

## The Effect of STEAM Learning and Scientific Attitude on Students' Creative Thinking Skills

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### ABSTRACT

Facing the development of 21<sup>st</sup> -century technology, students must be equipped with skills that help them become superior human resources, one of which is creative thinking skills. Creative thinking skills are the ability to analyze something based on data or information to generate new ideas in understanding something. One way to improve creative thinking skills is to train students to explore scientific attitudes and carry out learning that applies scientific activities such as STEAM learning (science, technology, engineering, art, and mathematics). This study uses a quantitative research method Pre-Experimental Design. The design used is the One Group Pretest-Posttest Design. The instruments used were twin observations during STEAM learning to assess creative thinking skills and questionnaires to assess scientific attitudes. The test used is a simple regression test that produces the equation  $Y=3.51+1.21X$ . Test the hypothesis using the t-test which concludes that there is a significant influence of scientific attitude on the creative thinking skills of students who apply STEAM learning.

**Keywords:** STEAM, scientific, attitude, creative thinking

### 1. INTRODUCTION

Graduate competencies today must have 21st century skills, namely Critical Thinking Skills, Creative Thinking Skills, Communication skills and Collaboration skills [1]. So that education currently focuses on achieving certain specializations, Indonesia's national education goals must also be directed at efforts to shape the skills and attitudes of individuals in the 21st century [2]. This demand occurs because of the surge in the development of science and information so that it erases space and time in various activities. Mastery of information and communication technology in the world of education is used to expedite the learning and learning process [3]. In order to face this challenge, learning must also be prepared to be more innovative and fun [4].

The 21st century requires a balance between knowledge and skills as the basis of quality human resources in the changing times [5]. Education is one way for humans to "survive" so that they can adapt to the rapidly changing times [6]. Schools as an organization certainly have an organizational culture which plays an important role in the success of achieving superior human resources [7]. Education and schools are the main elements in the process of forming the resource itself.

The implementation of the independent learning curriculum is one of the solutions proposed by the government in producing Indonesia's golden generation. The independent curriculum gives students the freedom to choose their interests, talents and ways of learning according to their needs [8]. Suryaman stated that the learning process in the independent curriculum must be autonomous and flexible to create a learning culture that is innovative, not restrictive, according to needs [9].

Employability skills and scientific literacy are two skills that students must have in dealing with the rapid development of current knowledge. Employability skills are skills that are transferable in various fields of work and needed to enter the world of work and develop a career [10]. Employability skills are a group of core skills, describing the main functions of the knowledge, skills, and attitudes of individuals needed in the workplace [11]. Employability skills are general and cover all types of industries, business sizes, and levels of employment [12]. Gowsalya, et al. (2015) describes 9 skills that are intended as employability skills, namely; (1) teamwork skills, (2) problem-solving skills, (3) self-management skills, (4) knowledge of business, (5) literacy and numeric skills

related to position, (6) knowledge of technology, (7) communication skills (8) initiative skills and (9) leadership skills.

Scientific literacy is an essential ability that must be owned by humans to be able to organize, analyze, and interpret any information obtained properly [13]. Scientific literacy as one of the most important basic literacy for students, parents, and all members of society. The urgency of scientific literacy in education is used as a tool to measure components of science material which include; knowledge of science content, knowledge of science as a way of knowing, understanding and implementing scientific inquiry [14]. Fives, et al. (2014) classifies scientific literacy into 5 components, in the form of: the role of science, scientific thought and activity, science and society, mathematics in science, and science motivation and beliefs [15].

In order to measure these two skills, the right instrument is needed. One instrument that can be used is authentic self-assessment. Authentic assessment is defined as a form of assessment in which students are asked to complete real tasks by applying the knowledge and skills they have learned [16]. self-assessment is also interpreted as an assessment that involves monitoring and reflection on the process and results of one's own learning [17]. With self-assessment, students must be able to analyze the quality of learning and their respective assignments, assess the extent to which learning objectives have been achieved, identify strengths and weaknesses, and make appropriate revisions.

## 2. METODE

This research is development research using 4D design (Define, Design, Develop, and Disseminate) but has not yet reached the dissemination stage. The tool to be developed is an Authentic self-assessment instrument to measure Employability skills and scientific literacy. The data collection technique uses a validation sheet instrument in the form of a checklist sheet. The instruments developed were assessed for their validity level by expert lecturers using the v-Aiken formula, namely:

$$V = \sum \frac{S}{[n(c - 1)]}$$

Description:

$S : r - l_o$

$r : the\ number\ given\ by\ the\ appraiser$

$l_o : the\ lowest\ rater\ score$

$n : number\ of\ appraisers$

$c : the\ highest\ number\ of\ assessors$

The results of the vaiken calculations are then compared with the following validity category table.

Table 1 Instrument Validity Level Category

Indeks V-Aiken	Validity Category
$V < 0,4$	Low
$0,4 \leq V < 0,8$	Medium
$V \geq 0,8$	High

source: Arikunto [18]

After obtaining the validity of the instrument from the expert lecturer, then the instrument is assessed by the teacher in order to obtain an analysis of the teacher's response using the equation:

$$R = \frac{a}{N} \times 100\%$$

Description:

$R : Teacher's\ response$

$a : the\ score\ given\ by\ the\ teacher$

$N : maximum\ score$

The results of calculating the teacher's response are then compared with the response categories in the following table.

Table 2. Teacher Response Categories

Percentage	Qualification
$90\% \leq R < 100\%$	Very Good
$75\% \leq R < 90\%$	Good
$60\% \leq R < 75\%$	Moderate
$50\% \leq R < 60\%$	Less
$R < 50\%$	Very Less

source: Sugiono [19]

### 3. RESULTS AND DISCUSSION

This study uses a 4D design, then it will be discussed for each stage of development research, namely:

#### 3.1. Define

The definition of authentic assessment according to the variables to be measured, namely Employability Skills and Scientific Literacy, is carried out carefully so that the instrument is designed according to the level of the respondent to be measured, namely high school students. At this stage selected indicators for each instrument. The employability skills instrument will measure 9 indicators, while scientific literacy will measure 5 indicators as described above.

#### 3.2. Design

The products produced in this study are two authentic assessment instruments to measure Employability Skills and Scientific Literacy. The authentic assessment instrument measuring Employability Skills is designed with a 64-item questionnaire where each indicator is represented by several negative and positive statements. Meanwhile, the authentic assessment instrument measuring scientific literacy is designed with 20 questions taking into account each indicator.

#### 3.3. Develop

In this step, content validation was carried out on the Authentic Assessment instrument which was carried out by three expert lecturers. The employability skills instrument was designed in the form of a closed questionnaire with a Likert scale. The validation results of this instrument were analyzed according to the employability skills indicators as follows.

Table 3. Results of the Validity of the Employability Skills Instrument

No	Indicator	V-Aiken	Category
1	Team work skills	0,822	High
2	Problem solving skills	0,832	High
3	Self-management skills	0,843	High
4	Knowledge of business	0,841	High
5	Literacy and numeric skills related to position	0,821	High
6	Tech knowledge	0,822	High
7	Communication skills	0,853	High
8	Initiative skills	0,822	High
9	Leadership skills	0,833	High
	<b>AVERAGE</b>	<b>0,832</b>	<b>High</b>

Based on the validation results above, it can be seen that the 64 items in the employability skills instrument statements in the nine indicators are in the high validity category. This means that 64 statement items can be used as research instruments.

Furthermore, the employability skills instrument was given to 3 senior teachers to get teacher responses. The results of the teacher's response are as follows

Table 4. Teacher Response To The Employability Skills Instrument

Teacher Response Indicator	Percentage
Language	88%
Ease	93%
Quality	89%
Assistance	91%
<b>Average</b>	<b>90%</b>

The average teacher response in table 4 can be made in the following graphic figure.

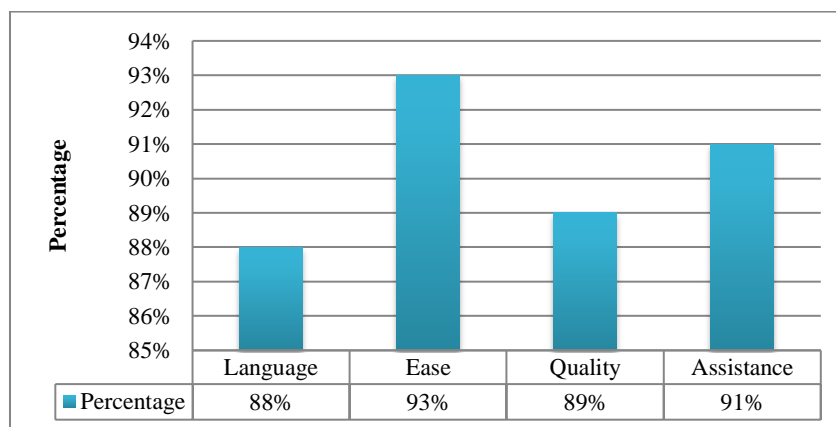


Figure 1. Percentage Teacher Response Employability Skills Instrument

The average teacher response to this instrument is 90% in the very good category. If you look more closely at the teacher's response to the ease indicator, you get the highest score, namely 93%, this shows that the instrument that has been developed is easy for teachers to use in measuring students' employability skills.

The employability skills instrument developed can be concluded that the instrument is valid in the high category and the teacher's response is very good. The results of this study were sharpened by research conducted by Suarta et al which stated that the development of this instrument could measure cognitive, affective and psychomotor aspects [20]. Indicators of employability skills that are very important for vocational education graduates to enter the world of work [21].

The next instrument, namely the scientific literacy instrument, was also validated by 3 expert lecturers. This instrument is designed in essay form. The scientific literacy instrument uses a test instrument designed to consist of 20 questions along with their assessment rubric. The results of the scientific literacy instrument validation for each item are as follows.

Table 5. Results of the Validity of Scientific Literacy Instruments

Question Item	V-Aiken	Category
1	0,822	High
2	0,832	High
3	0,854	High
4	0,734	Medium
5	0,822	High
6	0,890	High
7	0,821	High
8	0,828	High
9	0,694	Medium
10	0,881	High
11	0,812	High
12	0,834	High

13	0,856	High
14	0,809	High
15	0,833	High
16	0,779	medium
17	0,811	High
18	0,846	High
19	0,807	High
20	0,811	High

Based on the results of the validation above, it can be seen that 20 items on the scientific literacy instrument are in the high validity category, 17 items are in the medium category. The seventeen questions are then assessed by the teacher to see the response. The results of the teacher response test can be seen as follows.

Table 6 Teacher Response To Scientific Literacy Instruments

Indikator Respon Guru	Percentage
Language	88%
Ease	89%
Quality	90%
Assistance	91%
<b>Average</b>	<b>90%</b>

The average teacher response in table 6 can be made in the following graphic figure.

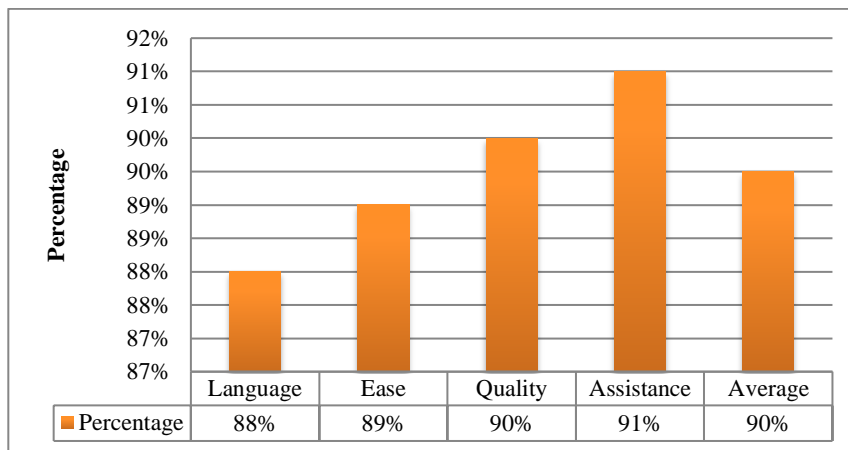


Figure 2. Percentage Teacher Response Scientific Literacy Instruments

The scientific literacy instrument developed can be concluded to be valid at a very valid level and with a very good teacher response. Novanti stated that scientific literacy instruments should be prepared based on cognitive strategy steps in reading writing, so that students are faced directly with the atmosphere of the story to evaluate and determine what actions to take in solving related issues [22].

#### 3.4. Disseminate

This research did not reach the disseminate stage

### AUTHORS' CONTRIBUTIONS

Agus Muliawan, who is the head of the research team, is in charge of directing, compiling instruments and implementing research activities. Halimatus Sakdiah and Fajrul Wahdi Ginting, who are members of the research team, serve as executors and data processors from the results of the researchers. Najiha Sabrina and Zahara who are also research members serve as research assistants in the field.

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