Megabiodiversity Utilization through Integrated Learning Model of Natural Sciences with Development of Innertdepend Strategies in Indonesian Border Areas

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Abstract. The community empowerment and development attempts in Indonesia border area must be carried out through integrated efforts to foster innertdepend strategies. The potential threat to the national sovereignty should be prioritized although it needs some great efforts. The risk of losing islands along the cross-border areas of country needs to be anticipated better and more professionally. One strategic step to deal with this case is optimizing educational institutions in the cross-border region. It can be realized by utilizing megabiodiversity as a source of natural science learning as well as instilling a national pride of having abundant natural resources in the archipelago. The next strategy is by incorporating innertdepend strategies for the students. The research design of this study is the type of "Prototypal Studies" as put forward by [1] and [2]. The important thing to be considered in the Research and Development model is the quality of the produced learning model (product). [2] provides product quality criteria, namely: valid (reflects state-of-the-art knowledge and internal consistency), added value, practical, and effective. The results of the study are; (1) integrated learning model of natural sciences with the development of innertdepend strategies by utilizing the megabiodiversity that has been tested for its feasibility through expert judgment and limited empirical trials in the partnership schools can be categorized "Good", (2) integrated learning model of natural science with innert depend strategies is effective to improve concepts understanding and innert-dependent strategies for students in border area schools.

Keywords: Megabiodiversity; Innertdepend strategies; Learning model.

1. Introduction
Indonesia is the second most biodiverse countries with plentiful biodiversity assets, and listed as megabiodiversity country. Indonesia has various types of living things both on land and in water that are so abundant with its uniqueness. This country covers only 1.3% of the world’s total land but it possess enormous biological richness. It has 10% species of flowering plant from the entire flowering plants in the world, 12% of the world’s mammals, 16% of the world’s reptiles & amphibians, as well as 17% of the world's birds, and 25% of the world's fish. However, today, the biodiversity is threatened by various factors including global climate change and human invasion that cause environmental destruction [3]. Indonesia is not only megadiverse in terms of biodiversity but also in terms of cultural diversity. The country has about 370 ethnic groups [4], i.e., the third highest cultural diversity...
worldwide [5] associated with a long tradition of local knowledge systems of sustainable biodiversity utilization and nature conservation [6].

The Indonesian archipelago comprises 17,000 islands with many different types of habitats and an extremely complicated geological history, although the latter counts not only for Indonesia but for Southeast Asia in general [7]. Biogeographic, geological, climatic and ecological factors led to the evolution of a megadiverse fauna and flora with a high number of endemic and ecologically highly-adapted species [8]. These genetic resources and biodiversity are priceless assets of the country and it can be potential national income to boost Indonesia’s economic growth. Global change triggered by human activities is all around us. The pervasive effects of climate change habitat loss and fragmentation, overharvesting pollution, altered nutrient cycling, invasive species and interaction thereof affect virtually all earth’s ecosystem [9]. A recent study has compiled indicators on the state of biodiversity and reported overall decline with no significant recent reduction in the decline rate. This strongly suggests that the rate of biodiversity loss is not slowing down [10].

Biodiversity conservation was first defined as a science less than three decades ago [11], but is now well developed, multidisciplinary research endeavor [12]. The interest of quantification and valuation from natural scientists that biodiversity is imperiled by human activities [13], especially the destruction of natural habitats [14]. The Indonesia’s biodiversity is widely spread including in the outer areas or borderline whose condition is currently very lagging behind in case of equitable access to the economy and education, especially in those frontier, outermost and least developed area or often referred as Indonesian border areas.

It makes only a small portion of the megabiodiversity that has been effectively utilized to develop the economic potential in the areas of Indonesian border areas. One strategic step to anticipate this problem is optimizing educational institutions in those border region. It can be realized by utilizing megabiodiversity as a source of natural science learning, as well as instilling a national pride having abundant natural resources in the archipelago. The next strategy is to incorporate innertdepend strategies for students. It is very important to produce an integrated learning model of natural science with the development of innertdepend strategies by utilizing megabiodiversity. Educational institutions are strategic intermediate parties in order to improve the life quality among the community though its impact can be gathered for long term. It is so urgent that inequality in case of economic may lead to social problems that can further impact on losing nationalism, patriotism, national unity and integrity, love of the homeland as well as awareness of the state defence. Therefore, the solution that must be implemented is growing the "sense of belonging" towards the national sovereignty, as one of its manifestations is through educational institutions. Is shown in Figure 1 below:

![Figure 1. Conceptual Framework for integrated learning model of natural sciences with development of innert depend strategies](image-url)
In general, this study aims to produce an integrated learning model of natural science with the development of innertdepend strategies by utilizing megabiodiversity. Meanwhile, the specific objectives are; (1) identifying biodiversity in the outermost areas of Indonesia which is potential to be developed for learning resources, (2) producing integrated learning models of natural science with the development of innertdepend strategies by utilizing megabiodiversity, and (3) knowing the effectiveness results of during limited trials of the learning model.

Innertdepend strategies are cornerstone of culture and morality among society holistically with potential basis of the community itself including the spirit of state defence. There are two conditions for the existence of the state, namely the de facto requirements (facts or facts that exist), and de jure requirements (recognition from other countries). For the de facto requirements, there must be available at least the people, the region, the constitution and the government. Indonesia has fulfilled the de facto as well as de jure requirements and this country must maintain its existence and struggle to realize its country’s vision. To bring it into reality, education with innertdepend strategies must be prioritized because; (1) the state defense intelligence are not taken for granted, (2) the state existence can be maintain if the citizens are loyal and ready to defend their country, and this two aspect is nurtured through education for state defense, and (3), the citizens must have the intelligence of state defend through education of the country defence.

The rest of this paper is organized as follow: Section 2 describes the proposed research method. Section 3 presented the obtained results and following by discussion. Finally Section 4 concludes this work.

2. Research Method

The main focus of this study is the development of an integrated learning model design for natural science with the development of innertdepend strategies by utilizing megabiodiversity. This study employs a research and development design to develop the type of "Prototypal Studies" as put forward by [1] and [2]. The important thing to be considered in the Research and Development model is the quality of the produced learning model (product). [2] provides product quality criteria, namely: valid (reflects state-of-the-art knowledge and internal consistency), added value, practical, and effective.

Generally, [2] states that the implementation of development research includes three phases, namely: front-end analysis, prototyping phase, and assessment phase or summative evaluation. Related to the research focus of developing the integrated learning model of natural science with innertdepend strategies development by utilizing megabiodiversity, it includes operational standard procedures for models implementation, and policy recommendations for learning models to be applied in the natural science class in the schools of border area and the final product of learning model of natural science with innertdepend strategies development by utilizing megabiodiversity which is valid, practical and effective. A product declared as practical if it is useful and easily implemented by teachers and students. The effective criteria, if it reflects students’ experience and meets the expected learning outcomes. In this case, the integrated learning models design of natural science with the development of innertdepend strategies by utilizing megabiodiversity of which relatively new thing in the field of educational research is certainly considered having an added value. Thus, the focus of product quality is valid, practical, effective, and relevant to the needs of teachers and students in supporting learning process. The results of the feasibility test of the model and its syntax by expert judgment and teachers of natural science, is shown in Table 1.

| No | Validator  | Assessed Components | Scale Value 5 | Category |
|----|------------|---------------------|---------------|----------|
| 1  | Expert     | Model objectives    | 4.5           | Very good|
|    |            | Model syntax        | 4.7           | Very good|
|    |            | Linguistic Component| 3.5           | Good     |
|    |            | Variable of Models  | 3.6           | Good     |
The experimental design carried out on limited trial activities was using Pretest-Posttest of Control Group Design is shown in Table 2.

3. Result and Discussion
This section presents the results used and the proposed discussion

3.1. General Description of the Model
Weil and Joyce [15] proposed several key ideas as a component of a learning model, namely; (1) Syntax of the model, namely the steps, phases, or sequence of learning activities. So the syntax is a description of the model in the action. Each model has a different model syntax or structure. (2) Principle of Reaction is the reaction of students to learning activities. The principle of reaction helps to choose the effective reactions in learning. (3) Social systems that cover three main meanings, namely; (a) description of the various roles of learners and learning, (b) description of hierarchical relationships / learners' and learning's authority, (c) description of various rules to encourage learning. (4) Support System is actually a condition needed by a model, it is not the model itself. The support system departs from the questions of needed support by a model to create a special environment. Related to this, the support system is in the form of abilities or technical skills and facilities. The support system is derived from two sources, namely the specificity of the students role and the learning demands (see Figure 2).

Integrated natural science learning model with the development of innterdependence strategies by utilizing megabiodiversity in Indonesian border region is a developed model through national institutional strategic research activities in the framework of development and utilization the megabiodiversity potential to improve the quality of life of the people in the border area. The mission of this model development is to increase student participation, to improve the quality of human resources, and to reinforce educational institutions through strengthening the role of schools as facilitators of collaborative community empowerment in order to foster innterdependence strategies. The development of the model aims at improving the quality of human resources through the development of integrated natural science learning tools by utilizing megabiodiversity which is sustainable so that it can foster innterdependence strategies. The targets of the model development are:

a. Improving the role and the function of educational institutions in Indonesian border region in supporting the implementation of Integrated natural science learning model development

b. Improving the capacity and participation of educational practitioners in Indonesian border region in developing commodities based on relevant biodiversity.

c. Improving teacher quality in utilizing the resources of megabiodiversity as a source of continuous learning so that it can foster innterdependence strategies.

The benefited party of the development model activities are groups of teacher who are related to Indonesian border region megabiodiversity resources as teaching materials in order to foster innterdependence strategies, is shown in Figure 3:

Tabel 2. Preliminary field testing experimntal design (Pretest- Posttest Control Group Design)

| Group | Pre-test | Experiment | Post-test |
|-------|----------|------------|----------|
| EG    | O₁       | X₁         | O₂       |
| CG    | O₃       | X₂         | O₄       |

Explanation of symbols

EG: Experiment Group  O₁: Pre-test EG
CG: Control Group
X₁: Class Model
O₃: Pre-test CG
X₂: Non Class Model
O₄: Post-test CG

**Figure 2. Research Design**

- **R&D Prototypical Studies**
  - **Front-end analysis**
    - Megabiodiversity analysis in the Indonesian border area
    - Determination of solutions to overcome the problem of low spirit of patriotism
    - Analysis of local wisdom dan natural resources
  - **Prototyping phase**
    - The design of learning model utilizes megabiodiversity
    - Indonesian local potentials
    - Innert depend strategies
  - **Assessment phase**
    - Determination of Core Standards for learning
    - Designing innovative learning media
  - **Final Recommendation**
    - Development of prototypes media, syllabi, lesson plans, worksheets, assessment of concept understanding and Assessment of innert depend strategies

- **Main Product Review (5)**
  - Implementation of the integrated learning model of natural science with innert-depend strategies development by utilizing megabiodiversity
  - Evaluation of learning model
  - Main Field Testing (6)
  - Dessemination of Model
  - Border area of Indonesia
  - Findings
  - Final Report
  - Operational Product Review (7)
3.2. Result of Implementation Model

Limited trials were carried out in the eighth grade of junior high school in Nusakambangan and Riau Islands involving postgraduate students of the Graduate Program, Universitas Negeri Yogyakarta. The selection of limited trials was conducted randomly by paying attention to the different abilities of students. The trials were done after improvements to the initial draft of the learning model to develop innocent-dependent strategies based on the validation results. This trial aimed to test the feasibility of the developed model including the syntax, the instructional impact and the materials. It was also to test the validity of the concept understanding about megabiodiversity and a questionnaire about innertdepend strategies as well as to collect information in order to improve models and instruments.
The obtained information during limited trials was collected in the form of the knowledge data about megabiodiversity and intradepend strategies of students.

The result of the integrated learning model development of natural science with intradepend strategies development by utilizing megabiodiversity was validated through expert judgment divided into 6 assessment components, namely; (1) completeness of megabiodiversity aspects, (2) syntax of the model, (3) instructional impact, (4) principle of Reaction, (5) social system, and (6) support system. Each component has its own assessment aspects. The validation results of each component of the learning model were in the form of mean scores converted into values. The validation results of the learning model components are presented in Table 3 and Figure 4 below.

**Table 3. Validation of the integrated learning model of natural science with intradepend strategies development by utilizing megabiodiversity**

|                          | Completeness of megabiodiversity aspects | Syntax of the model | Instructional impact | Principle of Reaction | Social system | Support System |
|--------------------------|------------------------------------------|---------------------|----------------------|-----------------------|--------------|----------------|
| Expert 1                 | 3.65                                     | 3.85                | 3.75                 | 3.55                  | 3.45         | 3.60           |
| Expert 2                 | 3.55                                     | 3.75                | 3.55                 | 3.65                  | 3.75         | 3.75           |
| Average                  | 3.60                                     | 3.80                | 3.65                 | 3.60                  | 3.60         | 3.68           |
| Category                 | Good                                     | Very Good           | Good                 | Good                  | Good         | Very Good      |

**Figure 4.** Graph of validation results for the integrated learning model of natural science with intradepend strategies development by utilizing megabiodiversity

The results of the lesson plan development were validated through expert judgment divided into 5 assessment components, namely; (1) Learning objectives, (2) Learning materials, (3) component linguistics and, (4) Learning time, (5) Concept Truth. Each component contained its own assessment aspects. The results of its validation of each lesson plan component in the form of mean scores were converted into values. The results of the validation of the Lessons Plan component are presented in Table 4 and Figure 5 below.
### Table 4. Sub dimension of lessons plan validation

|                  | Learning Objectives | Learning Material | Linguistic Component | Learning Time | Concept truth |
|------------------|---------------------|-------------------|----------------------|---------------|---------------|
| Expert 1         | 3.82                | 3.84              | 3.62                 | 3.84          | 3.54          |
| Expert 2         | 3.76                | 3.76              | 3.42                 | 3.78          | 3.62          |
| Average          | 3.79                | 3.8               | 3.52                 | 3.81          | 3.58          |
| Category         | Very Good           | Very Good         | Good                 | Very Good     | Good          |

### Figure 5. Results of the Lessons Plan Validation

#### 3.3. Discussion

The results of the models development and learning tools show that the model is feasible to apply because each component can be categorized as "good" and "very good" based on the expert judgment and the results of practicality tests by natural science teachers. Likewise, the learning tools used in the developed model, in this article are represented by Lessons Plan, also categorized "good" and "very good" in each component based on expert judgment and the results of practicality tests by natural science teachers. The feasibility of the learning model and tools is important to ensure that all components of the model can be applied in learning process. The components of the model and their categories are as follows; (1) Completeness of megabiodiversity aspects (Good), (2) Syntax of the model (Very Good), (3) instructional impact (Good), (4) Principle of Reaction (Good), (5) Social system (Good), and (6) Support System (Very Good).

The innertdepend strategies attitude scale is developed based on the innertdepend strategies consisting of the following six dimensions; patriotism, nationalism, unity, willing to sacrifice, love domestic products and obey the rules and laws. The arrangement of this innertdepend strategies attitude scale refers to the Likert model scale with five alternative answers of scores range from 1 to 5.
Likert model scale is chosen so that teachers who will use this instrument can understand and use it easily is shown in Table 5 below.

**Table 5.** Innterdelp strategies development in each learning cycle

|               | Lessons 1 | Lessons 2 | Lessons 3 |
|---------------|-----------|-----------|-----------|
| Patriotism    | 3.42      | 3.46      | 3.64      |
| Nationalism   | 3.32      | 3.36      | 3.44      |
| The spirit of unity | 3.52  | 3.64      | 3.72      |
| Willingness to sacrifice | 3.52  | 3.66      | 3.82      |
| Love domestic products | 2.48  | 3.66      | 3.78      |
| Obey the rules and laws | 3.54  | 3.72      | 4.84      |

![Figure 6. Graph of innterdelp strategies development in each learning cycle](image)

Based on Table 5 and Figure 6, it shows consistency in the development of innterdelp strategies from one learning to the next. It happens because both the teacher and students are getting accustomed with the developed learning model. Based on the analysis results of the attitude scale questionnaire, it indicates a positive trend of improvement so that it can be stated explicitly that the application of the learning model can significantly improve innterdelp strategies.

Bloom points out that concept understanding is the ability to capture knowledge such as able to express presented material into better understandable explanation, able to provide interpretation and its application. The concept understanding can also be interpreted as the ability to construct meaning or understanding of a concept based on the initial knowledge, or to integrate new knowledge into a scheme that already exists in students’ thinking. According to Novak and Gowin in [16], concept understanding can be evaluated through concept maps, the teacher can find out the prior concepts owned by his/her students to be associated with new information to those that already exists in students’ cognitive structure use shown in Table 6. The indicators of the achievement aspects for understanding concepts in this study are; (1) restating the concept, (2) classifying objects according to certain traits based on the concept, (3) classifying examples of concepts and those which is not, (4) presenting concepts in various forms of mathematical representations, (5) developing requirements or sufficient conditions of a concept, (6) using, utilizing and choosing certain procedures or operations, (7) applying concepts for problem solving (see Figure 7).
Table 6. Development of scientific concepts understanding in each learning cycle

| Lessons | Re-express concepts | Classify objects | give examples of concepts | present mathematical representations | develop the requirements of a concept | use certain procedures or operations | apply concepts |
|---------|---------------------|------------------|--------------------------|--------------------------------------|--------------------------------------|--------------------------------------|---------------|
| Lessons 1 | 3.54                | 3.34             | 3.54                     | 3.52                                 | 2.56                                 | 3.54                                 | 3.32          |
| Lessons 2 | 3.62                | 3.42             | 3.62                     | 3.62                                 | 3.66                                 | 3.62                                 | 3.64          |
| Lessons 3 | 3.68                | 3.54             | 3.76                     | 3.82                                 | 3.78                                 | 3.78                                 | 3.78          |

Figure 7. Graph of development of scientific concepts understanding in each learning cycle

4. Conclusion

Based on the research findings and discussion, the development results of megabiodiversity learning models and tools in order to develop patriotism characters is as follow: (1) integrated natural science learning model with the development of innterdependent strategies by utilizing the megabiodiversity that has been tested for its feasibility through expert judgment and empirical limited trials in the partnership schools can be categorized “Good” (2) integrated natural learning model with innterdependent strategies is effective to improve the concepts understanding of innter-dependent strategies among students in border area schools.

Acknowledgement

Our gratitude goes to DRPM of Ministry of Research, Technology & Higher Education, also LPPM of Universitas Negeri Yogyakarta that has provided opportunities as well as funding and managerial support for the implementation of this research activity.

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