of technology, colleges tall has big responsibility to realizing competent graduates, so that a systematic and fun learning process is required. Competent graduates depends on input and the learning process carried out at the university high (Paramita et al., 2016);(Oktavia, 2019). Lecturer as end spear learning in college high, must capable create atmosphere fun and leading learning student for more active, independent and innovative. Independence students in the learning process form paradigm learning student Centre (Ananta & Suhery, 2022).

To support the embodiment student Centre learning, lecturers need creative and innovative, one of them in develop teaching materials. Teaching materials are summary given material to the student, ok oral or written, in form print or other saved formats in electronic files Amdayani et al., (2022); Afriana et al., (2016). Very useful teaching materials in the learning process among them give opportunity to study independent to student, reduce dependency to lecturer, and make it easier student in shape draft alone.

Based on eye observation studying chemical general, in the learning process the already use teaching materials from the internet, compiled by the lecturer support or other teaching materials. However availability this teaching material still not yet capable fulfil demands today's learning this. This thing could seen from still existence students who haven't trained for study independent, and more than 50% yield quiz still low, especially in the eyes studying chemical general Afifah & Suhery, (2021); Yuliati & Saputra, (2019).

One multiple approaches developed for increase quality education in the middle fast progress field science and technology in the 21st century is approach learning based Science, Technology, Engineering, and Mathematics (STEM). STEM approach that integrates Among science, technology, engineering, and mathematics with focus the learning process on solving problem real in life daily or life in the world of work van Gog et al., (2020);Jesionkowska et al., (2020). Destination STEM approach in line with demands education 21st century, namely so that participants educate have literacy visible science and technology from ability reading, writing, observing, carrying out scientific processes, and capable develop competence possessed for applied in face problem life daily related field STEM science Lombardi et al., (2021). Skills field science, technology, engineering, and mathematics in developments in the world of education and work this 21st century seen each other need among one with other. Therefore, in face challenge education and work that, we need tough student prepare self in fields that.

Motivation learning is very decisive level achievement results study child. When students have motivation for study so student will have spirit for explore given knowledge, students will attempted develop Skills in himself, and show attitude curious learner know to learning that is followed (Makki & Affaandi, 2019); Hidayati et al., (2019). Motivation study needed in all context learning, good learning stare advance nor online learning. During this Covid-19 pandemic, some big school to do activity home learning with help internet network. Limited activity stare face at school demand encouragement high learning from every students for learning could followed with maximum. Motivation study be one much needed factor during the online learning period so that student could Keep going involved active in learn and in the end student will get meaningful learning Mulyasari & Sholikhah, (2021); Zulaiha & Kusuma, (2020).

Indicator from existence motivation study student is there is attention or interest to learning provided by the teacher (Zebua, 2020). Besides that, students who have motivation study will show attitude positive to something object in the form of excitement or feeling happy and excited inside

learning (Rizqi, 2018). Based on observations made, one of the cause that makes student not enough motivated is the teacher doing explanation Theory verbally with more media many use the words or text so that student lost focus and look not enough interested on lessons delivered. During the learning process, one of the party who can push growing motivation study students in class is a teacher (Widarti et al., 2020). Awareness important that every student valuable and continue develop must owned by teacher in guide student during study. Teacher will the more anticipatory when recognize uniqueness or characteristics every student so that the teacher can create learning that can fulfil needs every students. Teacher need knowing moment where student need for motivated During study (Wijayanto et al., 2020). Teachers have a hand in increase motivation study student good intrinsic nor by extrinsic. In build motivation study, teachers need for presenting variation learning that can build motivation study student as well as Keep going encourage the form of strengthening to students to follow learning with good.

Based on results research conducted Ulmi (2019), shows that module chemical base Theory biochemistry STEM-PBL based can increase results study student with value of t count of 7, 813 > t table 1,667. So are the results research conducted by Nina (2015) which states : that use of learning media chemical STEM based with system carbon gas detector monoxide make difference results significant learning reviewed from aspect cognitive, emotional, and psychomotor. Based on the description above, researchers need to conduct research with the title "The Influence of STEM Learning Modules Based on Learning Outcomes and Student Learning Motivation in General Chemistry Courses". With the aim and benefit of this study is to determine the effect of STEM learning modules based on learning outcomes and student motivation on student learning outcomes in general chemistry subjects.

B. METHODS

Study this held at the Faculty Teacher Training and Education (Yustina et al., 2020), HKBP Nommensen University Pematangsiantar in September 2021 - January 2022. Research this use approach descriptive. Study this is study quasi experiment with use design study Non Equivalent Control Group pre-test-post-test design (Sugiyono, 2017) .

Population in study this is student at Faculty Teacher Training and Education, HKBP Nommensen University Pematangsiantar who took eye General Chemistry course. The sample in this study were 50 students of the Mathematics Education Study Program. Selection technique sample use (Prestiadi et al., 2020). Technique data collection in study this is with give test for knowing results learn and give questionnaire for knowing motivation study student in study after use module learning STEM based (Umanailo, 2019). The data obtained in study this are qualitative and quantitative (Rohma et al., 2020). Quantitative data will analyzed use statistics descriptive for describe the result data learning and motivation study students, while qualitative data analyzed with give meaning to data description. Statistical data analysis used in the form of normality test, homogeneity test, t-test and N-Gain test (Purba et al., 2021).

Normality test conducted for knowing the data is normally distributed or no . Homogeneity test aim for know homogeneous data or no t-test used for knowing there is or whether or not difference from class experiment and class compared control (Agustina et al., 2020). N-Gain test used for knowing enhancement results study student in group experiment and control with analyze the average value of the pre-test and the average value of the post-test (Sugiyono, 2017). Questionnaire motivation study obtained with share amount score motivation study student with amount students, who use a Likert Scale, namely strongly agree (SS), agree (S), not agree (TS) and strongly disagree

agree (STS). Average response score student obtained with share amount score response student with amount student.

C. RESULT AND DISCUSSION
1. Effect of Learning Module STEM - Based on Learning Outcomes Student

Please check all the images in your journal, both on screen and in the printed version. Normality test to the result data study student before and after use module learning STEM-based can seen the results are in Table 1.

Table 1. Normality Test Results on Learning Outcomes Student before and after using the Learning Module STEM Based

No	Learning Outcome Data Student	L Count	L Table	Information
1.	Before Experiment	0.14	0.173	Normal
2.	After	0.12	0.173	Normal

Normality test data the show that the result data study student before and after use module learning STEM based is normally distributed because L Count < L Table. Homogeneity test to the result data study student before and after use module learning STEM-based can seen the results are in Table 2.

Table 2. Homogeneity Test Results on Learning Outcomes Student before and after using the Learning Module STEM Based

S ^{2} Before	S ^{2} After	F Count	F Table	Information
125.68	66.98	1.87	2.02	Homogeneous

Homogeneity test data the show that the result data study student before and after use module learning STEM based is homogeneous for level significance (α) of 0.05 and dk1 = 23 because F Calculate < F Table. Statistical test to the result data study student before and after use module learning STEM -based can seen the results are in Table 3.

Table 3. Hypothesis Test Results with t-test on Learning Outcomes Student

t count	T table	Hypothesis Test	Information
10.63	1,714	Ho rejected	there difference significant

From hypothesis test data the show that value of t table at level significant 0.05 and degrees freedom dk = 24-1=23 is of 1.714. Because t count > t table ie 10.63 > 1.714, then Ho is rejected it means there is significant difference in results study before and after use module learning STEM based Learning outcomes obtained from pre-test and post-test data study this could seen than average score pre-test and post-test as in Table 4.

Table 4. Average Pre-test and Post-test scores Student

Score	Experiment	Control
Pre-test	64.38	63.55
Post-test	85.45	77.65

Based on the average value pre-test and post-test the show that results study student in class experiments using module learning more STEM based tall compared with class control (85.45 >

77.65). This thing caused because in learning using module learning STEM based , student could understand Theory in eye General Chemistry course with link it with Science, Technology, Engineering and Mathematics (STEM) independent. There are problems in module could increase ability student in analysis so that student capable solve related problems with life daily that is related problems with material on the eye General Chemistry course. Experience learning gained student the in find knowledge new and solution problem, will more increase understanding the concept in the eye General Chemistry course. Based on results pre-test and post-test the analysis using the N-Gain test for see percentage enhancement results study student before and after use module learning STEM based. As for the results percentage N-Gain value can be seen in Table 5.

Table 5. Percentage of N-Gain Class Experiment and Control

% N-Gain	Experiment	Control
Low	3.4%	43%
Currently	26.5%	34%
Tall	67.8%	20%

Based on percentage the value of the N-Gain, can be concluded that there is enhancement results study in class experiment. This thing seen from big percentage students who get high N-Gain value in class experiment that is reached 67.8% compared to with percentage students who get high N-gain value in class control that is reach 20%.

As for the results study student be measured with use instrument test in form test choice double (multiple choice). Test given at the beginning (pre-test) before implementation learning and the end after learning finished (post-test). Instrument test both at the beginning (pre-test) and at the end learning (post-test) each amounted to 25 pieces matter. Pre-test aim for see knowledge beginning student before given treatment, while post-test aim for see enhancement understanding student to material on the eye General Chemistry course that has been taught during the learning process. In class experiment study use module learning STEM -based while in class control no use module learning STEM based.

2. Effect of Learning Module STEM based on Motivation Study

In determine influence module learning STEM based on motivation study student conducted with charging student questionnaire to the learning process use module learning STEM based on the eye General Chemistry course. Questionnaire that is instrument containing motivation learning given after learning finished. Questionnaire motivation made as many as 20 items , with criteria answer in form Likert scale, namely strongly agree (SS), agree (S), not agree (TS) and strongly disagree agree (STS). Questionnaire motivation study given to respondent class experiment with a total of 24 students.

From result analysis questionnaire motivation study after follow learning with use module learning STEM based on the eye General Chemistry course obtained that as much as 76% very high category, 9% with category high, and 15% with category medium . Not there is no one students who have motivation study with category low and very low. This thing could concluded that use module learning STEM-based in the General Chemistry lecture process could increase motivation study student.

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D. CONCLUSION AND SUGGESTIONS

Learning module STEM based when applied to General Chemistry lectures could increase results study by significant. This thing shown from hypothesis test data with level significant 0.05 (5%) which indicates 10.63 > 1.714 (t count > t table). From result pre-test and post-test analyzed enhancement results study student before and after use module learning STEM -based using the N-Gain test for see percentage. Enhancement results study in class experiment seen from from big percentage students who get high N-Gain value in class experiment that is reached 67.8% compared to with percentage students who get high N-gain value in class control that is reach 20%. In the learning process eye General Chemistry course, usage module learning STEM-based capable increase motivation study student. This thing showed from motivational data study student in class experiment to application module learning based STEM earned through questionnaire. After the lecture process use module learning STEM based on the eye General Chemistry course, obtained analysis motivation study that is as much as 76% with very high category, 9% with category high, and 15% with category medium, and no there is no one students who have motivation study in category low and very low.

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