

## Conference Paper

# An Analysis of STEM-Based Lesson Plan Development for Economic Learning at SMAN 1 Kota Batu

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**Abstract**

The current era of education is entering Education 4.0 as a result of Industrial Revolution 4.0. The quality of learning can be improved by integrating STEM-based learning models. STEM is an integration of science, technology, engineering and mathematics, which is in accordance with Industrial Revolution 4.0. Handayani (2019) researched the development of STEM-based learning models for prospective economics teachers (a case study at state teacher colleges in East Java) and found that by carrying out STEM-based learning, the pedagogical ability of prospective economic teachers (S1 Economics Education students) in East Java had a significant increase of 14.5 at the State University of Malang (UM), 12.15 at the State University of Surabaya (UNESA) and 13.56 at the Jember State University (UNEJ). Based on these results, it can be said that the STEM model can be applied to support teachers' pedagogical abilities in the era of Industrial Revolution 4.0. This study aimed to analyze STEM-based lesson plan development at SMAN 1 Kota Batu. Descriptive qualitative methods were used. The results indicated that: 1) the preparation of lesson plans in economic subjects was carried out well; 2) the development of STEM-based lesson plans can be applied in economic learning; and 3) the STEM-based lesson plans that were developed succeeded in improving student learning outcomes.

**Keywords:** STEM, Lesson Plan, Learning Result

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Published: 14 July 2021

Publishing services provided by  
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Selection and Peer-review under the responsibility of the IRCEB Conference Committee.

## 1. Introduction

To implement the 2013 curriculum in accordance with the demands of the Education Era 4.0, it requires the establishment of an appropriate strategy. The characteristics of education 4.0 are based on 1) character quality which consists of religiosity, nationalism, independence, mutual cooperation, and integrity; 2) basic literacy consisting of language literacy, numeracy literacy, scientific literacy, digital literacy, financial literacy and cultural and civic literacy; 3) competencies consisting of critical thinking,

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creativity, communication and collaboration. To achieve this aspect, it can be done by planning the correct preparation of learning tools. Learning tools that have been developed so far have not been integrated with innovation. One of the innovations we can do is STEM-based innovation. To carry out STEM-based learning activities a teacher must carry out activities to design learning in accordance with STEM learning standards and steps. Rahmatina (2020) states that STEM is learning that integrates science, technology, engineering and mathematics in the learning process. According to Kennedy and Odel (in Keley, 2016), they describe that high-quality STEM education must have the following criteria: 1) integration of technology and engineering into science and mathematics; 2) promote scientific investigation and engineering design, including mathematics and science instruction; 3) a collaborative approach to learning, connecting students and educators with STEM; 4) provide a global perspective and multi perspective; 5) incorporating other strategies such as project-based learning, providing formal and informal learning experiences; 6) incorporate appropriate technology to enhance learning. Because of these various advantages, a lot of research includes STEM elements in learning. As a research conducted by Utami (2017) with the title STEM-A Development (science, technology, engineering, mathematic and animation) Based on Local Wisdom in Physics Learning, the results of the study found that students became aware of the local wisdom of the kuwung stone and how to use it.

On December 10, 2019, the Minister of Education and Culture of the Republic of Indonesia, Nadiem Anwar Makarim, issued Circular No. 14 of 2019 concerning Simplification of the Learning Implementation Plan. In the circular, it is explained that the core components of the preparation of the Learning Implementation Plan (RPP) are learning objectives, learning steps, and learning assessments. Meanwhile, other components as stated in Permendikbud No. 22 of 2016 is complementary.

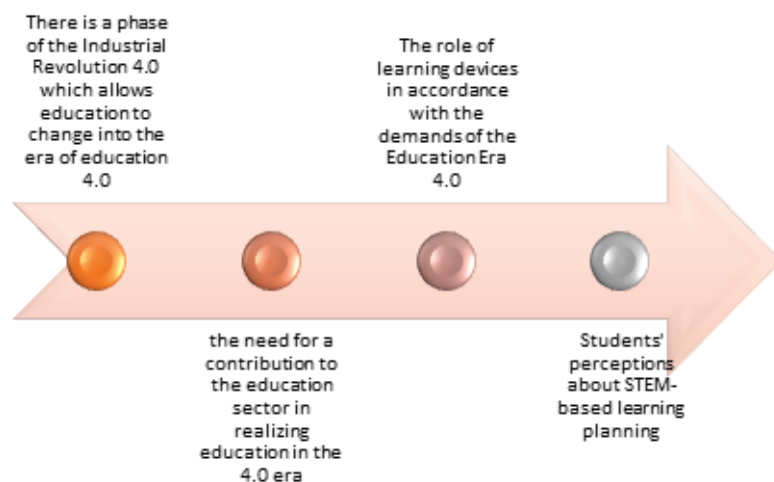
Simplifying the lesson plans aims to make teachers focus more on preparing and evaluating the learning process so that teachers do not spend time just compiling lesson plans in great detail. The preparation of this lesson plan is based on the principles of being effective, efficient, and student-oriented. Effective means that the preparation of RPP aims to achieve learning objectives, Efficient means that the preparation of lesson plans is done appropriately and does not take up a lot of teacher energy and time. Student-oriented means that the preparation of lesson plans takes into account the needs, readiness and interests of students in class.

With these changes, SMAN 1 Kota Batu also made adjustments to the preparation of RPP in economic learning activities. As one of the favorite public schools in the community, this school does have complete facilities and academic and non-academic

activities for students. In addition to facilities and school programs, it turns out that this school also has the characteristics of heterogeneous students and diverse academic abilities. For this reason, this study has the objectives, namely 1) to describe the basic concepts of the preparation of learning tools, 2) to analyze the integration of STEM in the preparation of economic learning planning and 3) to analyze the effectiveness of the application of STEM-based Learning Tools applied to SMAN 1 Kota Batu.

## 2. Research Method

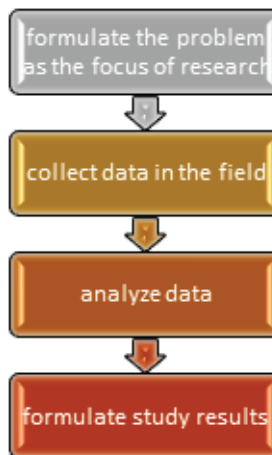
The method used in this research is descriptive qualitative research which studies existing problems and existing conditions. The goal is to describe the events that are happening at this time. As in this study which focuses on the analysis of STEM-based learning tools in SMAN 1 Kota Batu. Respondents in this study were 17 students. The data collection technique used is survey technique. The survey was conducted using google form which contains questions in accordance with the context of the topic. The research framework carried out refers to Figure 1 below which contains the object of research as well as the measuring instrument carried out and the technical research.



**Figure 1:** Research thinking framework

The following will also explain the stages carried out in qualitative research in Figure 2 below

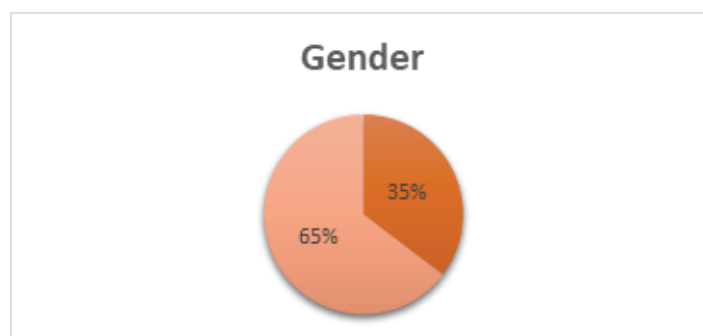
Based on Figure 2, the research stages consist of 4 steps, namely formulating the problem as the focus of research, collecting data in the field, analyzing data, and formulating study results.



**Figure 2:** Qualitative Research Stages

### 3. Result and Discussion

The results of this research obtained can be explained in the description below. Respondents who became the sample in this study consisted of 17 respondents. The following is an explanation of the survey results.



**Figure 3:** Research Respondent

The questionnaire for the development of STEM-based learning tools was filled in by 17 respondents, all of whom were class XII. Of the 17 respondents, 65% were female.

#### 3.1. Basic Concept of Learning Planning

To see the basic concepts of lesson planning can be seen in Figure 4 below.

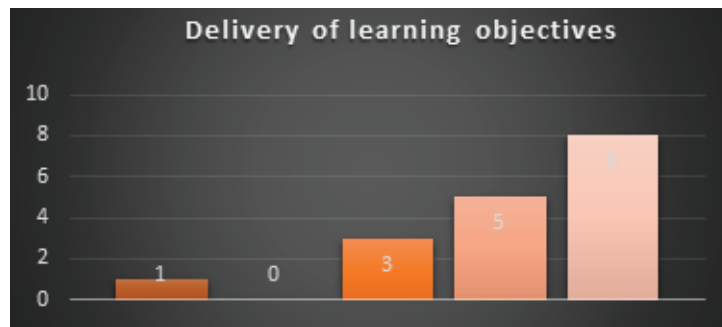


Figure 4: Explanation Objective in learning

### 3.1.1. Delivery of learning objectives

Based on this graph, it is known that the majority of teachers always convey learning objectives in class. This is evident from the 47% of respondents who answered that the teacher always conveyed learning objectives at the beginning of learning activities.

### 3.1.2. Suitability of Lesson Plan

The majority of teachers in teaching always comply with the lesson plans that have been made. This is shown by as many as 29% of respondents answered that teachers always teach according to the lesson plans.

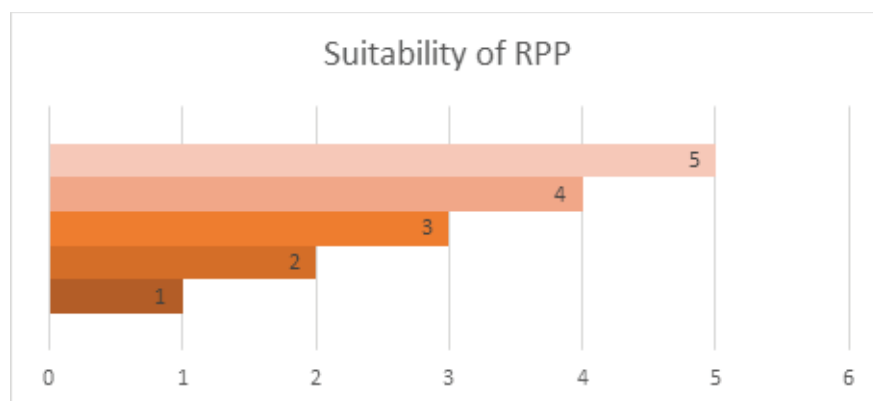


Figure 5: Suitability of Lesson Plan

### 3.1.3. Suitability of Lesson Plan with Curriculum 2013

The lesson plans that have been prepared by the majority of teachers (29.4%) are always in accordance with the current 2013 curriculum. However, only 5.9% of respondents said the teacher had not prepared the lesson plan according to the 2013 curriculum.

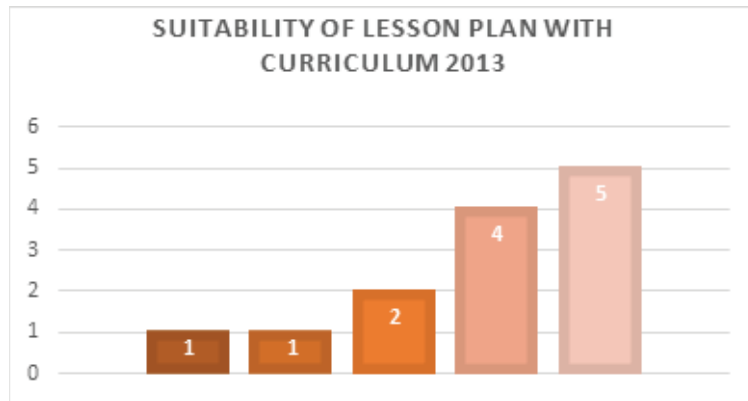


Figure 6: Suitability of Lesson Plan with 2013 curriculum

### 3.1.4. The format of the Lesson Plan is in accordance with the criteria

In the preparation of the lesson plans, the majority of teachers (58.8%) had adjusted to the applicable regulatory criteria, and 35.3% always prepared the lesson plans according to the applicable regulatory criteria. However, there were still 5.9% of teachers who prepared lesson plans that did not comply with the applicable regulatory criteria.

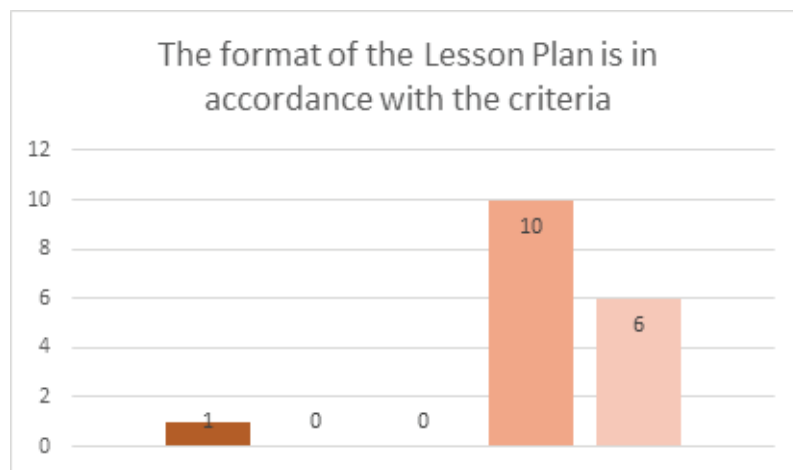


Figure 7: Suitability Lesson Plan with criteria

### 3.1.5. Teacher Innovation in Preparation of Lesson Plan

In preparing lesson plans, 41.2% of teachers always make learning innovations. However, there are still 5.9% of teachers who have never made learning innovations in the preparation of their lesson plans. This can be seen in Figure 8 below.

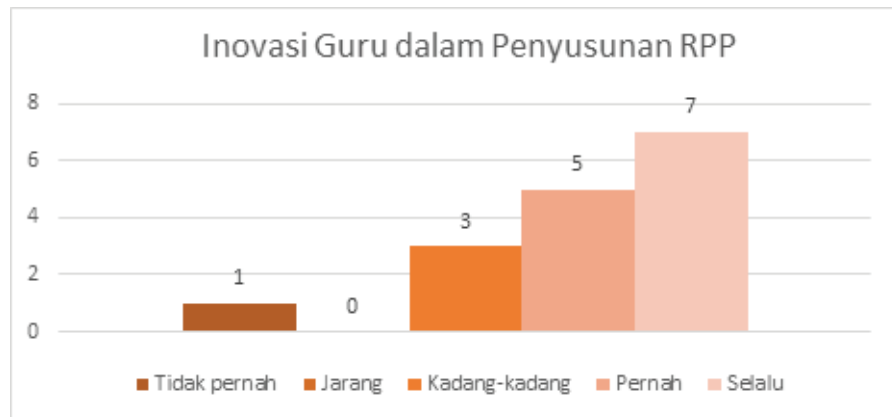


Figure 8: Innovation in Lesson Plan

### 3.1.6. Development of lesson plans according to student character

The majority of teachers (64.7%) had developed lesson plans according to student characteristics. However, there were 5.9% of teachers who never adjusted the lesson plans they prepared to the characteristics of their students.

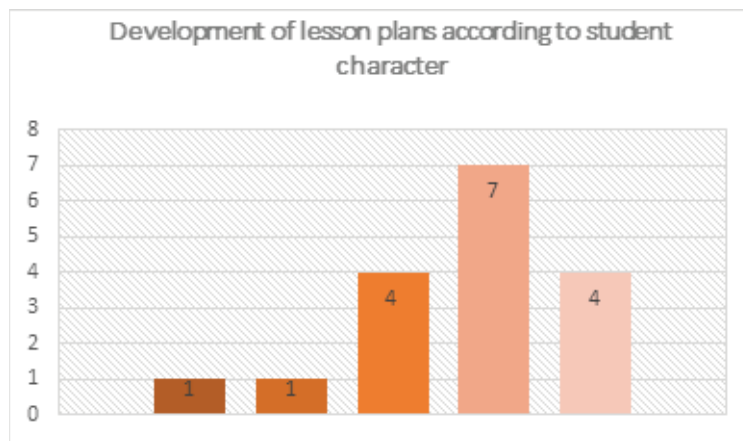


Figure 9: Developing of Lesson Plan according to Student Character

### 3.1.7. Learning Model

Based on the results of the questionnaire, it is known that teachers often apply the assignment learning model with a percentage of 82.35%. Meanwhile, the method that is rarely used by teachers is the lecture model. On the other hand, project based learning, problem based learning, and discussion models have been used by teachers, but not as frequently as the assignment model.

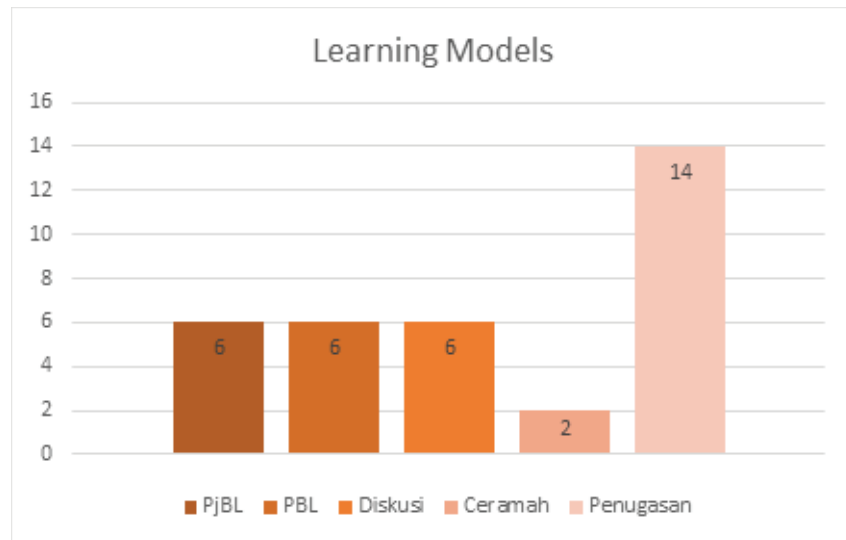


Figure 10: Learning Model in Lesson Plan

### 3.1.8. Preparation of Learning Tools

The arrangement of integrated learning tools with STEM 70.6% is considered capable of helping students to change and develop student skills, attitudes, aspirations, rewards, and knowledge. However, there were 5.9% of students who thought otherwise.

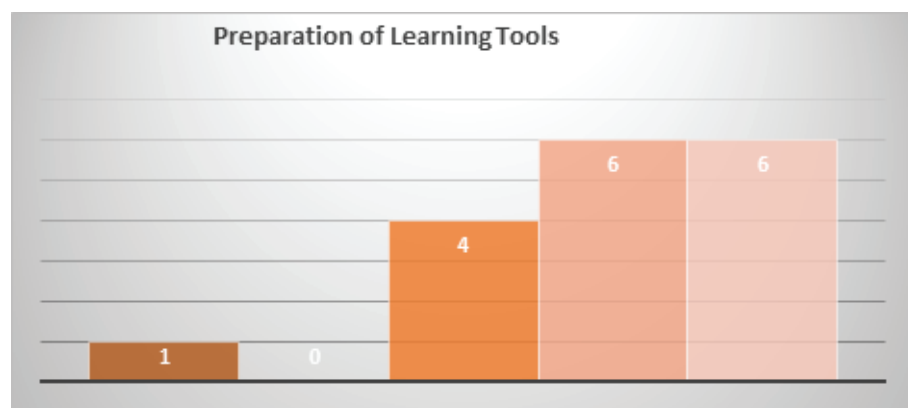


Figure 11: Developing Lesson Plan

Based on the information in the graph above, it can be seen specifically in Table 1 below.

From table 1, it can be seen that the preparation of learning tools can be well structured. This can be seen in the RPP (Learning Implementation Plan) document which is in accordance with the 2013 curriculum and format as well as the learning innovations that have been carried out. As we know, the lesson plan is an arrangement with regard to the prediction of activity designs during learning activities. Therefore, the RPP is situational because it adapts to conditions or conditions in the field. Based on the



TABLE 1: Basic Concepts of Preparing Learning Devices

No	Indicator	Percentage	Description
1	Delivery of learning objectives	47,058%	It's done
2	Lesson Plan Suitability	29,41%	Correct
3	The suitability of the Lesson Study with the 2013 Curriculum	29,41%	Correct
4	Lesson Study format according to the criteria	58,8%	Correct
5	Teacher Innovations in Preparing Lesson Plan	41,2%	There are learning innovations
6	RPP development according to student character	64,7%	Correct
7	Learning Model	82,35%	There are learning variations
8	Preparation of Learning Tools	70,60%	Already arranged

survey results, it can be seen that the lesson plans developed are in accordance with the 2013 curriculum criteria and standards. Currently, the latest RPP format is in effect based on the Minister of Education and Culture Circular Letter Number 14 of 2019 which explains that the preparation of RPP is carried out on the principle of being efficient, effective and student-oriented.

Simplification made for RPP systematics contains at least 13 components, namely school identity, subjects, classes / semesters, subject matter, time allocation, learning objectives, KD and indicators, learning materials, learning methods, learning media, learning resources, activity steps. learning, and assessment. Based on this, what has been developed in the Economics subject at SMAN 1 Kota Batu is appropriate. This is in line with Rakhmawati (2016) who conducted research on the Analysis of 2013 Curriculum Implementation in terms of Process Standards in Class X Biology Learning at SMA Negeri 1 Krangkeng. No.65 of 2013 concerning process standards. The lesson plans compiled by the Biology teacher at SMA Negeri 1 Krangkeng have met the achievement with good criteria. (2) in general the implementation of the 2013 curriculum in class X Biology learning at SMA Negeri 1 Krangkeng has been carried out well. The implementation is in accordance with Permendikbud No. 65 of 2013 concerning process standards. (3) the students gave a strong response to the Biology learning process applied by the Biology teacher at SMA Negeri 1 Krangkeng. In line with the research conducted by Ayuliasari (2017) also obtained research results, namely (1) Conformity between the scientific process development planning in the Learning Implementation Plan (RPP) made by teachers with the demands of the 2013 Curriculum at SMA Negeri 3 Yogyakarta, almost all in accordance with the demands of the curriculum. 2013. (2) The development of the scientific process in the implementation of learning is not in accordance with the scientific process capability design compiled in the Learning Implementation Plan (RPP).

### 3.2. STEM Based Learning Tools

To integrate the STEM model in the implementation of learning can be seen in Figure 12 below.

#### 3.2.1. The suitability of STEM in Economic Learning

Based on the questionnaire, 70.6% of respondents considered the STEM learning model suitable to be applied in economic learning. And only 5.9% of respondents think otherwise.

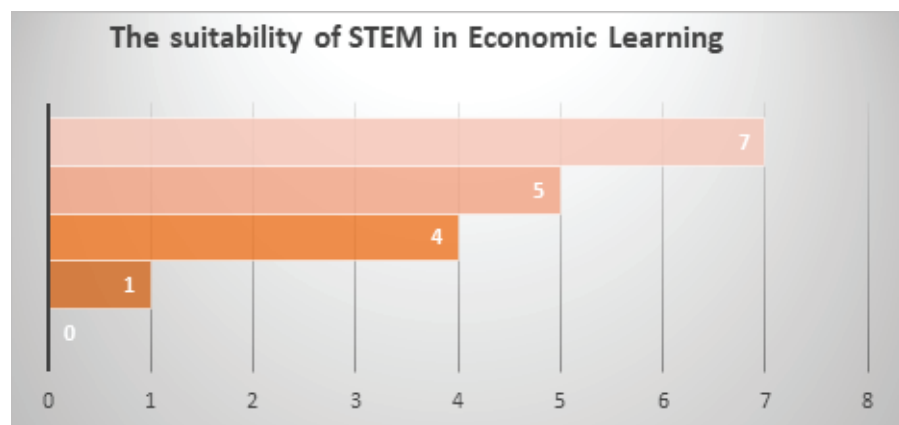


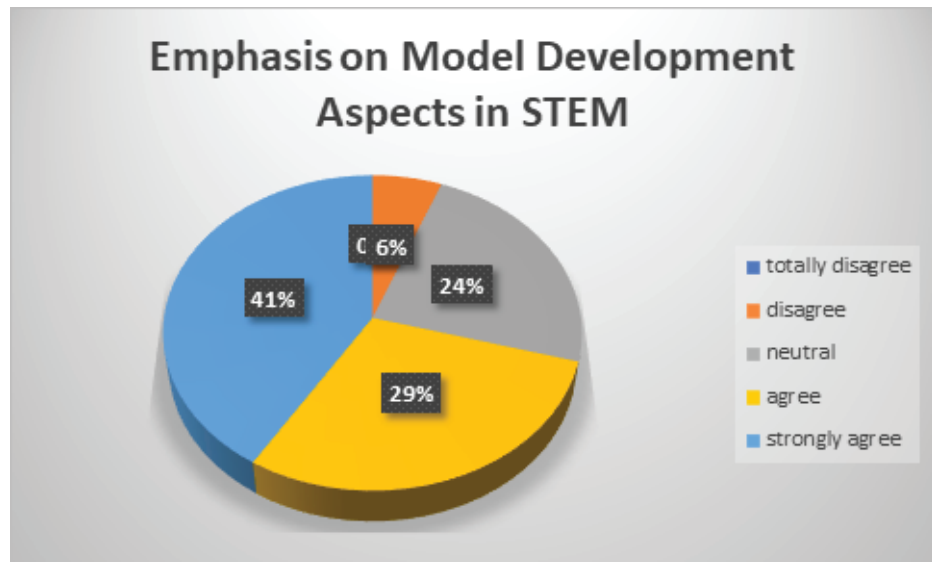
Figure 12: STEM suitability with Economic Learning

#### 3.2.2. Emphasis on Model Development Aspects in STEM

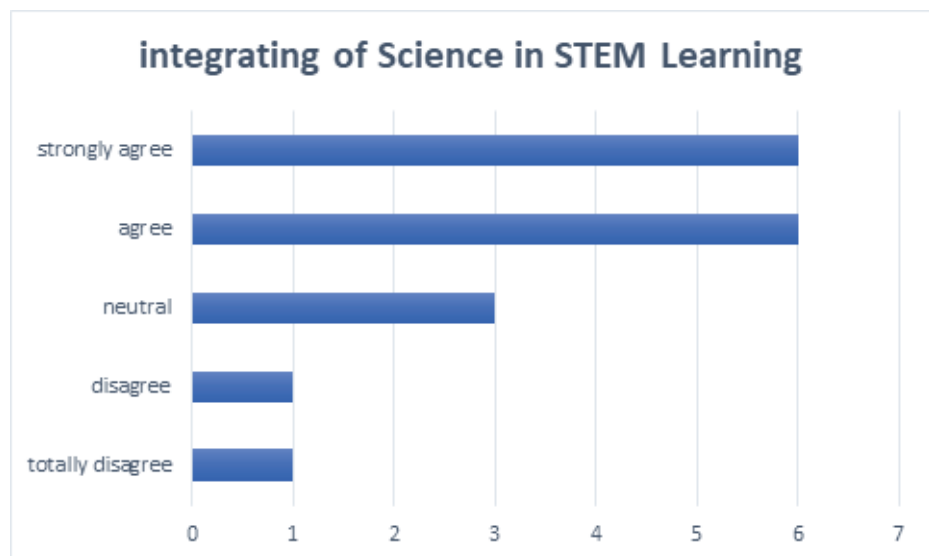
Based on the results of the questionnaire, it is known that 70.6% of respondents assessed that the application of STEM-based learning tools needs to emphasize the aspects of developing and using the model. The following can be seen in the image below.

#### 3.2.3. Integration of Science in STEM Learning

70.6% of respondents agree with the preparation of STEM-based learning tools in which there are integrated science questions in economic topics.



**Figure 13:** Emphasis on Model Development Aspects in STEM



**Figure 14:** Integration of Science in STEM Learning

### 3.2.4. Integration of analytical and interpretive aspects in STEM

The majority of respondents agreed that data analysis and interpretation activities on economic topics were integrated in the STEM-based learning tools that the teacher had prepared.

### 3.2.5. Integration of Technology in STEM

82.4% of respondents agreed with the integration of technology in the preparation of STEM-based learning tools needed by students.

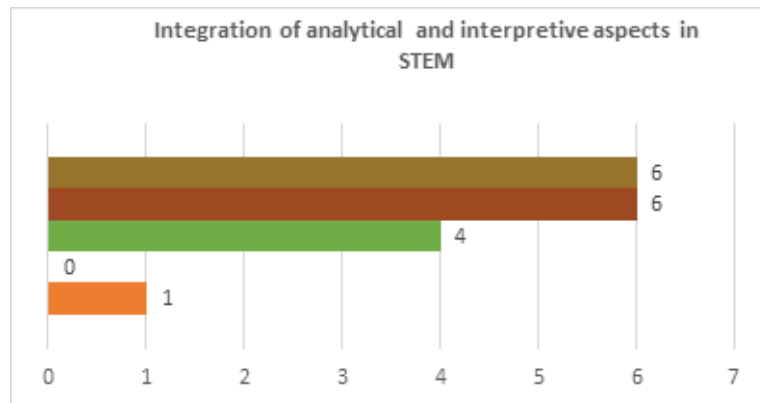


Figure 15: Integration of analytical and interpretive aspects in STEM

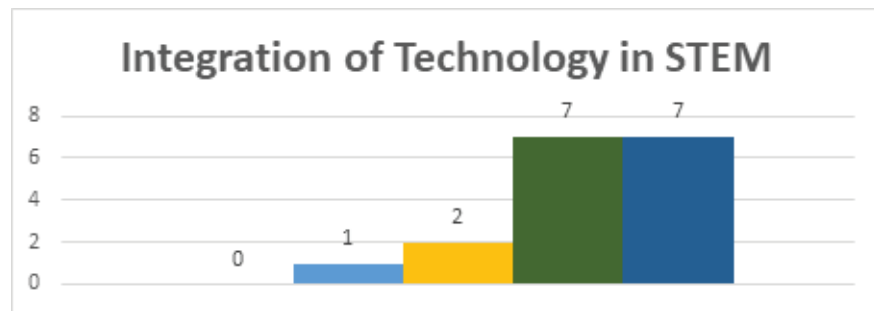


Figure 16: Integration of Technology in STEM

Based on the information in the chart above, it can be seen specifically in Table 2 below.

TABLE 2: STEM Based Learning Tools

No	Indicator	Percentage	Description
1	The suitability of STEM in Economic Learning	70,60%	Already appropriate
2	STEM menekankan aspek pengembangan model	70,60%	Already appropriate
3	Integration of Science in STEM Learning	70,6%	It's integrated
4	Figure 15 Integration of analytical and interpretive aspects in STEM	35,29%	It's integrated
5	Integration of Technology in STEM	82,4%	It's integrated

From table 2, it can be seen that the development of STEM-based Learning Implementation Plans (RPP) has been implemented well in economic learning. To carry out STEM-based learning activities a teacher must carry out activities to design learning in accordance with STEM learning standards and steps. This is because the teacher's role as a facilitator should be able to inspire and provide opportunities for students to increase interest, acquire, and apply knowledge, skills and values in the context of real life in every environment. This is in line with Sriyati, et al (2018) which states that teachers

are able to come up with new ideas in designing STEM-based learning plans (RPP). In general, teachers are good at designing STEM-based learning and lesson plans that are ready to be implemented in class.

### 3.3. The Effectiveness of STEM-Based RPP Implementation in Economic Learning

To measure the level of effectiveness of the development of STEM-based Learning Plans, it can be measured from the Mid-Semester Exam (UTS) scores. After the STEM-based learning model was applied, 64.7% of students obtained excellent UTS scores, which were between 84-90 points. However, there are still 35.3% of students who get a UTS score below 84.

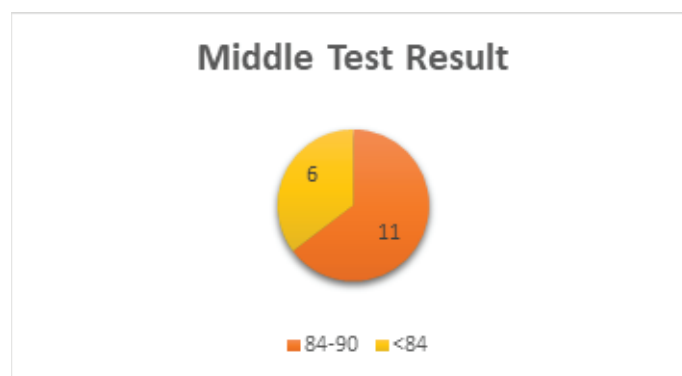


Figure 17: Middle Test Result

Based on Figure 17, this is in line with Astuti (2019) who conducted research with a design, namely the one-group pretest-posttest design. The instrument used was a concept mastery test instrument consisting of 20 questions on the subject of Ecosystems and observation sheet instruments for student learning activities. The data analysis technique used in this study was the z test. The results of the study concluded that the STEM integrated Project Based Learning (PjBL) model can improve the mastery of concepts and learning activities.

## 4. Conclusion

From the results of the study it can be concluded that: 1) The preparation of lesson plans in economic subjects has been carried out well, 2) The development of STEM-based lesson plans can be applied in economic learning and 3) the STEM-based lesson plans developed have successfully improved student learning outcomes.

## Acknowledgement

The author would like to thank the Dean of the Faculty of Economics, State University of Malang, who gave our team the opportunity to carry out research. Our gratitude also goes to the principal of SMAN 1 Kota Batu and the economics teacher at SMAN 1 Kota Batu for allowing the research team to conduct research. Of course also to the research team and to respondents who are willing to help the research team to provide data relevant to this research.

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