

## CHAPTER V

### CONCLUSIONS AND RECOMMENDATION

#### A. Conclusions

The conclusions of analyzing The Development of STEM-Based Module on Sound Wave Topic to Enhance Student's Creative Thinking and Creative Product are shown below.

1. The developed STEM-based module was produced based on the needs of developing STEM based module which are fulfilling the criteria of good module and fulfilling characteristics of STEM learning materials to enhance students' creative thinking and creative product. As it is found that existing science modules cannot fully meet those criteria. Therefore, in developing STEM based module, this research follows outline criteria to fulfil the needs of developing good STEM learning material. Developed STEM based module consists of two parts. The first part is the content of sound wave topic which is developed based on 8 steps of science and engineering practices based on Bybee (2011) namely ask questions and define problems, develop and use models or examples, plan and conduct an investigation, analysis and interpretation of data, using mathematical and computational thinking, develop explanations and design solutions, engaging in argumentation and evidence. In the first part, each page of STEM based module has different focus namely science, science-mathematics, science- technology, and science-technology-engineering-mathematics. Furthermore, the second part of the module is student's science activity. In developing this part, the outline follows engineering design process stages based on English and King (2015).
2. The implementation of STEM-based module on sound wave topic can improve students' creative thinking. The average N-gain is 0,70 which includes as high category.
3. The implementation of STEM-based module on sound wave topic affects students' creativity in making STEM product. The average of students' creativity score (%) was 81,47 which includes as good category.

## B. Recommendation

Based on the findings of the research that has been conducted and concluded, there are several recommendations that necessary to be stated by the researcher, some of them are:

1. In the learning process, the students should be triggered more to applied the knowledge that already studied and also students need to be triggered to formulate the productive question and construct the knowledge to improve their creative thinking in the lesson.
2. The implementation of STEM-based learning using STEM-based teaching material that require students to develop their creative thinking and creativity in other topics such as energy, optics and electricity were recommended.
3. The one of important thing before conduct the research is Analyzing students' ability before grouping the students. The group members should consist of low and high achievement student. Teacher also should make sure that each group is working collaboratively.
4. The time allocation for creating loudspeaker should be determined properly, so that students can finish it optimally.
5. Teacher supervision during creating loudspeaker is necessary to make sure every group member active in giving the idea and share their knowledge among the groups' member.
6. The time allocation of the lesson that implements STEM-based module on sound wave topic as teaching material should be determined properly so students can finish the learning process optimally.