Designing an ESD Learning Module on Net Neutral Renewable Energy Concept for Aboriginal Community

Siti Mariam Dasman, Ruhizan Mohammad Yasin, Mazzlida Mat Deli
Faculty of Education
Universiti Kebangsaan Malaysia
Bangi, Selangor, Malaysia
mariamdasman91@gmail.com

Abstract—Education for Sustainable Development (ESD) requires widespread changes in our education today. This study is to design the access of Net Neutral Renewable Energy concept and application especially for the disadvantaged community like in the rural areas. This is important to ensure that future learning is more effective and more likely to be life- long. Qualitative approach is used in this study through focus group discussions (FGD) and in-depth interviews as data collection techniques. 10 knowledgeable experts of aboriginal community gathered to have a discussion on determining the needs of the solar energy learning module. The in-depth interview was conducted in this session, focused on the basic needs of the module that suit the aboriginal community. The findings are focused on determining the needs of the ESD solar energy learning module, including the manners in which collective and community participate. It is also focused on the educational delivery strategies on social, environment and life skills learning. Discussion considers the importance of education for sustainability development through certain unique contexts. The impact of the module is hoped to empower the aboriginal community in complex problem-solving and to ensure that the sustainability elements are flexible to manage.

Keywords—sustainable development, aboriginal community, module development

I. INTRODUCTION

Sustainable development of rural areas is a concept which contained the general principles of sustainability, but more emphasis were placed on certain elements, issues and goals for rural development, especially the ones related to the use [1] and maintenance of the sources of rural and developing rural communities [2]. Matters relating to the sustainability of rural areas are also perceived differently from one region to another due to significant differences in terms of the problems experienced by the people or even different levels of development.

There is 'interconnectedness' between the natural environments and the human community as well as huge amount of respect for the surrounding environment as the foundation of all life, rooted in aboriginal cultural traditions [3]. The formation of sustainable society depends on the level of competence in all spheres of life. Society should be involved in the educational process in order to survive, to adjust to the requirements of the contemporary world, to develop, to grow personally and professionally. This process is continuous and life-long. Moreover, education of sustainable development (ESD) has an interdisciplinary stance, with a strong critical component towards un-sustainability in order to generate discussion and action awakening [4].

Sustainable development must improve the quality of life, improve the living and working environments of all people, provide adequate shelter for all, creating energy and transport activities and sustainable construction [5]. It must also foster the development of human resources-related and stimulate the development of capabilities needed to achieve this goal [5]. Thus, it will help aboriginal to have connection to other potential organizations in improving life quality. Education for sustainability is also an effective combination of mastery and discovery learning.

Net neutral renewable energy have been found as an alternative energy source which allows for sustainable development [6]. One of the renewable energy that is used locally in Malaysia is solar energy. Not all of the Aboriginal community village in Tasik Chini are connected to power grid. There are a few villages still do not have access to electricity. The rural areas in these regions rely on traditional fuels such as wood and agricultural residues to support their heating and cooking needs. However, these poor areas were already informed and familiarised with simple solar energy system to aid their daily activities. However, the lacks are in maintaining and educating people of the system.

This study is conducted to elaborate further on this topic and also to explore issues relating to sustainability among Aboriginal communities in rural areas, specifically on the designing of learning module for their education to support the awareness on renewable energy use in their surroundings. This is considered important as the Aboriginal community is a group that inhabits and uses most of the resources of the countryside. Behavioral and socio-cultural practices will determine the sustainability of rural areas [7]. The Indigenous basically means native or

resident who naturally belong to a certain place. Indigenous People are usually referred to the native ethnic groups in an area, in which a state shall recognize and protect them. They are native because they represent the earliest human group inhabiting an area, long before the formation of a sovereign state.

The main research question and sub-research question of this study as follows:

- What are the designs of basic learning module that meet the needs of mastery knowledge on Aboriginal community development?

- What are the needs of designing the learning module for education needs of aboriginal community?

II. LITERATURE REVIEW

A. Aboriginal Learning Styles

Aboriginals have lived in isolated communities and lack access to good services, particularly education [8] and health [9]. Geographical aspect that far from outside communities made them disinterested to send their children to school [10]. Generally, parents of the aboriginal do not have keen interest with education. They perceive the school as a place to send their children to play and just for the experience [11]. But when they see the outside communities expressing interest in the education of aboriginals, they became more aware of the importance of education. However, it is still difficult to change their perception which is caused by the lack of assistance and support to aboriginal education.

Aboriginal people generally hold the view that education must acknowledge their culture, help them to learn and aware of their environment as well as supporting their cultural identity [12]. The method of traditional aboriginal education was largely based on an informal learning approach. The focus in aboriginal learning is on mastering context-specifics skills. Mastery of context-specifics skills is in contrast to a school education system which seeks to teach abstract content-free principles which can be applied in new previously inexperienced situations [13], [14]. Education for aboriginal communities should, first, reinforce and build on their aboriginality and also prepare them for interaction with the outside communities in their surroundings.

B. Kolb Experiential Learning Theory

The concept of learning is depending on the formations of holistic, dynamic nature of learning styles through the interaction of person and the environment. Experiential Learning Theory defines learning as 'the process whereby knowledge is created through the transformation of experience' [15]. This Experiential Learning shows that there are four learning modes that is responsive to the contextual demands. There are 1) concrete experience, 2) reflective observations, 3) abstract conceptualization and 4) active experimentation.

In this paper, the Aboriginal Learning Styles are much related to the Experiential Learning Theory that focusing on fully environment. So that, the learners can learn throughout their own surrounding to make their own meaning of knowledge

concept. Hence, this relationship is suit to the aboriginal's life style in having better community in future.

C. Net Neutral Renewable Energy

In terms of the difficulties in having access to the electricity, the concept of net neutral renewable energy is explored to encounter this issue. Net neutral renewable energy refers to the reduction of energy consumption through energy needs of efficiency gains within the users is met by renewable energy [16]–[18]. If we apply the most general definition of zero-energy to the concept of community, a net-zero energy community is "one that has greatly reduced energy needs though efficiency gains such that the balance of energy for vehicles, thermal, and electrical energy within the community is met by renewable energy" [4]. The best renewable energy which can be used for aboriginals in Tasik Chini is solar energy. This type of RE can help the villagers to consume more energy in less cost for a longer time.

The integration of renewable energy and education in community is complementary to each other. The concept and the technical application of renewable energy must be done first before the community utilise the system [19], [20]. These kind of activities are valuable to the aboriginals if the system benefits them and their daily living. One of the solutions is to generate awareness and educate the aboriginal with specific and meaningful content.

III. METHODOLOGY

In this study, the research design used is a qualitative approach, through focus group discussion (FGD). The technique used was a semi-structured interview. The thematic analysis was done for the data analysis method of this study.

A. Research Context

Aboriginal engagement in development is still an issue. They are often considered as a minority group that was left out of the process community development [21]. The main aspect to the process of community development is involvement. Through involvement, the community will form the ability and build their empowerment in the community. Hence, a tool was design and will develop in term of engaging the aboriginal community towards the simple modern system yet enhancing their skills for sustainable development.

Designing the Solar Energy Basic Modules is according to the context and needs of Aboriginal communities in Tasik Chini. The education on the Renewable Energy (RE) particularly on Solar Energy is very important to the communities which have difficulty accessing electricity for daily activities. Therefore, the design of the Solar Energy Basic Module to the community and the environment has to consider the appropriate form of engagement with the lifestyle and culture of Aboriginal communities in Tasik Chini. Thus, the existence of this module, may help the Aboriginal community become knowledgeable on Solar Energy and aware of the importance of energy in life.

B. Sampling

The participants of this study involve ten experts from various field related to Aboriginal development. Those experts was gathered in one place to discuss on needs of Aboriginal

training and learning in general and also focused on renewable energy education. The sampling is selected purposively by looking at certain criteria chosen by the researcher. Some of the criterions were the duration of work with Aboriginal, the experience of expert in aboriginal development and the contribution of knowledge towards aboriginal economy, social and environment.

IV. RESULT AND DISCUSSION

A. Demography profile of participants

TABLE I.   PARTICIPANTS PROFILE BY GENDER

Male		Female	
Frequency	*Percentage*	*Frequency*	*Percentage*
6	60%	4	40%

Based on table 1, the participants consist of 6 male and 4 female. They are from various institutions including local universities, Ministry of Education and NGO's. The participants were selected by their field and experts in term of Aboriginal learning and community development.

B. Thematic Analysis

The research questions were answered from the discussion among the experts and face to face focus group discussion. The instruments used were the semi-structure interview protocol by thematic analysis. There are a few of themes discovered in relation to the needs of suitable learning module for Aboriginal Community. Those themes as follows:

1) Modules that can build a sense of belonging and sustainability: There are priorities in providing early identification and acquisition of knowledge [22] of the basic concepts of solar energy and also the use of apparatus and training of the skills on maintenance so, they will have a sense of belonging towards the facilities provided. Hence, they can transfer the knowledge and skills to the next generation as well as the content of modules. Below is the statement by experts that explains the theme.

"We want to make them have a sense of self-belonging...especially if this kind of project will promote sustainability in their community. When we start to develop the learning center, is it us as researchers, always need to be there to monitor them? So, we have to train people among the community itself…..to become trainers and our jobs to give them the specific training or nowadays we called as professional development. By doing so, the people can sustain and maintain this kind of project but not solely for this grant only… (Expert 1)

"There should be a sense of belonging to the program developed, crucial to ensure sustainability" (Expert 2)

2) Module that empowering the indigenous knowledge: Aboriginal communities are very concerned about the traditions of their ancestors, especially in terms of medical and social activities. This is the aspects to win them to ensure support of the development. The implementation should emphasize on the identity of these communities with very high indigenous knowledge. So, the content for the program should include their indigenous knowledge [23]. Some statements from the experts as follows.

"They have indigenous knowledge... fantastic.... they live in network...if there are computers, ask them to do by themselves" (Expert 2)

"So we make them feel the sense of ownership. We ask them to go to the jungle, we gave them a camera then ask them to take some pictures then upload it. Each item in the picture has their own name that only they know. Next we called our scientists to come and check the output. (Expert 2)

3) Modules that encourage the engagement of community with meaningful content: The importance of involving all members of the Aboriginal community because they all have the right to speak out and get involved with the welfare of their people.

"The most important is how we want to tackle their heart. Not just the leader. If we look back to United Nation report, we need to use everybody in the community, if there is any problem reported, the government will ask for each and everyone in the community. (Expert 3)

"by involving the whole community for each phase of development from day one to the last day. (Expert 3)

"We really need to involve the people as much as possible (Expert 3)

It is important to note that planning and implementing meaningful activities must involve the needs of indigenous people. There are statements by experts which supports this;

"We need to give meaningful content to them. This is because, if we ask the parents why the children are discouraged to go to school, it is mainly because to get some experience. They also answered that the government lied to them, there were misunderstandings that if they send their children to school, they became better but the real outcome is that their children know nothing compared to the children that never go to school, they are very skillful in life survival skills.

Their understanding on school education remains vague and they do not feel the benefit at all. (Expert 4)

4) Module that can become as guidance for accessing basic needs and tools: Experts says, the needs of larger electrical energy storage is very important to cover the basic needs of Aboriginal economy such as refrigerators and product dryer for storage of fish or herbs.

"Like prof. xx said before, how can we support their economy, let say if we have 3KW tools, what kind of things can they improve? For example, the solar equipment that we will provide later, how can they use it for the whole village, it should be some ideas that we need to explore first (Expert 3)

"...there is this situation, this aboriginal went fishing and going to sell it. We ask them, where will the fishes be stored? They point to the river. Apparently, they have built the fish cage

inside the river. They said if they can get a freezer it will really help them. It is because it is not easy to keep the fishes in the cage, it should have sponsor for better application. (Expert 2)

The advantages and features of some equipment can help the Aboriginals community to have a better life as well as to improve the quality of their lives.

"The solar panels provide 3KW. The capacity is meant for basic needs such as lamps and fans. Solar cooker use Fresnel panel that can capture sunlight. The energy is used to move the motor to make the pump functioning. Besides, the size of the equipment is in human size. There is solar dryer. There, the aboriginal dry the herbs under the tree, put that with not covered. The problem is in term of hygiene. If this equipment is used, the user will be more confident to buy it". (Expert 7)

"In business matter, the equipment is valuable to them. The user is concern about hygiene. We can educate them to make a change and come out with different output of the product using this equipment. If we can convince them that by using this tool, they can gain profit then they will start to do it. Besides, it can be one of the attractions to increase the number of tourist. It is also for marketing purposes. However, we should bear in mind that, there is no need to make a comparison with the traditional process, it is quite dangerous. So let's just focus on the benefit and what this equipment can do for them" (Expert 10).

With regards to the overall discussion, it can be seen that majority of the experts mentioned about the design of the features and the use of indigenous knowledge elements in this learning module. They commented that the module content should offer more freedom to communicate comfortably and perform various assessments stress-free. Therefore, experts also mentioned that the module must ensure that the aboriginal actively control their learning process, develop the ability and identify their weakness as well as being motivated throughout the learning process. Table 2 refers to the summary of the themes discovered.

TABLE II. SUMMARY OF THEMES DISCOVERED

Theme	Action Explanation
Modules that can build a sense of belonging and sustainability	There are spaces for interesting activities and training.
Module that empowers the indigenous knowledge	The application of basic 8 ways indigenous pedagogy
Module that encourage the engagement of community with meaningful content	There are group activities or team player training to increase the curiosity.
Module that can become as guidance for accessing basic needs and tools	There are reasonable plan to use the knowledge for increase the quality in daily life.

V. THE IMPORTANCE AND IMPACT OF ESD LEARNING MODULE

There are important impacts of ESD Learning Module which will benefit the aboriginal. The most important impact is in terms of mastery learning. The aboriginal is just focused on certain types of information important to them. They will be interested to the content of new knowledge if it can make their life improved. The aboriginal is a very selective community and they might not be too eager of any content which is not important to them. Thus, developing the learning module according to their

culture and environment will make sure that there is an engagement between them and meaningful content which in the end will help the community. Thus, there are needs of developing the learning module as a part of the aboriginal community to increase their education system to be more flexible and meaningful.

Additionally, the condition of the user in the implementation of ESD learning module is expected to have a lot of benefits and advantages. According to Gagne in condition of learning theory, there are five aspects that linked to the condition of learning. The five aspects are cognitive strategy, intellectual skills, verbal information, motor skills and attitude [24]. These aspects helps aboriginal community to focus on certain knowledge deeply by increase the cognitive development which is enhanced in their knowledge through mastery learning [25]. Besides, these conditions of learning will ensure that the aboriginal get a 'well structured' knowledge. They will help their own learning through the module developed specifically to their needs and culture. Hence, the aboriginal can be more aware of their environment and can help them understand more about the content in order to have a good quality life.

Moreover, the interest in learning can be created by starting with a simple material and learn to avoid the term 'a long time'. [26]. Material that is difficult and time consuming will cause boredom and fatigue. Learning in groups also adds more interest in learning rather than studying alone and each member of the group should also maintain self-discipline. If not, the study group will not have any an effects on the performance and will only be a waste of time and energy. However, the development of this learning module can be an aid to help the community in learning at their own time and in their own spaces. Lastly, it shows that this learning module does not have a 'force' system that can make the aboriginals feel worst or give up in learning.

Generally, encouragement, determination and a boost from the instructors is important factors in the process of teaching and learning to nurture and empower the learners. The findings are also supported by the past research. Teaching became more interesting and effective by using a teaching aid [27]. Instructor's skills in teaching are not only in delivering lessons, but also in terms of teacher's ability to use different types of interesting and effective teaching aids. It is the best time to develop a learning aid specifically for aboriginal learning which is an ESD learning module in term of community engagement and local environment. Thus, without the outside instructors or the organizer which started a program, they can try their own learning by using the ESD learning module provided.

VI. SUGGESTION AND CONCLUSION

The module will be developed to achieve the intended learning outcomes at the end of each module. Similarly, the activities that are available in the module is able to improve the learners performance [25] of next lesson yet helps instructor to organize their teaching well by diversifying activities for learners. It also follows the constructive alignment in teaching and learning by Briggs which stated that the objectives, procedures and evaluation in teaching and learning session must be aligned. These alignments should be implemented for developing the ESD learning module to achieve the intended

aim. This module also will help the learners apply their learning when the instructors are not around. Besides, the module development also is expected to help students cooperate in groups to provide ideas and another contribution that will help launch the process of learning in the classroom.

This phase has shown that the implementation of constructive learning environment requires planning to think carefully at the design stage and construction of the module. The purpose of this chapter is to enable researchers to explore the factors that affect the process of curriculum design and use of learning outcomes as key principles for the design of the module. The focus has been investigated through developing cohesion aspects of the curriculum through the intended learning outcomes, teaching methods, materials and activities, and evaluation. The research outputs had shown that this learning strategy will train the aboriginal to be positive towards self-paced learning and responsible in improving their performance. As a conclusion, learning through environment with the incorporation of learning module and the use of real apparatus in developing learning materials can be a viable strategy in increasing the learning effectiveness and should be further encouraged and adopted by academician in the teaching and learning approach.

REFERENCES

[1] P. B. and K. Y. L. Ania Lian, Peter Kell, *Challenges in Global Learning: Dealing with Education Issues from an International Perspective.* Cambridge Scholars Publishing, 2017.

[2] C. Chuong and J. O. N. Schiess, *The Promise of Personalized Learning in Rural America*, no. October. Bellwether Education Partners, 2016.

[3] D. Tracey, R. G. Craven, A. S. Yeung, S. Tregeagle, J. Burnstein, and H. Stanley, "A place to learn: cultivating engaging learning environments for young rural Aboriginal Australians," *Int. J. Incl. Educ.*, vol. 20, no. 6, pp. 641–658, 2016.

[4] L. F. Walter, M. Evangelos, and P. Paul, "The future we want: Key issues on sustainable development in higher education after Rio and the UN decade of education for sustainable development," *Int. J. Sustain. High. Educ.*, vol. 16, no. 1, pp. 112–129, 2015.

[5] a. Azapagic and S. Perdan, "Indicators of sustainable development for industry: a general framework," *Trans IChemE*, vol. 78, no. July, pp. 243–261, 2000.

[6] M. Y. Abu bakar, H. A. hadi Habib, and N. Isyaku, "Impact of Renewable Energy for the Economic and Sustainable Development in Nigeria," *Int. J. Eng. Comput.*, vol. 6, no. 6, pp. 6366–6370, 2016.

[7] H. M. Jamilah Hj. Ahmad and H. A. H. & J. A. Wahab, "Pengetahuan , Sikap dan Amalan Masyarakat Malaysia terhadap Isu Alam Sekitar," *Akademika*, vol. 81, no. 3, pp. 103–115, 2011.

[8] A. Desta, "Comprehending Indigenous Knowledge: An Ethnographic Study of Knowledge Processes within Natural Resource Management," 2009.

[9] UNICEF, *A Human Rights-Based Approach to EDUCATION FOR ALL A Human Rights-Based Approach to Education.* New York: United Nations Educational, Scientific and Cultural Organization, 2007.

[10] T. K. Yunkaporta, *Aboriginal Pedagogies at the Cultural Interface.* Australia, 2009.

[11] J. H. and I. M. A Habibah, "Sustainable Livelihood of the Community in Tasik Chini Biosphere Reserve : the Local Practices," *J. Sustain. Dev.*, vol. 3, no. 3, pp. 184–196, 2010.

[12] D. Karrow, "Educating-Within-Place : Care , Citizen Science , and EcoJustice," in *Cultural Studies and Environmentalism, Cultural Studies of Science Education*, no. August 2016, 2010.

[13] A. A. Ibrahim, "Comparative Analysis between System Approach , Kemp , and ASSURE Instructional Design Models," *Int. J. Educ. Res.*, vol. 3, no. 12, pp. 261–270, 2015.

[14] Mahyuddin bin Arsat & Norshahidah binti Shafie, "PEMBANGUNAN MODUL ' BASIC OF ELECTRIC AND ELECTRONIC ,'" 2013.

[15] A. Y. K. and D. A. Kolb, "Experiential Learning Theory: A Dynamic, Holistic Approach to Management Learning, Education and Development." pp. 1–57, 2011.

[16] A. Brew-hammond, "Energy access in Africa : Challenges ahead," *Energy Policy*, vol. 38, no. 5, pp. 2291–2301, 2010.

[17] A. Chebak, "Concept of educational renewable energy laboratory integrating wind , solar and biodiesel energies," *Int. J. Hydrog. Energy XXX*, pp. 1–11, 2016.

[18] A. Yadoo, H. Cruickshank, A. Yadoo, and H. Cruickshank, "The role for low carbon electrification technologies in poverty reduction and climate change strategies : A focus on renewable energy mini-grids with case studies in Nepal , Peru and ...," *Energy Policy*, no. February 2016, 2012.

[19] N. Izadyar, H. C. Ong, W. T. Chong, and K. Y. Leong, "Resource assessment of the renewable energy potential for a remote area: A review," *Renew. Sustain. Energy Rev.*, vol. 62, pp. 908–923, 2016.

[20] A. Zyadin, "Prospects for renewable energy education (REE) in elevating youth energy and environmental awareness in Jordan," *Dissertationes Forestales 207.* p. 39, 2015.

[21] F. J. Lozano-Garcia, M. Manzano, G. Gandara, O. Perrni, D. E. Hernandez, and D. Huisingh, "Capacity building: a course on sustainable development to educate the educators," *Int. J. Sustain. High. Educ.*, vol. 9, no. 3, pp. 257–281, 2008.

[22] UNCTAD, "Renewable Energy Technologies for Rural Development," *Curr. Stud. Sci. Technol. Innov.*, no. 1, p. 42, 2010.

[23] L. Hiwasaki, E. Luna, Shamsidik, and R. Shaw, *Local and indigenous knowledge for community resilience Local and indigenous knowledge for community resilience.* Jakarta: UNESCO, 2014.

[24] K. Khadjooi, K. Rostami, and S. Ishaq, "How to use Gagne's model of instructional design in teaching psychomotor skills.," *Gastroenterol. Hepatol. from bed to bench*, vol. 4, no. 3, pp. 116–9, 2011.

[25] A. Slahova, J. Savvina, M. Cacka, and I. Volonte, "Creative activity in conception of sustainable development education," *Int. J. Sustain. High. Educ.*, vol. 8, no. 2, pp. 142–154, 2007.

[26] N. H. & C. C. R. ALIFF NAWI, GAMAL ABDUL NASIR ZAKARIA, "Penilaian Kualiti Modul iPBL: Aspek Kesahan dan Kebolehpercayaan," *J. Pengukuran Kual. dan Anal.*, vol. 11, no. 2, pp. 1–10, 2015.

[27] H. K. and F. Meijers, "Education for sustainable development (ESD): Exploring theoretical and practical challenges," *Sustain. Dev.*, vol. 92, no. September, pp. 27–30, 2010.