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Environmental Education Competence of Technology and Livelihood Pre-Service Teachers Aided with ICT-Based Learning Resource Materials

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***Abstract* – This study evaluated the level of competence of the Technology and Livelihood Education pre-service teachers on environmental education concepts and principle. This was a joint program of BU-DENR and Cebu Normal University as a respondent University in the National Network of Normal Schools. Project ICT-based Environmental Education materials in different media of learning. This research study is in deductive design through testing the hypothesis with the use of the research and program made questionnaire: Level of competence on Environmental Education Concepts and Principles of Pre-service Teachers; This program assessment envisioned to enhance the greater positioning of the pre-service teachers to handle the integration of Environmental Education in the Basic Education Curriculum of the Department of Education. The findings supported that pre-service teachers are in the best position to teach the world attain sustainable environmental development for they are ICT learners. ICT learners can better innovate more ICT-based learning materials for children. Through ICT-based learning materials children can acquire mind-set on how to attain sustainable environmental development. This initiative provides a platform for exchanges of expertise and collaboration with local leaders and universities and schools through understanding the views and interests of the learners in developing ICT based learning resource materials which can touch and involve them in sustainable environmental development education.**

***Keywords* – Environmental Education, State University, Pre-Service Teacher, ICT-Based Learning, Community-Based Initiative.**

I. INTRODUCTION

Environmental Education has now become so significant because of the greatest problem of food shortage and other supply shortages in the country and around the world. However, with the finding of the study of [Manase, J.] that there is inadequacy of environmental educational approaches, techniques and strategies employed that resulted thereof. Thus, the common people have now felt the negative changes like the illness, unhealthy foods and other relevant issues brought about by the unsustainable environment. UNESCO and the Canadian Commission for UNESCO, held an event on Education for Sustainable Development (ESD) and Global Citizenship Education (GCED) and their contribution to achieving the Sustainable Development Goals (SDGs), notably Target 4.7 of SDG 4 on Education on March 6, 2017 in Ottawa Canada. They would examined pedagogical approaches and teaching practices in promoting ESD and GCED. With this development and planning on how to position Teacher Education Institution (TEIs) pre-service teachers became a challenge with the National Network of State Universities in the Philippines with the aid of the of the Department of Environment and Natural Resources then the project of augmenting the status of Philippines in the state of ESD ranking in the world. Atting of your paper. Now there is a need to propose new conceptual foundation for teaching environmental education [Schlottmann]

As there is an ongoing discussion about output oriented models and about basic competences for teachers. Environmental organization can do more to improve their ways of evaluation to better sought the existing understanding of it. [Carleton] the reason for this focal shift was the insufficient quality of teacher education. Like for example in Minnesota USA, their legislation has found the need for enrichment of environmental education literacy [Frederickson] for example, Hascher & Altrichter (2002) describe teacher education in Austria as a ‘conglomerate of unconnected knowledge’. According to Mifsud, M. (2012), one way of seeing the situation is by examining the existing human resources available in the universities and colleges, the pre service teachers. These teachers would eventually will become the teachers in the field (Mifsud, 2012.) Through ICT these can be empowered to become environmental educationist who are equipped with the process on how to integrate environmental education concepts and principles in their teaching. The process of merging the ICT-based learning resource materials in different media would be their thrust in order to effect mind-setting for the elementary and secondary students.

Pre service teachers empowered by ICT as ICT learners are better situation to produce more ICT-based learning materials. They are exposed in Educational Technology courses on how to select and make their own instructional materials. With the ICT-based learning resource materials they can efficiently and effectively touch the minds and hearts of the students. The children nowadays would like to view ICT learning materials rather than the old ways of presenting lessons and topics. The television, interactive media and the internet had become influential to the learning of the students. If the students would be inclined to do something they must then be allured to visit ICT-based learning resource materials for environmental education. Children are surprisingly affected by the mind-set of the cartoon characters in television. They become carried away with the suggestions of their favourite model. So with this thought then it must be strategic to develop the concepts and principles of environmental education through ICT-based learning resource materials like interactive games, videos and simulations presentations.

II. Theoretical Framework

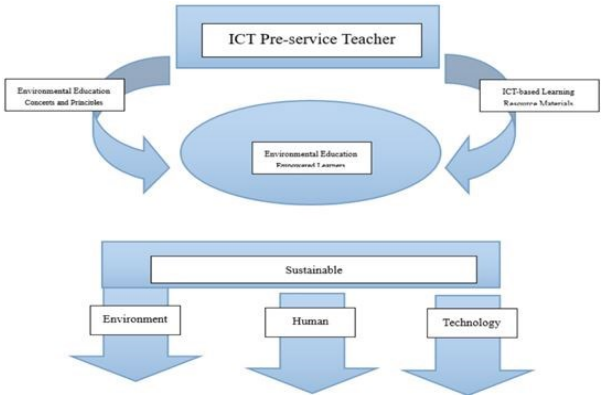

Fig. A. Competent Pre-service Teacher Engaging in ICT-based Environmental Education Learning Resource Materials. Adapted from the Theory Framework of Input-Output Flow

III. Theory

Environmental Education is the way for the world to attain sustainable environment which comes from common action of local people. Pre-service teachers are in the best position to teach the world attain sustainable environmental development for they are ICT learners. ICT learners can better innovate more ICT-based learning materials for children. Through ICT-based learning materials children can acquire mind-set on how to attain sustainable environmental development. Action of local people can contribute for the acquisition of a sustainable environmental development mind-set of children. ICT learners can acquire mind-set for sustainable development. Pre service teachers can cooperate with the local people develop ICT based learning materials for environmental education. Developed ICT-based learning materials for environmental education can be likened by children. Children can acquire mind-set of sustainable environment through ICT-based learning materials. Children learning Environmental Education is teaching the world attain sustainable environment.

IV. Research design and Methodology

This was a deductive research design which used the data gathered from the responses of the pre-service teachers in Cebu Normal University specifically the Bachelor of Secondary Education major in Technology and Livelihood Education. These pre-service teachers were registered in the "Bicol University-Department of Environmental and Natural Resources Environmental Education Program." Bicol University is Environment Education Learning Resource Center of the National Network of Normal Schools in the Philippines. This project, "ICT-Based Environmental Education Materials in Different Media of Learning was easily shared and used by the correspondent state universities in the Philippines. The how to do instructions and materials for all the environment education materials were available and the pre-service respondents were exposed to it. The program was well integrated in their major subjects and assessment were done after the program. The curriculum guide for the Technology and Livelihood Education with schedule, content/ topic/ subject matter, Environmental Education concept/ principle, strategy identified, assessment techniques and tools, with instructional resources and time frame. The whole program was completed in six weeks.

The researcher used also the data of UNESCO UIS for Peace and Sustainable Development highlights teachers' role in achieving Global Development. The researcher transformed the assessment questions of the Program to a pre-coded researcher made questionnaire. These empirical data were used as basis for the hypothesis testing. The respondents were random sampled from the classrooms of Cebu Normal University. The questionnaire on level of competence on Environmental Education Concepts and Principle of Pre-service Teachers were: Part I A. Personal Information, B. Background Experience Related to Environmental Education; Part II Checklist on Awareness and Understanding of the Environmental Principles; They had been notified to respond on the preferences (*A*) Self assessment rating and (*B*) Classify each statement in the correct Environmental Principle. They had to read the statements below and indicate their honest assessment of themselves in terms of their level of knowledge of the different environmental principles. Referring to the same statements, indicate the environmental principle referred to by using the following codes: 1 Environmental Principle 1- Nature knows best; 2 Environmental Principle 2- All forms of life are important; 3 Environmental Principle 3- Everything is connected to everything else; 4 Environmental Principle 4- Everything changes; 5 Environmental Principle- 5 Everything must go somewhere; 6 Environmental Principle 6- Ours is a finite earth; 7 Environmental Principle 7- Nature is beautiful and we are stewards of God's creation. Part III Environmental Education in Technology and Livelihood Education (TLE) with fifteen (15) multiple choice questions; Part IV Essay question, " *As a pre-service teacher, discuss briefly the responsible environment-related actions and behaviors you consciously practice regularly. How do these influence your future role as a teacher?*" A frequency analysis of the variables of all the responses of Part I -Part II was done. The researcher conducted focus group discussions with the respondent before and after the program specially after the assessment results were at hand.

V. Findings

Pre-Implementation Assessment Results: Awareness and Understanding of the Environmental Principles

The first statement, '*Wastes which are thrown away and disappear from sight does not cease to exist, they dispersed in the atmosphere or remain in the ecosystem in another form whether in useful or hazardous form,'* was responded completely by the twenty-eight respondents

with, '*I know and understand this very well*' yet only one correctly responded that the principle on this should be '*Environmental Principle 5- Everything must go somewhere.'* Most of them selected that it is Environmental Principle 4- Everything changes. For the second statement, '*Flora and fauna and environment change with the seasons*,' was responded by all the respondent with '*I know and understand this very well*' yet only no one responded with Environmental Principle 4 - Everything changes. Most of them with twenty of them responded that it is Environmental Principle 6- Ours is a finite earth. While the third statement, '*Population growth, polluting technologies and consumerist's lifestyle contribute to the depletion of the earth's limited resources*,' was responded with complete number of respondents that, '*I know and understand this very well*' however with the classification of statement for the environmental principle, only three of them were able to respond correctly with '*Environmental Principle 6- Ours is a finite earth,'* while most of them with twenty-two respondents answered, '*Environmental Principle 7- Nature is beautiful and we are stewards of God's creations*. The fourth statement, '*Classification of wastes facilitates their proper disposal and minimizes the entry of toxic substances in the ecosystem but does not eliminate wastes from the ecosystem*.' was responded with everyone that they, '*I know and understand this very well*' however only one of them correctly responded that the principle should be, *'Environmental Principle 5- Everything must go somewhere*,' with majority (21) of them responded that it is, '*Environmental Principle 3 - Everything is connected to everything else.'* The fifth statement, *'Humans cannot live without nature so they should not destroy or ravage it, but rather take care of it.*' was responded with '*I know and understand this very well,*' from all of the respondents. However, on the classification of environmental principle it showed that most of them (24) responded incorrect environmental principle; they choose '*Environmental Principle 6- Ours is a finite earth*'. The correct response is '*Environmental Principle 3 - Everything is connected to everything else.'* The sixth statement, '*Unlovely, wriggly and troublesome creatures such as earthworms, snakes, spiders and other are necessary part of nature.'* was responded with complete number of (28) respondents choose, '*I know and understand this very well*' and the environmental principle most of them selected was '*Environmental Principle 5- Everything must go somewhere*' however, the correct answer is, '*Environmental Principle 2- All forms of life are important,* yet nobody was able to choose correctly. The seventh statement, '*Although organisms evolve through time through mutation, chemicals like pesticides induce insect mutations which go against the natural checks and balances,'* was responded with, '*I know and understand this very well*,' by everyone. However, most of them with 18 respondents classified it as, *'Environmental Principle 4 - Everything changes,'* but the correct classification is '*Environmental Principle 3- Everything is connected to everything else,'* with only 6 correctly responded. The eighth statement, '*Nature has its own mechanism to maintain balance such as in the conduciveness of environment for growth and reproduction and feeding relationship between and among organisms,'* was responded with, '*I know and understand this very well*,' by the respondents generally. However, this time the classification was correct, *'Environmental Principle 1 - Nature knows best,'* with 89% of them opted this principle. The ninth statement, *'Deforestation in the mountains may adversely affect the lowlands through erosions, floods and droughts because all components of the ecosystem are linked to each other,* were responded with, '*I know and understand this very well*,' but they wrongly classified this with, *'Environmental Principle 1 - Nature knows best,'* instead '*Environmental Principle 3 - Everything is connected to everything else.'* The tenth statement, '*Human as beings gifted with reason and free will have dominion over all creatures and are capable of using these creations responsibly to their advantage,'* was responded by the respondents with perfect number. They completely answered that they, '*I know and understand this very well*,' however, they classified them as 'Environmental Principle 2 - All forms of life are important,' with 96% of them classified them so instead of 'Environmental Principle 7- Nature is beautiful and we are stewards of God's creations,' which was choose by only one. The eleventh statement, *'Organisms are linked to another through feeding, to the environment and the environment is also affected by the organisms living in it including the humans through their actions and practices,'* was responded with '*I know and understand this very well*,' by most of the respondents, however, only one opted to classify this with, '*Environmental Principle 3 - Everything is connected to everything else,'* which is the correct principle behind this statement, instead most of them with 96% of them choose it. The twelfth statement, '*Practices such as use of chemical pesticides, use of crude oil and burning of wastes go against the natural processes and lead to ecological backlash,'* was responded with, '*I know and understand this very well*,' by all of them. However, only 3% of them got the correct answer that, that is '*Environmental Principle 3- Everything is connected to everything else.'* Most of them with 27 respondents choose, '*Environmental Principle 7- Nature is beautiful and we are stewards of God's creations.'* The thirteenth statement, '*All faith, whether religious or tribal beliefs, teach that everyone should respect all life and the order of nature and reject those that degrade the environment and human condition,'* was responded with, '*I know and understand this very well*.' However, their responses on environmental principle behind that statement was incorrect, 'Environmental Principle 3 - Everything is connected to everything else,' with 27 respondents who answered it instead that, *'Environmental Principle 7- Nature is beautiful and we are stewards of God's creations,'* which got zero respondent. The fourteenth statement, '*Although renewable resources can be replenished, the rate of consumption of exploitation should be balanced to the rate of replenishment*,' was responded with most of them with '*I know and understand this very well*.' and however, they did not get the correct response

on environmental principle, which is '*Environmental Principle 6- Ours is a finite earth*,' most of them responded that it is '*Environmental Principle 5- Everything must go somewhere*.' With 27 respondents answered it. Lastly, the fifteenth statement, '*Both big and small creatures have invaluable roles in the ecosystem and therefore to human life,'* was responded with, '*I know and understand this very well*.' However, the environmental principle that most of them choose was incorrect, that is, '*Environmental Principle 7- Nature is beautiful and we are stewards of God's creations,'* instead of 'Environmental Principle 2 - All forms of life are important'

A. Environmental Education in Technology and Livelihood Education (TLE)

The first competency, *Solid wastes from different sources such as households, markets, schools and offices, factories and hospitals should not be combined for safety reasons and for proper management. Which of the following laws is violated if the wastes are not segregated?'* was correctly answered by only two respondents, which the answer is '*Republic Act 9003*,' while mostly answered wrongfully. The second competency, *'Food borne illness may occur if____,'* was correctly responded by 10% of the respondent with, *'All of the above: The ingredients used for the dish are expired already; The food is contaminated by insects; and 'The food is not thoroughly cooked.'* The third competency, '*Which bulb should be used to save more energy?'* was rightfully responded by 28%. The fourth question, *'The law on solid waste management requires the following EXCEPT,'* was correctly responded by 39%, which is, '*Solid waste must be reduced at source which is the barangay.'* The fifth competency, '*Left-overs may be spoiled so we may reheat them to be palatable. What is the proper reheating time and temperature for left over foods?'* the correct option is '*until warm'* answered by 18% of the respondents while most of them answered, '*until boiling.'* The sixth competency, '*The segregation of wastes helps in determining those which may be reused or recycled. It is the primary responsibility of the following,'* was rightfully responded by 89% which includes, *Local Government Unit (City or Town); Household or Family; and Barangay Unit.'* The seventh competency, *'Mang Pedro has an abundant harvest of fruits and vegetables from his farm. He believes food processing is important because___,'* was correctly responded by 25% which is for, '*it preserves food.'* The eighth competency, '*Climate change has a great impact on food production. Which of the following statements is FALSE?'* was correctly responded with 35% of the respondents, which the answer is, '*Warmer temperatures may make many crops grow more quickly, but warmer temperatures could also reduce yields.'* Was rightfully responded by 36% while 37% answered, *'Warmer temperatures may make many crops grow more quickly, but warmer temperatures could also reduce yields.'* The ninth competency, *'The following practices will help you save energy EXCEPT,'* was correctly responded by 25% which is *'Choose refrigerator with high Energy Efficiency Factor or EEF*.' The tenth competency, '*The following practices should be observed to minimize food wastage EXCEPT,'* was correctly responded with 39%, which is, '*Put date on the leftovers and use them within 5 to 7 days.'* The eleventh competency, '*Which of the following fabrics is made from recycled materials?'* was correctly responded with 32%, which is *'nylon.'* The twelfth competency, '*Which of the following is NOT considered as the safe storage time for refrigerator?'* was correctly responded with 46%, which is *'Cooked ground meat: 5 to 6 days.'* The thirteenth competency, '*Which of the following environmental factors is NOT a potential hazard to food production?'* was rightfully responded with 39%, which is '*Use of organic fertilizers.'* The fourteenth competency, *'Minimizing food starts with smart marketing of food items. Which of the following should be observed to avoid food wastage?'* was correctly responded by 14%, which is *'Buy food in partially damaged packages as long as they are not yet expired.'* The fifteenth competency, '*Creating a power supply from old electronic appliances is a process called,'* was rightfully responded by 43%, which is, *'recycling.'*

B. Post-implementation Assessment Results

Awareness and Understanding of the Environmental Principles

All of the responses of the related statements to the environmental principles are responded with '*I know and understand this very well*,' while the classification of each statement into its environmental principle are now 100% correct. The TLE pre-service teachers were able to respond correctly the environmental principles behind the each of the statement.

C. Environmental Education in Technology and Livelihood Education (TLE)

In the post-test of the environmental education in TLE has been responded correctly all sample questions of environmental education competencies after the completion of the program. There was increase in the score of the respondents with regards to environmental concepts and principles. All most all of the items got 100% from item 1-15. The respondents also were able to answer confidently with increase of number of words used in their discussion on how they would responsibly the environment-related action and behaviors that they practice regularly.

VI. Discussion of Findings

Pre-service Teachers are in the Best Position to Teach the World Attain Sustainable Environmental Development for they are ICT Learners.

The teachers of tomorrow are the pre-service of today. State universities and colleges nowadays are now following the new BSED and BEED curriculum which made the pre-service teachers at the strategic location for mentoring students of the concepts and principles of Environmental Education with the use of ICT-based learning resource materials. ICT learning must be substantive way to bring in higher level learning outcomes to the learners. Pre-service teachers are trained to make

use of ICT in such a to make the learners active and productive. The learners would learn to use their skills in focusing, information gathering, remembering, analyzing, generating, organizing, imagining, designing, integration and evaluating (Lucido, 2015). All the activities according to Uwaezu, et.al. (2014) in the world comes from the dreams of once a upon a time a child who dreamed of becoming great. However, greatness not directed and guided to the way of serving many people according to Almeida, S., & Cutter-Mackenzie, A. (2011), would rather end up to enriching oneself alone and it would never become great. So pre-service teachers who dreamed of becoming great must then be able to situate themselves in a position where they can give more to the environment than lose most because of neglecting the basic concepts and principles of environmental education.

A. ICT Learners Can Better Innovate More ICT-based Learning Materials for Children.

Pre-service teachers who are ICT learners can better innovate this technology which are ICT materials because of their interest and awareness of ICT. There is a disparity of the millennial as digital native from the digital emigrants. Most of these children have high expectations about user interfaces and are confident in their skills (Meyer 2016). With these thought Environmental Education which can be relayed effectively through ICT learning materials to the young generation can have a potential sustainability growth because these learners know what they want and how want it to be or its form. Learning resource materials fit to their interest can have more potential to be used by most of them so in comparison to the traditional learning materials.

B. *Children can Acquire Mind-Set on how to Attain Sustainable Environmental Development.*

The very essence of our effort on using ICT LRM is for setting the stage ready for the young learners to appreciate the lessons with easeness and less teacher supervision. Technology that has the capacity to be replay and to be relistened too can have more chances of retention compare to our human capacity of the teacher to do again and again in the classroom. While doing this, this can give them more freedom, learner directed learning atmosphere in the classrooms can create more interaction with environmental development education [Schlottmann, C.]. Mind-setting the children on how to take care of our environment can be achieved by ICT LRM. It would not even be a forceful action on the part of the teachers. However, it gives more learner initiative to go through and through and subconcious get imbibed with sustainable environmental concepts for environmental education is the most tangible of what we call environmental protection [Short, P. C.] for there is a continuous quest for environmental quest according to [Thakran, S.]

C. Action of Local People can Contribute for the Acquisition of a Sustainable Environmental Development Mind-set of Children.

The initiate of BU-DENR and Cebu Normal University in implementing this ICT LRM project with the pre-service teachers can be a very example of action of local people to contribute for the acquisition of a sustainable environment development mind-set of children. Conservation education is prevalent ways to teach environmental education with non-government organisations [Marcos]; & [Mifsud, M.]. That these actions of the non-government organizations with the help of the government instrumentalities can be go a long way because it is clearly now accepted that ICT LRM goes a long way of sharing to the children what is the original intention of the educational movement. Thus ICT LRM can be a sustainable tool by any main movers of environment a education according to [Mifsud, M.] Duplication of this activity in basic education and in the local barangay and local correspondent of DENR in our areas in their environmental development program can mind-set the children into actually acquiring more thoughts because of the massive repeation and more than one sector is doing the implementation for this sample BU-DENR-CNU ICT LRM is a complete package of learning materials for environmental development sustainability and can be implemented with less human resource. Like in the case of Costa Rica [Trends in Environmental Education for Biodiversity Conservation in Costa Rica] widespread of the quest thereof may reveal that there is a trend to make it sustainable by training the young to have an environmentally nurturing through their own ways of learning.

D. Pre Service Teachers can Cooperate with the Local People Develop ICT based Learning Materials for Environmental Education.

Through the immersion of pre-service teacher in the community through the University extension projects can cooperate with the local leaders to develop ICT based learning materials for environmental education. This is a movement that is travelled by educational universities and institutions involving the local leaders and pre-service teacher for better understanding of the current community status and responsiveness of schools to their immediate need. While it is through that local barangays need help in their educational committee programs which can be easily facilitated by the school and universities. Filling in what is in abundance of the universities and schools which the local people need, while on the other hand, the local community is the immediate and direct receiver of the outputs of schools and universities so why not collaborating in responding to our environmental development education as one solid group with one common goal. [National Environmental Education Advisory Council; Solicitation of Applications] Developing ICT based learning materials in the barangay centers or halls can be twenty-four by seven opportunities of these materials to be used by the children and adults because they are mostly open compare to schools and universities. There is a need to protect and diversify the field as it is true in the case of North America and US for environmental education [North American Association for Environmental Education; North American Association for Environmental Education and the U.S. Environmental Protection Agency Partner to Strengthen and Diversify the Field of Environmental Education.]

VII. Conclusion

The study showed that ICT based learning resource material can touch and involved the 21st century learners or the young learners who are active and can learn more if the can relate to the materials (Frederickson, 1994) as this is a pilot testing of the ICT LRM in the Philippine Higher Education Institution curriculum [Paje, R]. For environmental education is appealing to the student's knowledge and rational understanding [University of Tampere] the learning resource materials that they are attuned too even if there will be repetition to it over and over would not bored them rather than the traditional way of delivery. In positioning of the higher education as cited by Brunold, (2015) would be positioning our pre-service teachers to be in touch with the young learners in environmental education it would be most appropriate to involve them through ICT based learning resource material mind-setting. This can better position the ICT learners grasped the knowledge and skills of environmental development education. This study runs-counter the idea that schools are not the organizations that can be used for solving societal problems (Jensen & Schnack, 1997; Scott, 2002). However, it clearly holds on to the belief that Teacher Education Institutions (TEI) are in the best position to start gear of changing the mind-set of the young through ICT based learning materials as it is a query on the paper of why not the education for the environment is a query of unevitable answer which still bounced to education [Robottom, I. M., Cutter-Mackenzie, A., Gough, A., Gough, N., & Whitehouse, H.]. For the fundamental goal of environmental education is the creation of environmentally literate citizenry who possessed the knowledge, skills and motivation to objectively analyzed environmental issues and engage in responsible behaviours leading to issue resolution and improved and maintained environmental quality [Short, P. C.] and the integration of environmental education in the business schools curriculum [Rohweder, L.] which is one of the better way approach to develop environmentally literate citizenry.

VIII. Policy Implication

This partnership is a clear collaboration that can be duplicated with other local leaders in barangays and schools and universities to make this inclusive, permanent and continuous initiative [Viezzer, M. L.]. So the existing relationship and collaboration of the local government and educational institutions can be strengthened by this initiative of the BU-DENR and the Network of Normal Schools in the country for this provides outputs and materials readily can be used by them to implement environmental development education which almost all local government have problems and pending situations on solid waste management and resolving other waste management and segregation according to Carleton-Hug, A., & Hug, J. W. (2010). The aim of the community collaboration is to promote the brighter future and welfare of the our children or our young generation and with the integration of this in the curriculum of the preservice teachers is found one of the best ways to make this sustainable just like in Find land [Rohweder, L.]We can start this great deal of implementation by touching their interest which is through ICT learning resource materials and involving them in creating and designing these materials for easy absorption and retention of mind-setting for environmental care and balance through proper knowledge and orientation on the right environmental principles. Furthermore, environmental education (Jensen & Schnack, 1997; Scott, 2002) emphasized environmental problems, but if pre-service teachers have the intention to take the issue of sustainable development seriously, they will also link the issue to the economic, social, cultural and political aspects as becomes part of themselves as the lived-practice [University of Tampere].

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