CHAPTER V
CONCLUSION, IMPLICATION, AND RECOMMENDATION

5.1 Conclusion

The implementation of engineering design process consist of five stages, there are generating the problem, ingathering information, generating the solution, implementing the best solution, and evaluating the best solution and reflecting. Among these stages, students actively participating most in the generating the problem and implementing the best solution stages. Especially in the stage of implementing the best solution, students are excited in making water filtration tool. Their excitement triggered by the result that they got during testing their water filtration. They even directly revised their design and make another prototype when they found that their water filtration has not fit their expected result.

Students' scientific literacy between experiment and control class showed there is significant difference in post-test, the test conduct after the treatment given. Experiment class got 0.38 N-Gain score and categorized as medium improvement while control class got 0.11 N-Gain score and categorized as low improvement. It can be defined that engineering design process can enhancing students' scientific literacy. The scientific literacy then analyzed based on the two aspects of scientific literacy, competency aspect and knowledge aspect. As well as on each sub topic of scientific literacy that consists of element, compound, and mixture. In the competency aspect, the highest score of experiment class obtained from explain phenomena scientifically with 0.44 N-Gain score which categorized as medium improvement. Control class also obtained the highest score in that competency sub aspect with 0.27 of N-Gain score and indicated as low improvement. Meanwhile for the lowest score, in experiment class shown in interpret the data and evidence scientifically with N-Gain score is 0.14 describe as low improvement. In control class, the lowest score shown in design and evaluate scientific enquiry with -0.31 of N-Gain score that indicated decrease score form pre-test to post-test. Knowledge aspect of scientific literacy show highest score in content from both classes with experiment class 0.5 N-Gain score (medium improvement) and control class 0.18 N-Gain score (low improvement). The lowest score occurred in epistemic knowledge for experiment class with -0.96 N-Gain score and indicate there is

decreasing score from pre-test to post-test. While control class shows no improvement in procedural knowledge aspect with -0.04 of N-Gain score. Lastly, students' scientific literacy on each sub topic shows the highest score in experiment class is 0.56 of compound sub topic N-Gain score categorized as medium improvement. While in control class, the element sub topic gained the highest score with 0.32 N-Gain score and categorized as medium improvement. The lowest score on each sub topic aspect occur oppositely with highest score. In experiment class, lowest score obtained from element sub topic with 0.03 of N-Gain score and indicated as low improvement. While in control class, lowest score obtained from compound sub topic with 0.05 of N-Gain score and describe as low improvement.

From the result of students' creativity, the score from each sub scales analysis showed the highest N-Gain score in experiment class is imagery and flow with 0.13 and indicated as low improvement. As for the control class, the highest score occurred in flow sub scale with 0.07 of N-Gain score and describe as low improvement. The lowest score of students' creativity on each sub scales obtained from incubation with -0.05 in experiment class and -0.03 in control class. This result indicate there is no improvement and even can describe as decreasing score of pre-test to post-test. The minus score in experiment class is higher than in control class means that experiment class get lower score than control class. However, the hypothesis test shows there is no significant difference between experiment and control class in both pre-test and post-test. It can be conclude that the implementation of engineering design process do not enhance the creativity of student.

5.2 Implication

From the result of overall aspects of scientific literacy, students in experiment class experienced much higher improvement than in control class. This result can be imply that the engineering design process is effectively enhancing students' scientific literacy. Based on the implementation of engineering design process, students follow all of the stages well and the enthusiasm from the students are also good. Students can explain phenomena scientifically while generating the problem, fully engaged in making prototype, and improving their knowledge in element, compound, and mixture topic.

Even though there are so many things that influenced the low score of students' creativity such as class environment, time limitation, lack of communication and collaboration between students during discussion session, as well as the availability of tools and materials for making prototype. However, students still show an improvement in creativity and the experiment class get higher improvement than control class in creativity. The result indicated that the implementation of engineering design process can enhance students' creativity even just only small improvement.

5.3 Recommendation

From what the researcher going through in conducting this research, there are several things that can be recommended for future research especially in similar research of the implementation of engineering design process to enhance students' scientific literacy and creativity in element, compound, and mixture topic. The recommendations stated as follow:

1) Improve the amount of sample. This research only consists of 19 sample in each class. To get more precise data, the sample can be added especially when using quasi-experimental research approach.
2) Discuss with the teacher about the results. This research only showed the data based on the researcher's implementation. For future research, discuss the results of students in each variable with the teacher so that, the results and discussions can be more precise.
3) Considering the availability of measurement tool. This research require turbidity meter which is hard to find especially in the school's laboratory so that, students could not measure the things that they supposed to. For future research make sure the materials and equipment needed can be provided.
4) Prepare more questions. The researcher only prepare 20 questions of students' scientific literacy. For future research, add more questions because if a lot of questions did not match the criteria, the researcher still has questions spare.
5) Maximize the available time as best as possible. Researcher takes a lot of times in pre-test session and it makes the time truncated for the implementation stage. For future research, the researcher has to maximize the time given as best as possible.