

## CHAPTER V

### CONCLUSION AND RECOMMENDATION

#### 5.1 Conclusion

This research provides information about how to develop a learning model of environmental education course based on Ethno-STEM learning model and how it can be effective in enhancing preservice teachers' sustainability literacy. Based on the research findings and the discussion in the previous chapter, the researcher proposes some conclusions regarded to each research question.

Firstly, an Ethno-STEM learning model has a number of requirements in order to meet the two main focuses of 21<sup>st</sup> century challenges which are skilled/informed citizens in STEM workforce and a sustainable future. Those skills must be developed through STEM education and the Sustainable Development Goals (SDG). Indonesia, being a developed country with a diverse range of cultures and local wisdoms, plays an important role in addressing the issues of the twenty-first century by connecting those challenges with Indonesia's indigenous wisdoms. An ethno-STEM learning model is the creation of STEM-based learning that is infused with components of local wisdom to develop some sustainability literacy aspects that consist of conceptual development (conceptual awareness of sustainability issue), identity development, skill development and confidence. The key components of Ethno-STEM learning model may be thought of as a cycle of the educational process namely defining local-wisdom problem/local wisdom products design challenge, build possible solution to solve local wisdom problem/products design challenge, constructing functioning product of local wisdom, testing the prototypes of local wisdom products, redesign the prototypes of local wisdom products and communicate the solution of local -wisdom problem.

Secondly, Observation during the implementation of Ethno-STEM learning model, which consists of defining a local-wisdom problem/local wisdom products design challenge, developing a possible solution to solve the local wisdom problem/products design challenge, building a functioning product of local

wisdom, and testing the prototyping process shows that practically all of preservice teachers in this research are capable of conducting the first cycle where they accurately defining and characterizing the local-wisdom problem, because during this phase. Based on the finding, there are less than 100% of preservice teachers who are able to implement Ethno-STEM learning model in the first learning phase where they should construct an eco-friendly boat, the involvement in Ethno-STEM learning model was enhancing in second phase where they should construct a drying fish machine, even though in some cycles such as testing and redesign the prototypes there were not developing at all. Finally in the third phase, where the preservice teachers constructed a water purifying system, it can be seen the progress of engagement in each cycle of Ethno-STEM learning model.

The majority of preservice teachers engaged in a group discussion to identify and examine the problem that they had experienced, they proposed a number of different answers and reached a group agreement on how to improve the design of three difficulties that would function if they were really constructed. In the second cycle, the majority of groups conduct investigations and studies to gain a better understanding of the problem and how the system operates. According to the research, 100 % of preservice instructors are capable of doing many forms of analysis, the majority of which are focused on product function and economic worth, and the majority of groups are capable of explaining the sketch of the design using both graphics and words. It indicates that preservice teachers are encouraged to solve problems with multiple solutions when using an Ethno-STEM learning model that includes an engineering design process, that a variety of tools and representations can be used to produce a desired end product, and that initial design failure is acceptable. In the third cycle, preservice teachers arrange tools and resources, decide on procedures, and construct an initial prototype of a product, findings demonstrate that preservice teachers who were trained through an Ethno-STEM learning model performed admirably in terms of developing the manner in which preservice instructors produce products. In the fourth cycle, preservice teachers carefully tested and validated the prototype in real-world circumstances in order to find the region that needed to be revised until

an acceptable answer was achieved. According to the data, only 70 percent of preservice teachers were able to try prototypes of drying fish and environmentally friendly boats before going into the classroom, on the other hand, are capable of testing prototypes of water purification systems. In the fifth cycle, according to the findings there are only 70% of preservice teachers were able to redesign the prototypes of a drying fish machine and an environmentally friendly boat, while only 80% of preservice teachers were able to rebuild the prototype of a water purification system. It shows that some preservice teachers engage in tacit design when they think and act with little or no self-reflection, monitor their own or others' actions, articulate little of the knowledge they have or need to have to further their investigations, and pay little attention to their progress, obstacles they encounter or design values that influence their decisions.

Thirdly, learning model of environmental education course based on Ethno-STEM is effective in enhancing preservice teachers' sustainability literacy based on the finding that shows Ethno-STEM learning model has better effect in enhancing preservice teachers' sustainability literacy based on the hypothesis "there is significance difference of students' conceptual understanding improvement before and after implementation of learning model." that was accepted. It is supported by the result of t-test of the post-test scores. Students posttest score (mean = 49,54%) performed better than pretest score (mean = 76,9%) in answering conceptual understanding & sustainability literacy test after given Ethno-STEM learning model respectively.

There are four categories in improvement of sustainability literacy. Those categories are conceptual awareness of sustainability issues in the world, personal identity and values aligned with achieving sustainability, and confidence in an ability in contribute to achieving sustainability. Meanwhile, the issue of Compete in skills which can contribute to achieving sustainability has seen a lower (N-gain = 0,24) than others categories.

## 5.2 Recommendation

Regarding of the research that has been conducted, researcher arrange recommendation:

1. Ethno-STEM learning model can be implemented as learning model in science or environment instruction. This learning model can be implemented to increase students' conceptual understanding and sustainability literacy.
2. This research was conducted online courses, therefore it is necessary to adjust the timing if it will be applied in the classroom.
3. It is necessary to develop further research to see pre-service teachers' behavior and attitudes in the context of sustainability literacy.
4. Educational policy maker, school and teachers should start to see STEM and local wisdom in integrated way to achieve Sustainable Development Goals.