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Educating Society about Biotechnology and Its Impact to The Environment: an Analysis to Practical Experience at the Group of Farmer at Sukorambi Vilage, Distric of Sukorambi, Regency of Jember, East Java, Indonesia

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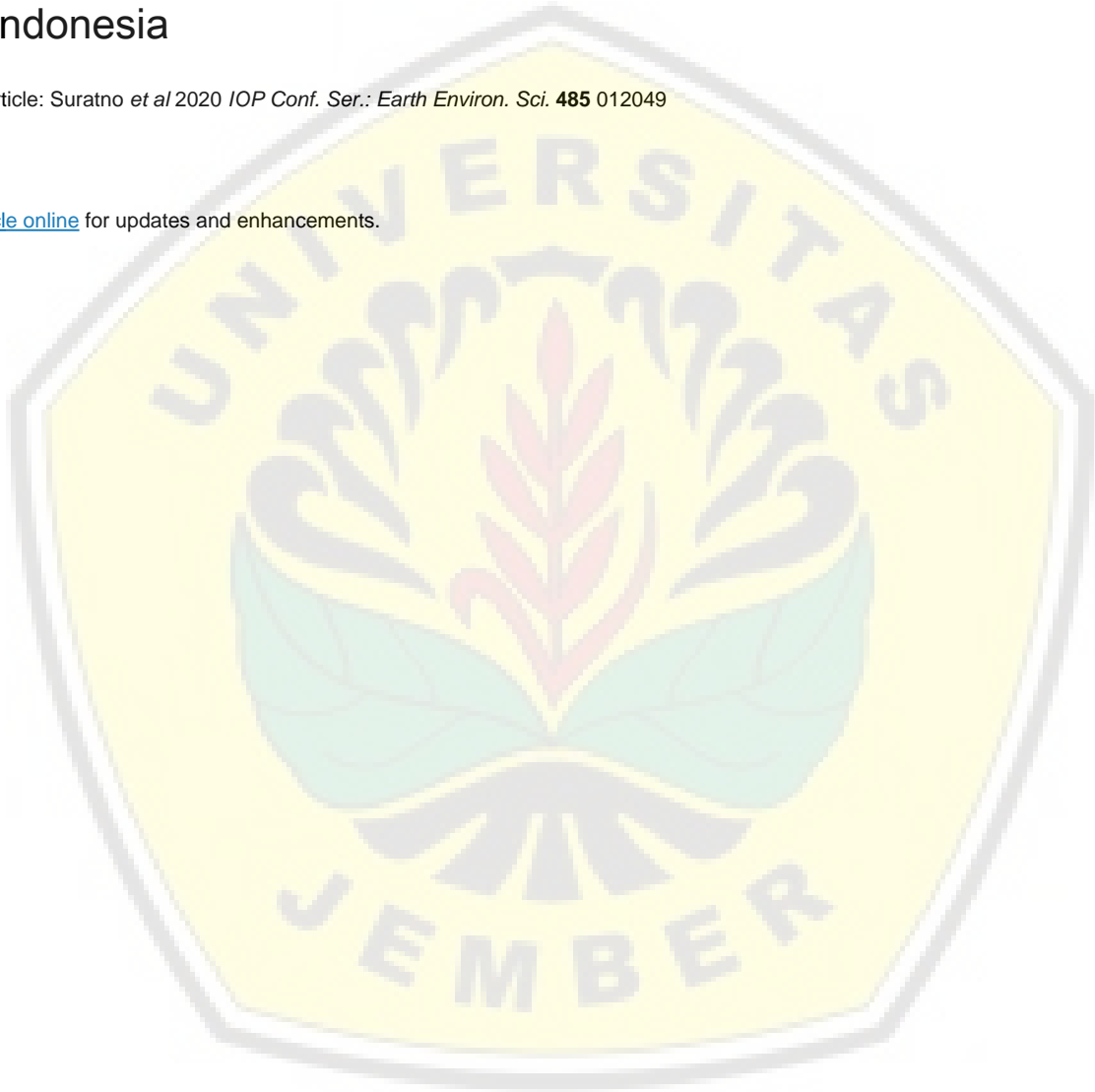


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Educating Society about Biotechnology and Its Impact to The Environment: an Analysis to Practical Experience at the Group of Farmer at Sukorambi Vilage, Distric of Sukorambi, Regency of Jember, East Java, Indonesia

Suratno^{1*}, N Umamah¹, F Hasan¹, I F Himmah¹ and K C Karwendyanto¹

¹University of Jember, Jl. Kalimantan No 37, Jember, East Java, Indonesia)

*suratno.fkip@unej.ac.id

Abstract. Study about biotechnology has growth fast and widely. It can be seen by the product that is resulted by researcher around the world. Although so many research shows that the product of biotechnology has great impact to the environment, pro and contra about implementation of the product also become case around the world. Many people accepted and adopted it, while the other refused. This study will explore and evaluate how biotechnology is educated to the farmers as one of users of biotechnology product. The product of biotechnology that is educated to the farmers is Effective microorganism (EM 4) that is used to make bokashi fertilizer. This study discuss more about what kind of learning design need to be implemented, what is the learning material should be given, what is the learning media should be used who and how the learning material should be presented. This study shows that training Is learning design used to educate group of farmers about biotechnology product but can be changed by the other education form. The learning material should be given is the important and right information about bokashi fertilizer and its eminence, especially to the environment and their welfare, how to make the fertilizer, and how to use the fertilizer. The media should be used in learning process is paper fill with key information of learning material, video and its actual form. And the person who should deliver the learning material I is someone who master the biotechnology product (learning material), understand about local language and how to use it to make the material more simple and understandable by the farmers.

1. Introduction

Biotechnology is the integrated use of biochemistry, microbiology, and engineering sciences in order to achieve technological (industrial) application of the capabilities of micro-organisms, cultural tissue cells (European Federation of Biotechnology). Nowadays, development of biotechnology has reached the use of the smallest part of organism called cell as an addition to use overall organism. Cell has general design consist of material that design and control over all process of cell work called DNA (deoxyribonucleic acid). All cell use same genetic term that also can be read and applied to other organism. The development of biotechnology at this level has reach molecular genetic.

Biotechnology can be applied at some sector such as agriculture and health sector. At agriculture sector, the application of biotechnology still reach development phase. However, the fusion of new gens has produce the new plant which have good quality (adaptable to dry area, resistant to poison of hard metal, pest and disease. The improvement of pant quality has been done by doing identification of desirable trait.

This article made based on practical experience when educating a group of farmers in making bokashi fertilizer where one of the material needed is Effective Microorganism (EM4). EM4 are mixed cultures of beneficial naturally-occurring organism that can be applied as inoculants to



increase the microbial diversity of soil ecosystem. The form of EM4 is liquid fertilizer consist of mixed variety of microorganism. The EM4 contains fotosintetic bacteria, lactobacillus sp., strepmyces sp, yeast, and actinomycetes. Shortly, EM4 have various benefits and friendly to the environment.

Bokashi fertilizer is an organic fertilizer resulted from fermentation of EM4 solution that can fertilize the land and suppress the growth of pathogen inside the land. It has positive effect which increase the growth and crop production. Bokashi fertilizer is easy to make and spend relatively a short of time. Based on economical point of view, it cost inexpensive so it can be said that bokashi fertilizer is effective and efficient to improve the farmer’s farm produce. With the womb of EM4 inside of bokashi fertilizer, this fertilizer is more effective and eco-friendly.

From those eminence, it is really important for the farmers to know and understand about EM4 as one of biotechnology products. More specifically, it is important for the farmers to gain skill to make the bokashi fertilizer.

This article is trying to explore how to educate the farmers about biotechnology product. The questions answered at this article is (1) the form of education can be applied, (2) the learning material need to be given, (3) learning media need to be used, and (4) how the learning material is given.

2. Methods

This research is conducted at Sukorambi Village, District of Sukorambi, Regency of Jember, East Java, Indonesia. This research aimed to identify and analyze learning element just like the form of education, learning material, learning media and how the learning media is given. That’s why qualitative approach is an appropriate research approach to be used at this research.

In collecting the data, the researchers were doing interview to some of participants and doing observation started from the beginning until the program is over. To gain the validity of data, researcher use check and recheck towards data that is already collected. Check and recheck is done by comparing it with other researcher data and video made while the learning process was conducted.

The data is analyzed by qualitative approach by evaluating through the process and its result. The evaluation is done by comparing the important information gotten through the process and the result of the program.

3. Results and Discussion

3.1. Learning Design

Education can be performed in some forms. As mentioned at Indonesian Regulation No. 20 Years 2003 about National Education System, there are three kinds of education system, they are formal, non-formal and informal education which complete each other. Formal education is the structured education and has tiered, started from kindergarten until higher education. Non formal education is all kinds of structured education except formal education that can also have tiered just like equality education and early childhood education and without tiered just like seminar, conference, counseling etc. Informal education is unstructured education that happen at the family and environment.

Table 1. Temporary Finding at Learning Design

Aspect	Description
Approach	The educator use andragogy approach that is seen by their action that want to be close with the learner. There are more sharing other than delivering material.
Form of education	The educator use training by emphasize it at practice (the proportion of practice is more than other learning activity)

The learning design use Andragogy, an educational approach for adult learner. Boeree cited Erikson theory which propose 8 developmental stage and put those who are in 20 years old and beyond as adult [3]. (Andragogy is chosen because all the farmers who become the learner is adult.

The adulthood of the farmers not only based on age which shows more than 30 years old, but also their experience in agriculture sector which more than 10 years.

To apply Andragogy, training is form of education that is used as learning form. Training is a form of non formal education that is conducted to improve certain skill [8]. Choosing training as learning design is a wise choice. It is because the learning objective is not only for gaining knowledge or understanding about biotechnology product, but also mastering skill to use biotechnology product to make another form of agriculture product.

The design of this training can be categorized by three kinds of activity. Those are giving the learning material, practice, and sharing. Giving learning material is face to face meeting that is conducted to deliver structured knowledge regarding EM4 and bokashi fertilizer. It has to be conducted face to face in order to the farmers can get the basic information and also questioning some questions probably show at the middle of face to face meeting.

Practice is an activity to apply technical knowledge gaining from face to face meeting. Practical activity is divided by narrow scale and large scale. The narrow scale practice is done at the place of training after getting the knowledge. It is done so the trainer can guide the practical process and make sure the farmers can master each steps. The trainer also can give correction directly if any error happen while practice. The large scale practice refer to practical activity without getting help from the trainer. It is done after face to face meeting at the farmers place independently. It is the home work to do by the farmers as consequence after gaining technical knowledge.

Sharing is activity to share the experience gaining while practice. It can be good experience just like the success of practice, the benefit they got from practice and every positive things they got from practice. While bad experience refer to unsuccessful of practice and the other negative things they got from practice.

Giving learning material, practice and sharing are the essential part of learning design for the farmers as adult learner. Those three activity have to be arranged as a proportional unity based on the condition at the field. However, proportion for practical activity must be more than the other activity.

3.2. Learning Material

Learning material is a set of material that is formulated systematically to develop learning environment [8], while stressing it at the full content from competency that is need to be mastered by the learners during learning process. The form of learning material are set of information, tools, reading text, audio, video and the other form that can give the information required for achieving learning objectives.

Table 2. Temporary Finding at Learning Material

Aspect	Description
Content	Introduction of bokashi fertilizer, how to make bokashi fertilizer and how to use it effectively
Criteria	Simple, true and enough information about the product

The biggest challenge of educating adult people is make them believe and then adopt the innovation. So, the challenge of learning material is to formulated learning material that can make the farmers understand and believe that the bokashi fertilizer where some of the material is EM4 as biotechnology product. To acquire the challenge, Knowles put learners experience as pre requirement need to be full filled. So, in formulating learning material, the experience of the farmers regarding farming activity must be put in mind to be analyzed and then compared it to the new experience they need to improve their productivity.

The learning material formulated here consist of introduction of bokashi fertilizer, how to make bokashi fertilizer and how to use it effectively. The introduction of bokashi fertilizer consist of information about what is bokashi fertilizer, the eminence of bokashi fertilizer and those who already use and get the benefit from using bokashi fertilizer. The material about how to make bokashi fertilizer consist of information about each material and tools need to make bokashi fertilizer, biotechnology and EM4, and steps in making bokashi fertilizer. The material about how to use

bokashi fertilizer effectively consist of information about doze to use bokashi fertilizer based on kinds of plant.

The other criteria need to be full filled is true and enough of information. The learning material made and informed to the farmers is general one. Although it is hard to decide that the information inside learning material is already enough or not, but the question rise in the process and also problems occuredwhen practice can become its indicator. The question rise in the process is not something inside material but has a clear connection with the material. This condition shows that the learning material is not clear enough or it can be said that the learning material that is made did not yet full fill what the farmers need.

The problem occurred when practice is something that is not informed at learning material. It can be said that the information at learning material is only the good effect of bokashi fertilizer. It also said that bokashi fertilizer can be used at any kinds of vegetables, but the result of practice shows that for the farmers who plant mustard has failed. The mustard become rotten after getting fertilize by bokashi fertilizer.

By that condition it can be said that the learning material made has failed to pass second criteria. This part is very fatal because it has triggered the farmers not to adopt bokashi fertilizer which has biotechnology product inside. And this experience also become a fetter to accept the other biotechnology product.

Another criteria need to be full filled is simple. Because most of the farmers is uneducated people, the learning material has to be made as simple as possible and need to be completed with some illustration rather than by word [11]. The learning material already filled with some illustration. However, it is also not enough yet because not every illustration can represent the real one.

Learning Media

Media is tools that has role to deliver the message (Dadang, 2009), while Arif Sudiman, dkk cited by Basri dan Rusdiana explain it as interpreter of the message from the educator to the student at learning process. Learning alone means process of interaction among slearners, educator, and learning resources that happen at learning environment (the law of Indonesian Educational System, No. 20 Years 2003). The form of learning media can be book, teks, audio, visual, audiovisual, etc.

Table 3. Temporary Finding at Learning Media

Aspect	Description
Form	Directly connected with learning material
Function	Easy to use and able to make the learner easy to understand

The learning media for adult learner must be something that is directly connected with the learning material and easy to understand. The learning media used at learning process is projector, paper, and actual form of each component need to make bokashi fertilizer. Based on the context of learning material, those media is already connected directly with learning material.

The content wrote on the paper use bahasa and dominated with words rather than picture. It is not match with criteria of adult learner, since most of the the farmersss is uneducated even some of them is illiterate. The effect of this condition is the farmers cannot fully understand the information/learning material given at the learning process. Using bahasa alone at paper is ok but the existent of picture illustrate the information have to be increased.

The other thing need to be considered is the size of word and picture. The farmers profile based on age point of view can be consider as middle age and their eye function was decrease. So, the picture at the paper or another media must made proportional.

Educator

Educator is them who have task to deliver knowledge or skill to the learners [8]. There are some kinds of educator, those are teacher, lecturer, counselor, pamong belajar, widya iswara, tutor, instructor, facilitator, and the others name that is suit with their speciality (the law of Indonesian educational system, no. 20 years 2003. Trainer and facilitator is the educator at this program since the form of education is training.

Table 4. Temporary Finding at Educator

Aspect	Description
Soft Skill	Mastering theory of adult learning, not quite mastering the content that is delivered
Hard Skill	design and implementing methods required to teach adult

The finding shows that the educator has already mastered the theory of adult learning and able to apply it at the learning process. Educator for adult learners is different with formal educator. The different starting from the way we call until the competency required to do learning activity. Educator for adult learners called trainer, facilitator, and other way to call based on the context.

Another different is from competency. Adult educator use andragogy as learning approach. Knowles describe four factors need to be understand by adult educator these are self concept, experience, readiness to learn, and learning orientation. Self concept means that adult learners is independent and has open and positive potency [9].

Experience means something happen, felt, done through life span. Adult learner use experience as learning resources. That is why at learning process, the learning material need to be connected with the experience.

Readiness to learn means when the learning process should be begin. Adult learners is different with child who is everyday come to school at certain time to learn. Adult learner will ready to learn when they feel need to learn it. So the learning program should be connected with tasks need to be done by adult [13].

Learning orientation means what the objectives of learning. Adult learner has short learning orientation, they need to learn something that can be applied directly. So the adult educator has to design the learning objectives that can be achieved and applied in short time.

Another funding at this category is the competency of educator that is not match with the theory. The adult learner should master not only how to teach but also the material that is given or cognitive factors [6]. It was already discussed at point learning material and concluded that the learning material was not match some of the criteria. It was happen because the educator is not from the basic science of the material that is given (not quite mastering the material that is given). It shown by the questions asked by the farmer that can not be answered by the educator. Although as adult learner some time the educator could find the solution/answer together with the learner, but at this context while the farmers need the solution not as a trial and error for their plant, it become the trigger for some of the farmer not to adopt the bokashi fertilizer.

4. Conclusions

Farmers is adult learner which have unique characteristic. Those characteristic need to be understood at the very first step to conduct learning program about biotechnology product which the objective is not only to know about biotechnology product but also to adopt it.

Generally, it can be concluded that the program conducted to educate people about biotechnology is less success. The learning design used at the process is right, but need some improvement at the implementation. The learning material was not representative and need so much refinement. The learning media is adequate to support the learning material, and the educator is not capable enough based on the subject and applying andragogy approach.

Based on the conclusion, Andragogy become an approach need to be understand and applied to over all program. Training still become the best education form especially when the learning objectives is also to acquire skills regarding the product of biotechnology. The learning design must accommodate face to face meeting to deliver material, practice and sharing. The learning material need to cover all information about the product weather the good effect or bad effect of the product. The learnig material can be improved by a simple financial benefit to courage the farmers in adopting it, (3) learning media should be representative with the condition of the farmers characteristic started from the size, form and function, and (4) the educator has to master andragogy and has enough information regarding the product that is educated to the farmers.

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