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Pre-service Teachers' Concept of Sustainable Development and Its Integration in Science Lessons

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Abstract: Sustainable development is a "durable development" that is systematic and long-term development of countries ensuring strong relationship between societal and environmental security with economic progress. The concept of sustainable development is essential for pre-service teachers to realize because the country is on its way to progress and industrialization and their role as future teachers is important. Hence, this paper investigates aims to determine pre-service teachers' concept of sustainable development. It is important that the concept of sustainable development should be clear to teachers because it determines how effective they can teach the concept to their students. A qualitative research design utilizing questionnaires, interviews, and focused group discussions reveal the misconceptions of the pre-service teachers on sustainable development. The result of the present research will be utilized to create a program that will assist them in preparing lessons that integrates the concept of sustainable development successfully.

Key Words: misconceptions on sustainable development, pre-service teachers concept of sustainable development, integration of the sustainable development concept on science lessons

Abstrak: Pembangunan berkelanjutan adalah "pembangunan tahan lama" yang merupakan pembangunan sistematis dan jangka panjang negara untuk menjamin hubungan yang kuat antara keamanan sosial dan lingkungan dengan kemajuan ekonomi. Konsep pembangunan berkelanjutan penting bagi calon guru untuk diwujudkan karena negara sedang dalam proses untuk kemajuan dan industrialisasi serta peran mereka sebagai guru masa depan sangatlah penting. Oleh karena itu, tulisan ini menelaah konsep pembangunan berkelanjutan calon guru. Sangatlah penting bahwa konsep pembangunan berkelanjutan calon guru harus sangat jelas karena hal itu menentukan seberapa efektif mereka dapat mengajarkan konsep kepada siswa mereka. Sebuah desain penelitian kualitatif menggunakan kuesioner, wawancara, dan diskusi kelompok terfokus mengungkapkan kesalahpahaman dari guru calon pada konsep pembangunan berkelanjutan. Hasil dari penelitian ini akan digunakan untuk membuat sebuah program yang akan membantu mereka dalam mempersiapkan pelajaran yang mengintegrasikan konsep pembangunan berkelanjutan dengan berhasil.

Kata kunci: kesalahpahaman pembangunan berkelanjutan, konsep pembangunan berkelanjutan calon guru, integrasi konsep pembangunan berkelanjutan pada pembelajaran sains

INTRODUCTION

As a country embarks on the challenge to develop economically and technologically, tension between different factors may exist (UNESCO, 2010). The dilemma between choosing progress and environmental protection arises. Can progress proceed without pollution? Are the resources of the earth equally shared by its people or just a few? What lies ahead for the future generation? These issues are being addressed by the countries of the world with the movement on sustainable development. Sustainable development according to Filho (2000) is synonymous to the word "durable development" which describes the systematic and long-term development of countries ensuring strong relationship between societal and environmental security with economic progress.

The role of education is crucial in ensuring the sustainability of a country (UN, 1992; Parliamentary

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Commission for the Environment, 2004; UNESCO, 2010). To help different countries inculcating sustainability principles to its citizens, UNESCO (2010) established the *Education for Sustainable Development (ESD)*. The program offers specific procedures on how to go through with the integration process involving two phases, the assessment and planning.

The Philippines as a progressing country should consider integrating the concept of sustainable development in its educational endeavor to educate its people with the consequences of unregulated progress. It is important that Filipinos should know that while the Philippine economy is on the rise, moral obligations to ensure the needs of the future generation should also get stronger. A sense of responsibility towards all the stakeholders of the economic progress is needed.

The present research is a foundational step to integrate ESD concepts in the basic education programs of the university where this research is conducted. To do so, the pre-service teachers who will conduct classroom demonstration at the basic education department must be prepared in terms of concept and pedagogy. A sound concept of sustainable development is a must for pre-service teachers for them to design instructional strategies and implement instruction successfully.

Specifically, the present research aims to determine pre-service teachers' concept of sustainable development, identify their misconceptions on sustainable development and describe their ability to integrate the concept of sustainable development in their lessons.

The result of the present study can be a basis for designing a program that can assist pre-service teachers with the challenges that they may encounter in integrating ESD concepts in their lessons.

> Sustainability Defined "…the development that meet the needs of the present without compromising the ability of future generations to meet their own needs" – Brundtland Commission Report (1987).

The definition of sustainable development is the guiding principle of the efforts of different sectors in promoting or attaining a sustainable development. The main aim of promoting awareness among the citizens of the world is to improve their quality of life and ensuring life in the future. But how? The United Nations (1992) acknowledges that it can only be done through education.

Education plays a major role in promoting awareness on sustainable development, hence Education for Sustainable Development (ESD) has been established (United Nations, 1992). The ESD was primarily designed to revolutionize values and understanding that every citizen of the world would show respect amongst each other and even the future generation. It is the aim of the ESD to promote awareness that all earth systems such as organisms, their values, and the environment are interconnected. The web of connection among the member of the earth's systems guarantees its very existence. Thus, the United Nations (2002) also crafted the pillars of sustainable development in the World Summit on Sustainable Development which are society, environment, and economy.

Culture also influences the attitude of people towards ESD. The lens by which each country looks at the goals of UN on ESD varies because of the context that country moves about. Though varied in context and culture, it is vital that the concept on sustainable in the educational endeavor should be clear. Table 1 presents the concepts on sustainable development according to UNESCO's *Education for Sustainable Development Lens Tools No. 2* (2010).

The concepts in Table 1 are believed to be constructs that are true to all the citizens of the world. Thus, they are considered to the guiding themes for classifying responses pre-service teachers' concept of SD in the present research.

Misconceptions on Sustainability

The terms "sustainability" has been used in many different areas like environment, industrialization, and education. With the wide coverage in which the term sustainable can be applied, it is inevitable to have different connotations of the word. Thus, the clarity of the meaning between "sustainability" and "sustainable development" should be clear among teachers and have a strong foundational concept teach their students the construct correctly.

The Parliamentary Commission for the Environment of New Zealand in 2004 differentiated that "sustainability" is the product while "sustainable development" is the process. Sustainable development is a continuous quest to improve the quality of life of the people without jeopardizing the earth's life supporting systems. The mechanism by which the sustainable development operates and it success in achieving the desired well balanced progress at a rate that can run for a long period of time is sustainability.

Sethi (2011) identified several misconceptions on the word sustainable development. Along the with varied definitions of the term "sustainability" the myth that it is confusing and deceptive arises. A common

Table 1. Common Concepts on Sustainable Development

Concept	Definition
Interdependence	The earth is made up of interconnected systems and are dependent of each other for survival
Diversity	Variety is a distinct characteristic of earth systems either biologically, culturally, linguistically, socially, and economically. People should learn how to respect the diverse characteristics of the earth and all its systems.
Human Rights	Respect for every individuals rights to fulfill their basic needs must be observed and that their should be equal opportunity for everyone to have a quality life
Global Equity and Justice	"Intra-generation equity" is emphasized that quality life is provided for all the citizens of the world
Right of future generation	"Inter-generation equity" respects the right of the next generation to sustain their needs and enjoy quality life
Conservation	The earth's natural resources should be utilized with a long term sustainability concept in mind.
Economic Vitality	Everyone has the right to access to natural resources improve the quality of life but within the framework of sustainable development
Values and lifestyle choices	Values to uphold the principles of sustainable development should be stressed in their lifestyle choices
Democracy and Civic participation	Peoples ability to take care of others and the environment rests on their rights to participate and make decisions for their lives
Precautionary Principle	Issues in sustainable development can be complex and the scientific studies are often divided. Thus, the need to act judiciously and with awareness should be inculcated to the people

idea on the word sustainability is the "capacity to endure" which implies that individuals should only consume their share and leave others their part. In real sense, sustainability is the long term maintenance of well-being that considers the environmental and the economy by practicing stewardship, responsible planning, and management of resources.

The next misconception on sustainability is that it is all about the environment. Sethi(2011) argued that the original focus of coining the word sustainability is on "finding ways to let the poor nations catch up to richer ones in terms of the standard of living". The Brudtland Commission Report (1987) stressed that sustainability movement is needed to help poor countries be at par with the rich ones by providing access to man's basic needs like water, food, and shelter which are readily available in their environment. Efficiency in utilizing resources is the main aim of the sustainable movement in which at the end, the environment would best benefit from the process.

The idea of "go green" is synonymous with sustainability. This idea is another misconception that has been identified by Sethi (2011). The preference for the natural over artificial does not always equate with sustainability. Comparing nuclear source of energy with renewable resources is not easy because of the the element of effect on the environment. Though the nuclear sources energy faces a challenge in eliminating its radioactive waste, it is still beyond comparable in terms of sustainability than the renewable resources.

Another cliché idea associated with sustainability is that it is all about recycling. Recycling is a good step towards sustainability but it is just a piece of the puzzle. The concept that should be stressed is that sustainability in terms of energy source and modes of transportation. Sustainability is more of maximizing the use of energy source rather than just less wasteful use of resources.

Sethi (2011) also clarified that though sustainability is a population problem because of its environmental threats some false solutions exist. To be sustainable is to educate the people on the effect of population and to raise the standard of living in developing countries.

So what does it mean to be sustainable? Do we have to lower our standards of living? Do we have to buy organic product all the time? Is sustainable development expensive? These questions describe another misconception of people on sustainable development which is on the concept of living. Sethi (2011) described that practice could not be really described sustainable until one has completed a life-cycle analysis of its environmental costs. With the evolving technology, unforeseen and unintended consequences may arise. Hawken (2010) described organizing one's ideas and innovate within that mindset, breakthroughs on sustainable development will be extraordinary. Therefore, to practice a sustainable lifestyle is to comprehend and

rethink of ways of living and evaluate if such efforts are really sustainable. It is not just doing more with less.

Living a sustainable life does not have to be expensive, rather it has to be purposive. A powerful economic engine that will propel the society to determine and practice measures that will maximize one's resources is the heart of sustainability.

Promoting Sustainable Development in the Classroom

Education plays a significant role in promoting ESD in the classroom, because it is through education by which the understanding for sustainability can be realized (UNESCO, 2010). There are several issues that has to be understood as 21st Century education proceed. These issues result to tensions only education can balance (Delor's Report, 1996). Thus, the integration of ESD is imperative in the educational process.

UNESCO (2010) in their Education for Sustainable Development (ESD) Lens suggest how to go through in integrating ESD in instructional planning and implementation. There were two phases which are promoting awareness or consensus for SD and ESD concepts and review and planning for ESD integration. The present research is concerned of the first phase which is to determine prior or existing concepts of pre-service teachers on ESD to assist them plan for ESD in their lessons in the future.

Parkin, et. al. (2004) published a book called *Learning and Skills for Sustainable Development* which helps to promote sustainable literacy. They have identified ways on how to integrate the concept of sustainable development (SD) in the curriculum. Figure 1 shows the components of the curriculum design.

According to Parkin, et. al. (2004), the following components can help teachers in integrating sustainable development in their lessons. Though the curriculum design was crafted for adult learners, the present research acknowledge that it can be applicable for basic education lessons.

The first step to integrate SD in one's lesson is to map the environment of the learner. This is to determine points of reference that can be utilized in designing the instructional plans. Knowing students' environment enables the teachers to contextualize instruction in the classrooms. The family, peers, and other societal back-

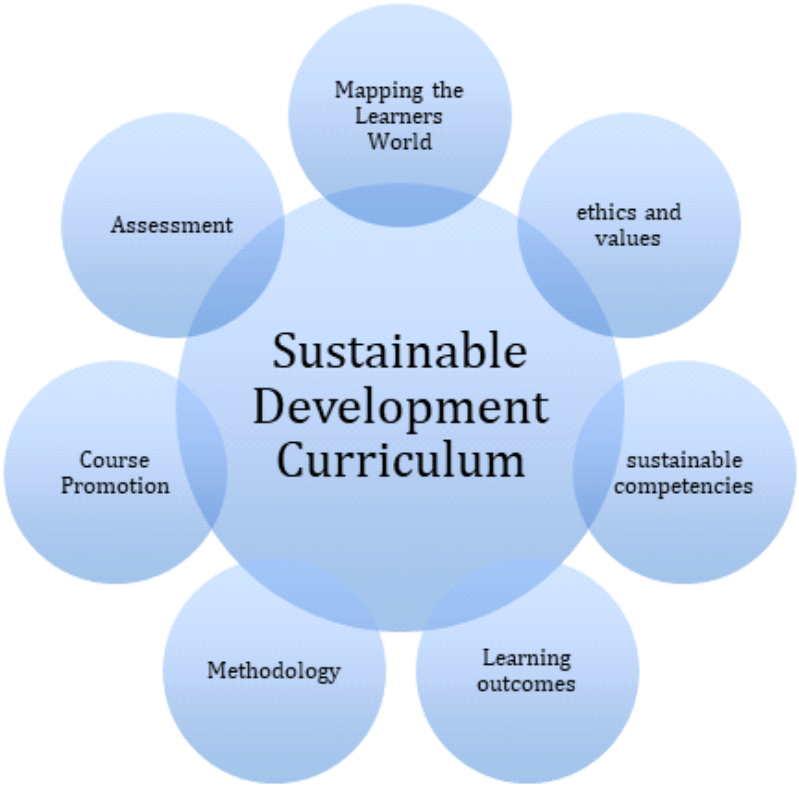

Figure 1. Components of a Sustainable Development Curriculum Adapted from Parkin, et. al. (2004), *Learning and Skills for Sustainable Development*

grounds of the learners can also help teachers craft lessons that will inclusively educate learners with SD.

The next component that should be carefully reviewed is ethics and values. The two constructs should be made explicit as it relates to content and pedagogy. Specifically, there are four moral principles that guides the advocacy of SD which are equality in society, environmental injustice, intergenerational equity, and stewardship. These four moral principles are important for everybody to live to promote SD.

Another area is determining the SD competency. There is a published set of SD competencies which are the natural capital, human capital, social capital, manufactured capital and financial capital. These competencies can be met using a matrix that will help teachers plan their instruction using purposive methodologies. By identifying the competencies and designing a matrix to achieve it will produce the desired learning outcomes among students. Students exposed to curriculum with integrated SD competencies are viewed to be graduates with professional specialist elements, professional but transferrable elements, and personal elements.

The methodologies designed to meet certain SD competencies and produce desired graduates should be carefully planned. It should always consider, the knowledge, understanding and skills of students. Going back to the profiles of the students can answer this challenge.

Another important aspect to be considered for integrating SD concept to the curriculum is the form of assessment. As in any educational endeavors, assessment determines whether all other educational efforts are effective or not. Thus, its potential to undermine the positive features of the teaching and learning process significant. In the case of a curriculum that integrated SD competencies, assessment should be aligned to all other features of the curriculum. External assessments such as entrance or qualifying exams that test the knowledge of students on SD ideas should also be considered by teachers.

Lastly, the concept of promoting the SD integration to the community and other educational stakeholders should be promoted. One reason would be the viability of students getting hired because of their knowledge on SD. Employers these days look for people that can help their companies produce better products at sustainable rates. Also, promoting the curriculum can attract potentials students and parents who would like their children to practice SD measure.

METHOD

Sampling and Respondents

The respondents of the present research were the twenty two, twenty one female and one male, bachelor of secondary education with specialization in biology students. They are all in their second year of their program. The respondents have been purposely chosen since the researcher will be their university supervisor in their practice teaching program. The result of the present research will be utilized to design a program that will help the chosen pre-service teachers in integrating ESD in the classroom.

Instrumentation and Data Collection Procedures

The researcher drafted a questionnaire to investigate pre-service teachers' concept on ESD. The questionnaire has been validated by the researcher's colleague in the university. The questionnaire was then answered by the respondents in one of their classes.

Interpretation

The answers of the respondents were categorized into themes that were identified based on the related studies. For the identifying pre-service teachers' concept of ESD, the sample concepts by the UNESCO (2010) were utilized. To determine the emerging misconception of pre-service teachers on ESD, the misconceptions identified by Sethi (2011) were used as themes. Lastly, to analyze pre-service teachers' ability to integrate ESD concepts in concepts in their lessons, Parkin, et. al.'s (2004) curriculum components were the theme used.

RESULTS AND DISCUSSION

Pre-service Teachers' Concept of Sustainable Development

Upon the analysis of the responses there were six emerging themes for responses that were identified. Table 2 reports the said themes.

Among the themes identified, it is conservation that had the most responses. There were about 41% who manifested the said response in the said category. The 'Human Rights' theme followed next with 18% of the responses. The themes right for future genera-

tion, values and lifestyle choices, and diversity shared the same percentage of responses of about 14% each.

Misconceptions of Pre-service Teachers on Sustainable Development

Finding pre-service teachers' misconceptions on sustainable development is important to determines their ability to integrate the concept of ESD in their lessons. As the data in the concept of ESD describe, most respondents view sustainable development to be concerned with the environment. Though, other respondents realized that sustainable development encompasses varied areas most of them focused on the relationship of progress and environment. When they were asked to describe the characteristic of an en environment that shows sustainable development, most of them described that it is an environment with progress yet plenty of trees and plants to be found. A sample response on the said observation is shown below:

> "A greener environment is the thing that I would describe to an environment that supports the concept of sustainable development…" – Respondent 22

Sethi (2011) stressed that people's idea that sustainable development is just in on the environment can be misconception since the movement on ESD was established to help poor nations catch up with the highly industrialized one's by improving their quality of life. The concept that SD is just about the environment can limit programs to just focus on saving the environment. Hence, the debate arises on nuclear energy versus renewable ones. Sethi (2011) described that sustainability is utilizing energy sources with efficiency because it can sustain the needs of the community with longevity.

Though most pre-service teachers equate SD with the state of environment, they have a correct idea on how to attain it. The statements below are their ideal concept of an environment that is characterized with SD:

- Environment that is protected by the government
- Consistent and well equipped strategies for sustainability
- With well managed and controlled products
- Practices reduce, re-use, recycle
- Development that is efficient
- Not polluted
- With societal equilibrium
- Long lasting measures
- With environmental innovations
- Organized, active, and goal oriented
- World peace
- With researches to improve the state of sustainability

It has also been observed that one of the respondents had a totally wrong concept of sustainable development. Her response show that she does not have a clear definition of SD in mind. It goes to show that

Table 2. Emerging Themes for Pre-service Teachers' Concept of Sustainable Development

Theme	Description	Sample Response
Conservation	Understands that there should be a balance between industrial improvement and environmental protection	"…development in terms of economy that do not harm or disturb the environment or nature" – Respondent 7
Human Rights	Respects the needs of the people around him or her	"…about knowing the needs of the society/people for them to sustain life…" – Respondent 5
Right of future generation	Comprehends that the needs of the next generation should be protected or the inter-generation equity	"…sustaining the natural resources and not to deplete, to have right amount of reservoir for the future" – Respondent 6
Values and lifestyle choices	Reflects on the different practices that affects sustainability	"…actions, projects, or developments that can be maintained for years and implement it until such development or goal is achieved through SD" – Respondent 17
Diversity	Acknowledges sustainable development promotes societal equity	"---progress without harming other sector in the country like education, health, environment, etc." – Respondent 11

though most of the respondents have a clear idea of SD, still there will be few that needs assistance. Therefore, a seminar or lecture to inform teachers of ESD is really suggested.

Pre-service Teachers' Ability to Integrate The Concept of ESD in their Lessons

The pre-service teachers were asked if they are interested to integrate the concept of ESD in their lessons, and all of them replied "yes". They have acknowledged that teachers play an important role that integrating ESD principles in the lessons so that students can develop certain values towards sustainable development. The respondents cited several reasons for agreeing to integrate ESD concepts in their lessons and primarily is to inculcate a sense of responsibility to the students in terms of wise usage of resources. Respondent 22 said that ESD is for "shared responsibility" while Respondent 16 said it is for "responsible participation in progress". According to Respondent 9, integrating ESD will make students not be ignorant of the consequences of their action and Respondent 4 said it is for students to understand the environmental systems. Though the ideas of the respondents on ESD varies, their responses cohesively point to ensuring that the needs of the future will be met.

The pre-service teachers chose different topics that they will make an instructional plan where ESD concepts can be integrated. Table 3 shows sample plans that shows potentially good integration of ESD concepts.

Though pre-service teachers acknowledged that it is apt to integrate the ESD concepts in science lessons most of them has a hard time how to. Only the three respondents whose work appeared in Table 2 were able to give an appropriate response. Most of the respondents chose the environment as as topics that they will have to make an instructional plan maybe because it is the topic that they have perceived where integration of ESD concepts is really needed. However, their instructional ability to integrate ESD concepts still need help. Most of the activities that they have described are not aligned with their instructional objectives while some of them described activities that are too shallow in depth.

While others tried to show their ability to integrate ESD concepts in their lessons, there were 32% of the respondents who manifested that they really find it hard to ingrate ESD concepts in their lessons by not writing any integration activity at all. The reasons that were cited were primarily do to the challenge of pedagogy. Respondent 12 said that *"Integrating ESD is not difficult but it is challenging as the pedagogy*

Table 3. Sample Instructional Plans that Integrate ESD Concepts

Respondent	Topic	Objective	Procedures	SD Integration
9	Ecosystem	Describe the different compositions of an ecosystem	• Review of some ecological terms • Picture analysis of an ecosystem • Analysis of factors that may affect the state of the ecosystem	Creation of a video that campaigns for the connection of the state of the environment and how it can affect sustainability
20	Energy Sources	Identify the different sources of energy Analyze how each energy source can be harnessed for human consumption	• Review concepts learned on the environment • Discuss energy, its definition, uses and sources	Ask the class to create miniature version of a power plant that can harness renewable resources like water and air
21	Bodies of water	Distinguish the different bodies of water and their importance	• Discuss the different bodies of water and how it can affect human lifestyle • Allow students to share their experiences on the different bodies of water • Gather student ideas on how to take cate of the different bodied of water	Conduct a research on the new inventions on how to better utilize and protect the different bodies of water

needs to suit the desired learning outcome". On the other hand, Respondents 14 revealed that he find it hard to integrate since he himself does not really grasp the full concept or meaning of ESD.

The results showed that pre-service teachers is not yet familiar with the integration of ESD concepts in their lessons. Based on the ESD curriculum components by Parkin, et. al. (2004), the respondents of this research needs more foundational structures on planning for instruction that integrates the concept of ESD.

CONCLUSION

Based on the results reported, it can be deduced that pre-service teachers have varied conceptual understanding on the construct of sustainable development. However, even if it is varied, it can be said that their ideas are still on the concepts under ESD. The notable misconception that emerged from the responses of the pre-service teachers is the limited association of the concept of sustainable development with the environmental conservation. Pre-service teachers failed to comprehend that ESD encompasses other areas and is not just focused with the environment alone.

Pre-service teachers need further training and support in terms of integrating ESD concepts in their lessons. A lecture on the goals of ESD must be provided and a seminar/workshop on how integrate ESD should also conducted.

For future research, it would interesting to know how pre-service teachers implement their instructional plans and determine areas that further needs assistance. Also, it would be interesting to know how students in the basic education program perceive their lessons with ESD integration.

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