The Need for Contextualization of Education for Sustainable Development (ESD) – A Study of ESD in Fiji and Japan

Improving Problem Solving as a skill of ESD in Science Classrooms in Fiji

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1. Introduction

Education for Sustainable Development (ESD) is one of the educational concomitant goals which has been adopted by members of the United Nations General Assembly, through the United Nations Decade of Education for Sustainable Development (2005-2014).

The United Nations Assembly has enacted the Sustainable Development Goals, which identify ESD as an educational approach to achieving the goals and targets. As the educational approach, ESD is a philosophy and a methodology; a philosophy as ESD can set broader goals, a methodology as ESD can influence pedagogy – precisely what and why teachers do what they do and how teachers do it (Koya, 2011).

ESD teaching and learning approaches encourage teachers to move from a traditional pedagogical approach to a more student-centered, transmissive to a transformational approach to teaching and learning. Learning to stimulate students to ask questions, analyze, think critically, and make decisions (UNESCO, 2012). Some schools’ systems can develop more flexible teaching and learning approaches; however, the reality is that others follow relatively rigid approaches in integrating ESD contents in the curriculum (UNESCO, 2011).

Additionally, school leaders need to identify ESD contents and pedagogy accurately. Otherwise, the quality of ESD teaching will depend on the philosophy and temperament of individual teachers (Stokes et al., 2001). Schools are the agents of Education for Sustainable Development; however, they can only be successful with knowledgeable teachers who are agents of Sustainable Development. Teachers who understand ESD and teaching approaches are influenced by ESD (Maebua, 2010).

Many countries have already integrated ESD into formal education. Even though specific ESD themes have been incorporated into the curriculum, there is little evidence on the effectiveness of ESD programs or classroom teaching (Benovot, 2014). Additionally, there is confusion on how ESD can be implemented in the classroom (Chikamori et al., 2019).

Another challenge is education systems which are overstrained by high examination stakes or by the curriculum, where ESD topics are de-prioritized by prioritized subject areas and assessing learning outcomes. In these contexts, the effective implementation of ESD into classroom teaching and learning is undermined (UNESCO, 2011).

ESD has the potential for transformational education for Sustainable development. However, ESD cannot be effective if it is not implemented in the classroom (Didham & Ofei-Manu, 2018).
paper focuses on ESD implementation of two different ESD pedagogical models, whereby the lessons are contextualized and used to improve problem-solving as a skill of ESD. The lessons are then implemented in a Fijian Year 10 Basic Science classroom.

2. Methodology and Data Collection
This paper focuses on the ESD pedagogical models and the implementation of lessons in the Fijian Year 10 classroom. The following is a brief outline of the ESD models and the procedure of the lessons:

2.1 Transformation Model for Education for Sustainable Development
The implementation of ESD in Japan, specifically in schools, has always caused controversy between the teachers, as some agree with the concept and the linkage of ESD with the Curriculum, while others were confused at the implementation and how this would affect pedagogy. The Transformational Model of ESD (TMESD) is an approach that would give teachers a framework to base their teaching methodology (Chikamori, 2019). TMESD is the learning process of socialization, which is based on two elements; social structure and human agency.

![Figure 2.1 TMESD as an ESD learning process](image)

In Figure 2.1, the ESD Learning Process is consists of three sub-processes. Firstly, the model allows students learn or analyze the present situation. The second sub-process is reproductive learning, which is divided into two sub-activities. The first sub-activity is where the student learns about the past. Then the second sub-activity is relating what the student had learned from the past with the present situation. This second sub-process uses reproductive logic when examining the past situation and logically develop ideas and opinions on the mechanisms or developments which took place and consequently lead to the current present situation. The mechanisms set in place was not necessarily positive. However, without which, the current present situation would not have transpired. The third sub-process is retrodictive learning and also divided into two sub-activities. From the first two sub-processes, the students would have a fair idea of the causes, which has led to the current situation. The first of the sub-activities is where the student imagines a realistic utopian future. This future is not an illusion or a dream but a future that is attainable with the current circumstances. The second sub-activity is for the students to consider how their present actions might impact the utopian future the students
have imagined. Then the students would identify conditions in their present actions that the students may have to change or modify in order for the students to be able to achieve that utopian future the students have imagined.

2.2 Fiji Education for Sustainable Development Perspective Model

The Fiji Curriculum has positioned ESD as a perspective of the Curriculum, where ESD is used to identify topics or concepts which are relevant for capacity building in students.

The Fiji ESD Perspective model is based on the Fiji Curriculum, specifically the subtopic of Conservation of ecosystems. This model focuses on the Past and Present of the Sustainability Issue and the Conservation Approaches.

![Figure 2.2 Fiji ESD Perspective Model](image)

The Perspective model allows an exploration of conservational approaches. This would include both Traditional Conservation Approaches and Modern Conservation Approaches. Looking at the current situation of the issue and the problems this issue has created but at the same time, the reasons why the issue was brought about. This was important as this allowed the students to understand the background and current standing of the issue fully.

2.3 Lesson Implementations in Fiji

The Lessons were based on the Fiji Basic Science Syllabus content for Year 10. The topic which the lessons were based on is the 'Environment Around Us,' which is the last topic in the Fiji Year 10 syllabus. From this topic, the subtopic of the Ecosystem was chosen, and the content was based on the Conservation of Ecosystems. ESD based lessons are based on the ESD value of appreciating nature and the ESD skill of problem-solving.

The lessons were divided into four lessons, which was a build-up from what is an ecosystem to human impacts and then Conservation of Ecosystems. This concluded with a final lesson, which was a Problem-Solving Lesson from as the main objective of the whole lessons was to Improve problem-solving skills among Year 10 Basic Science students.
The lessons were evaluated through the achievement indicators (AI) and the student's achievement of the AI through analysis of the worksheets and evaluations.

2.4 Problem Solving as a skill of ESD

Problem-solving is eminent in every sector of human activity and is a skill needed in all sectors such as Law, Science, Education, and so on. Problem-solving is one of the sustainable skills identified associated with Education for Sustainable Development.

By definition, a problem is a situation that is experienced by an individual that is different from the situation which the individual would ideally like to be in. This problem can be solved by a sequence of steps that reduce the difference between the initial situation and the goal (Hidetoshi.S, 1997).

A Problem-Solving Model (Figure 3.4), which was used in this study, was derived from the UNESCO ESD Decision Making Model for Elementary School Students (UNESCO, 2014b) and was modified to fit the purpose of this study. This model allowed students to have a sequenced approach to solving or finding solutions to a problem scenario.

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**Table 1 Summary of the Lessons**

<table>
<thead>
<tr>
<th>Lesson Topic</th>
<th>Living things and the Environment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subtopic</td>
<td>The Ecosystems</td>
</tr>
<tr>
<td>Lesson Duration</td>
<td>50 mins</td>
</tr>
<tr>
<td>Strand Outcome</td>
<td>Recognize the characteristics and functions of organisms concerning their diversity and interdependence.</td>
</tr>
<tr>
<td>ESD Skill</td>
<td>To improve Problem Solving</td>
</tr>
<tr>
<td>ESD Value</td>
<td>Respect for Nature and the Planet</td>
</tr>
</tbody>
</table>

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**Figure 2.3 Problem Solving Process Model (UNESCO, 2014)**
The above model starts with the students identifying the sustainable issue or problem. Then the students identify those stakeholders who are directly affected by this issue. This would allow the students to think carefully about how this issue would affect the stakeholders in the area.

Then the students are to identify the impacts of the issue or problem in three areas; Environment, economy, and health and wellbeing of the residents of that area. The impacts of these areas were analyzed by the students and specified according to the area.

The students were then required to formulate different approaches to deal with the issue/problem. These approaches are then assessed in terms of the different impacts the options may have on the above categories the Environment, economy, and the health and wellbeing of the residence of the area. From this assessment, students are then to choose the most suited solution for the problem.

<table>
<thead>
<tr>
<th>Levels of Problem Solving</th>
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<tbody>
<tr>
<td>Level 1 – Identify the issue/problem</td>
</tr>
<tr>
<td>Level 2 - Diagnose the situation</td>
</tr>
<tr>
<td>Level 3 – Generate solutions</td>
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<tr>
<td>Level 4 – Evaluate the solutions</td>
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<tr>
<td>Level 5 – Select the best solution and re-evaluate</td>
</tr>
<tr>
<td>Level 6 – Implement and follow up</td>
</tr>
</tbody>
</table>

The evaluation of the study identification of the levels of problem-solving the student can reach. The levels of problem-solving of the students were identified from the worksheets the students filled in and was compared to the Level of Problem-Solving key in Figure 3.5. The Levels of Problem Solving was adapted from ‘Beecrafts (2003), keys to approaching Problem-Solving, which is a business model of approaching Problem Solving.

3. RESULTS
3.1 Fiji ESD Perspective Model

The Fiji ESD Perspective model was conducted in 2 schools with a series of 4 lessons per school. The first lesson was based on the components of an ecosystem, with the achievement indicator of identifying the components of an ecosystem. From this, 75% of the students were able to identify the components of an ecosystem. Also, 70% of the students were able to state the interdependence of organisms. This was an essential concept as students conveyed understanding that in harming, one set of organisms, would cause indirect harm to another set of organisms. Additionally, students were able to identify a 'chain reaction' from the consequences of the destruction of natural habitat, for example, an entire ecosystem. This was important as this allowed the students to acknowledged the direct and indirect consequences of one event. Furthermore, students also agreed the use of the case study allowed a practical understanding of concepts.
Lesson 2 was based on Human Activities on Ecosystems. The lesson focused on Bauxite Mining in Fiji and the impacts of the mining. The lesson had a storytelling approach, whereby the students considered the pros and cons of Bauxite mining. The Achievement Indicator was the number of Human Activities Identified, which had a consequential impact on the surrounding environment. About 18% of the students could not identify human impacts, as shown in the first graph in Figure 3.2. Some students did not have an answer, or the students did not properly understand the term ‘impact.’

Figure 3.2  Results from Lesson 2 of the Fiji ESD Perspective Model
Around 85% of the students were able to achieve AI. Students were also able to use the interdependence and biodiversity of the terms in the evaluations of the second lesson. This showed students were able to correlate what they learned from the first lesson with the second lesson. Students also stated that the case study allowed them to understand better the impacts of Human Impacts and what is happening around them.

Lesson 3 was based on conservation, and the AI was for students to Identify conservation approaches from research. In this lesson, the students researched different newspaper articles for different conservation approaches. The students were also introduced to different traditional conservation approaches. Figure 3.3 focuses on the number of students able to identify the different conservation approaches from the research. Almost 70% of the students were able to identify three or more different conservation approaches, while only 2% of the students could only identify one conservation approach. The AI was achievable by 100% of the students.
This conveyed that students were more responsive to activities that were student-centered as the students were able to relay individual ideas and experiences regarding conservation.

### 3.2 Transformational Model for ESD

The TMESD Model lessons were divided into four lessons, which were based on the concept of Ecosystems. The lessons followed the TMESD approach and were contextualized to the current situation in Fiji.

The lesson one showcased the present ecosystem, which is being infiltrated by the present bauxite issue. The students were able to identify the current present issues which had raised from Bauxite mining. The students acknowledged that Bauxite mining did bring in certain things that were positive for the economy of the people and government. On the other hand, students also recognized the negative impacts that mining brought about to the environment and the people. The students then researched the past ecosystem of that area and critically analyzed the different issues of that time. The students recognized the lack of jobs and development, as well as the difference in the financial status of the people. However, there was an appreciation of the environment and the sustainable essence of the past ecosystem. The AI was to compare the past ecosystem and the present ecosystem of where the bauxite mining is situated. The AI was achieved by 100% of the students.

![Figure 3.3 Results from Lesson 3 of the Fiji ESD Perspective Model](image-url)
TMESD Lesson 2 was based on 'Sustainable Future.' From the previous lesson, students analyzed in detail the different factors which were associated with bauxite mining. Using this information, the students imagined a sustainable future. The students were then asked to draw the 'sustainable future' the students would want. From these drawings, the students were asked to identify what is a sustainable future. About 58% of the students stated a 'clean and healthy environment.' The rest of the students chose similar responses. However, 5% of the students stated more roads and more job opportunities.

Lesson 3 was related to the previous lesson and had an achievement indicator for students to identify conditions for a sustainable future. This was achievable by 100% of the students. Students were to use the drawings from Lesson 2 and identify the conditions the students will need to change or work on to achieve a sustainable future.
From figure 3.7, the majority of the students listed Afforestation or planting of trees as the main need for a sustainable future. This was the first time this lesson approach was conducted in a Fiji classroom, thus took time for the students to come up with an answer. However, students were able to formulate practical conditions.

### 3.3 Problem Solving Lesson Outcome

The TMSED and the Fiji ESD Perspective Model are two different approaches to teaching and learning for Education for Sustainable Development. The levels of Problem-solving reached by either approach was different.

Figure 3.7 displayed that 60% of the students reached Level 5 of Problem Solving, as these students were able to formulate different solutions and then evaluate the solutions and prioritize the best results. However, the results also show that 30% of the students reached level 2 and did not formulate solutions.

![Levels of Problem Solving](image)

Figure 3.7 Problem Solving Results for the TMESD Lessons

Figure 3.8 displays the final lesson results based on Problem-solving skills. In this lesson, more than 80% of the students reached level 5 of Problem-solving as students were able to identify the best solution and reevaluate the choice. About 12.5% of the students chose the best solution but did not evaluate this choice. The students were given a problem scenario, and students had to come up with an alternative solution through a thorough evaluation.
It was positive to note that students were able to identify the different outcomes of the scenario and the proposed solutions. About 75% of the students evaluated that the last lesson was the most interesting because of the problem-solving model. This model allowed the students to change their perspective on how to approach problems and how decisions have a ripple effect. Additionally, the FESDP lessons also displayed that if students were given the right tools and information, the students would be able to reach higher levels of problem-solving.

4. DISCUSSION

The two different pedagogical lessons a variety of results and observations. FESDP lessons showed that students responded better to learner-centered approaches, as students were able to relay individual ideas and experiences. The students related better to studying issues that affect them on a daily basis. Also, the students were able to identify a ‘chain reaction’ when studying case studies related to what was happening around them. Finally, the FESDP lessons also displayed that if students were given the right tools and information, the students would be able to reach higher levels of problem-solving.

The TMESD allowed the students to also were able to think carefully about sustainability and what it means to them. Also, this showed students have their own options on what is a sustainable future. For example, a number of students believe that development is proper, just as long as it goes hand in hand with environmentally sustainable approaches. Finally, students to use appreciated the use of a creative means to present their ideas and opinions. Given the resources to draw allowed the students to showcase what they wanted in a sustainable future.

The evaluation of the two models was in three avenues; the use of the Achievement Indicator, the Problem-Solving results, and the student's evaluation. Firstly, was the comparison of the Achievement Indicator reached for each lesson. The PESD lessons had an average of 87%, while the TMESD had an achievement of 100% of the Achievement Indicator for three lessons. However, in the
final lesson of Problem Solving, the TMESD approach led 60% of the students reaching Level 5, while the PESD approach led to 80% of the students reaching the same level of Problem Solving.

This was the first time the ESD Transformational Model was used in a Fijian Year 10 Basic Science students. Students took more time to understand the instructions fully and had to think carefully about the answers consciously. While the Fiji Perspective Model was a teaching approach that was based on the Fiji National Curriculum, the Perspective Model was also an approach the students were comfortable and familiar with. Additionally, the Perspective Model also provided the students with information and knowledge, which was beneficial to help students solve the problem in the final lesson. The Perspective approach was formulated to equip students with the knowledge needed to approach Problem-solving.

The TMESD approach required the students to think outside the box with regards to the sustainable future. There was no information used to influence the students on what kind of sustainable future they might want. The lessons required the students to think critically about what the individual student would want for a sustainable future. At the same time, the students were to analyze the practicality of the answers critically. Moreover, the timing of the delivery of lessons was different. The Fiji Perspective Lesson was conducted in Fiji in September after Year 10 had covered all the content of the Basic Science Coverage. So, the Year 10 Basic Science classes had already covered the topic of Ecosystems. The TMSESD lesson approach was delivered in June; this was before the students had covered any lessons on ecosystems and conservation.

During the evaluation, there were a number of responses from the students. For the PESD lessons, the students specifically identified the Conservation lesson and Problem-Solving Lessons as the best lessons. Students were also able to share their own experiences with conservation and also learn about traditional conservation approaches. The students also conveyed their appreciation for the learner-centered approach, as students. The conservation lesson allowed students to conduct their research and present the findings. Felt empowered with the knowledge of conservation approaches. These lessons were student-centered, where the educator focused on a facilitator role and facilitated the lessons, and the students played a more active role in these lessons.

The TMESD lessons, the students stated in the evaluation that the lesson on the sustainable future was the most memorable lesson. The evaluations also showed the students had an appreciation of the use of creativity to exhibit what the students would want for a sustainable future. This approach began to allow the students to explore competencies further.

Both TMESD and the PESD are learner-centered approach where a learner’s prior knowledge and experience in the social context, are the starting point for stimulating learning processes. The learner-centered approach is a critical ESD pedagogy, that has the potential to lead to action orient or transformational outcomes. In both instances, Transformative Learning is encouraged, where learners are empowered to question and change the way the student individually see the world.
One of the main limitations of this section of the research is the time factor. TMESD is a model that needs to be used in the field for a longer duration for students to feel comfortable and accustomed to the approach. This would allow students to exercise different key competencies and develop a deeper thinking pattern.

In evaluating the two different ESD approaches, one is not better than the other. Even though the TMESD had 100% achievement in all AIs, the FESDP model had a higher achievement for Problem Solving. Both approaches offer teachers different means for teachers for ESD and provide adequate support in teaching and learning. Additionally, there is more room for extensive research and further contextualization for ESD models to ensure better outcomes in the classroom.

4. CONCLUSION

Pacific ESD practitioners agree that ESD means rethinking the role of Education, in order that a clearer vision for ‘transformative education’ is developed (Koya, 2011a). In the classroom level, the ESD teaching models show that there are various means of implementing learner-centered, transformational approaches to learning.

Consequently, there is still a need for ESD practitioners to help formulate ESD pedagogical models to support school teachers in lesson formation and implementation. ESD implementation can be confusing for school teachers; however, with the support from ESD experts, the transition in the different. The ESD journey in Japan portrays that ESD is not a vague or generalized approach, but a flexible avenue where countries are empowered to identify ESD according to local context and cultures. Japan also showcases the possibilities of ESD activities in schools and specifically in the classroom.

The call for contextualization of ESD is the mitigating factor for any International Policy to have some degree of effectiveness. However, there is still a lot of factors that influence the outcomes of any policy adoption or implementation. The ESD path has never been a smooth one; however, with proper contextualizing at all levels, government, community, school, and even classroom level, ESD has the potential to make changes.


In conclusion, contextualization and extensive research are vital for the implementation of ESD to lead to transformational outcomes. Without proper contextualization, the ESD implementation will just be a policy slogan.

References

Abstract
Sustainability is everyone’s responsibility (Koya, 2011). As every individual is responsible for the sustainability of our world, and every individual will live with the impacts of previous and current actions. Education for Sustainable Development was labeled an ‘empty signifier’ by Environmental Researchers, with the potential of becoming policy slogans that remain symbolic or empty (Wals & Jickling, 2008). However, ESD has the prospect of making fundamental changes not only in terms of curriculum subject-matter but also with instructional methods organization and administration (Koya, 2008). ESD also recognizes the importance of Culture as the foundation of ESD (Thaman, 2017). The end of the UNDESD highlighted the need to adopt a contextualized approach is a critical factor to success in ESD Lotz-Sisitka, 2015).

The objective of this paper is the comparison of two ESD Pedagogical Models, which have been implemented in the Year 10 Fijian Basic Science Classroom. The Transformation Model of ESD (Chikamori et al., 2019) and the ESD Perspective Framework (Fijian Model). Year 10 Basic
Science lessons were prepared using the two ESD models to improve Problem-Solving Skills among the students.

The ESD model lessons displayed an improvement in problem-solving skills, as students were encouraged to use an Integrated Problem-Solving Method. This showed that ESD had the potential to stimulate students to analyze, think critically, and make a good decision when pedagogies move from the teacher-centered to student-centered learning.

Contextualization and extensive research are vital for the implementation of ESD to lead to transformational outcomes. Without proper contextualization, the ESD implementation will just be a policy slogan.