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A Learning Model of Environmental Education Integrated With Pair Check and Guided Inquiry Method

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Abstract : *This article outlines the stages of environmental education learning by integrating pair check and guided inquiry method in natural science learning. The integrated model serves as a guide for Science teachers in junior high schools to improve students' knowledge and environmental attitudes. The development of the learning model uses Plomp's educational design approach consisting of these phases: 1) preliminary investigation phase; 2) design phase; 3) realization phase, 4) test, evaluation, and revision phase. The result of the development is shown at the initial investigation stage which obtained integration's urgency of pair check and guided inquiry method. The initial investigation is carried out by involving six science teachers as the research informants. The design phase includes some learning model development activities. While the realization phase is the compilation of an environmental learning model covering the aspects of syntax, social system, reaction principle, supporting system, instructional impact, and companion impact. This model is conducted through the validity stage by three experts. For the test and evaluation phase, it is the implementation of prototype test on the subject of Natural Science at two times which later provides evidence that the learning model contributes to the improvement of students' environmental knowledge.*

Keywords - *validity, practicality, effectiveness*

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I. Introduction

Environmental education is a process of value formation and concept description of environmental protection which aims to increase knowledge and attitude to environmental issues. It is a model for human behavior development as a solution to environmental problems [1], [2]. Various countries have developed several models of environmental education as part of national education. The development of environmental education model at various levels of education includes curriculum development, teacher knowledge development as well as the involvement of all school elements [3], [4].

The Government of Indonesia elaborates on environmental education by implementing the concept of environmental material integration on various subjects in primary and secondary schools. The implementation is presented as an integrated subject into another subject. In the past, however, the implementation of Environmental Education (PLH) has been strengthened by Law Number 32 Year 2009, particularly Article 65 verse 2, which discloses that everyone is entitled to environmental education in terms of access to information and participation in the utilization of resources and a healthy environment.

The integration of environmental education with other subjects is done by adjusting to both subject matters. The expected integration is the conceptual one designed and systematically implemented based on the curriculum, so that the objectives, the subject matter of environmental education, and the integrated subject support each other and enrich students' knowledge and understanding.

The method of integrating environmental education with other subjects has become an important study, but the debate over the urgency remains a long record. Unclear learning orientation, different science curriculum designs, and fundamental philosophical issues regarding the nature of science hinder the implementation of environmental education in schools [5], [6].

This article presents a philosophical validity test of conceptual and methodological integration models. This model integrates environmental education with science learning by building a coherent science based on the subject element. An integration technique is reflected in the following four things: (1) Curriculum integration; (2) Integration in learning unit based on integrated GBPP (course outline); (3) Integration in teaching and learning process based on integrated learning unit; and (4) Integration in both formative and summative assessment [7], [8].

This research describes the integration model of environmental education with Natural Science subject at junior high school. The learning focus is the implementation of learning process and the evaluation of its achievements. Science learning is not enough just to give explanations where the students only listen. Nevertheless, this process should guard the students in discovering the concept itself. The science learning process emphasizes the process skill approach, so they can discover facts; build their own concepts, theories, and scientific attitudes that will ultimately and positively affect the quality of educational products.

The development of an environmental integration model with natural science learning materials in junior high school is adapted to the applied Curriculum 2013 in Indonesia. Cooperative learning model that refers to constructivism theory is a form of learning where students learn and work in groups as part of the integration design. Basically the cooperative learning model is the same as the group work, but the advantages of this model are the sharing process among learners or participants. By that way, it realizes the mutual understanding among them. In this learning, there will be a wider interaction that is between teacher and students, students and students, and a student and teacher.

Cooperative learning model as an effort to maximize student learning outcomes as well as the increased understanding of both individuals and groups. Furthermore, this model can accommodate the diversity of students' characters and the development of students' social skill through sharing activities. The stages of cooperative learning implementation are generally carried out with these steps: (1) delivering the objectives and motivating the students where teacher conveys the learning objectives and communicates basic competencies to be achieved while motivating them; (2) presenting the information where teacher presents the information to the students; (3)) organizing students into groups where teacher directs students to gather in groups; (4) guiding study groups where teacher motivates and facilitates student to work in study groups; and (5) evaluation where teacher evaluates learning outcomes about materials that have been implemented; and (6) giving award where teachers rewards individual and group regarding their learning outcomes.

This cooperative learning model has one type model which known as pair check. It is a paired learning model popularized [9]**.** This model demands the independence and ability of students to solve the problems given by the teacher. This learning also trains students' social feelings, cooperation, and judgment skill.

Thus, the application of cooperative learning with particular type of pair check in science learning is conducted by dividing students into groups consisting of four. Within each group, four students form a small or paired group. Each small or paired group discusses to solve a problem, and then the result would be examined by paired group from the other four-person groups.

II. Research Method

2.1 Research Design

This research is a developmental one with a modified educational design [10]. Several steps in the field of education (learning) [10] are: 1) preliminary investigation; 2) design; 3) realization/construction; 4) test, evaluation, and revision combined with the stages of educational product development according to [11] by considering aspects of validity, practicality, and effectiveness. It also considers several model elements such as syntax, social system, reaction principle, supporting system, instructional impact, and companion impact [12]–[14].

The subjects of this developmental research are the students of Class VII E and VII F at SMP Negeri 1 Sungguminasa Gowa. The research object is a learning model of environmental education with the integration of pair check and guided inquiry method. For its learning tools, it consist of learning design, books, achievement test in natural science subject and environmental education, questionnaire on environmental attitude, and students' discussion sheet.

Needs and data analysis is assessing by descriptive statistics in the form of average and or percentage. While the analysis of product validity is assessed by: 1) recapitulating all result of expert validation into table with respect to aspect, criteria, and the results of validator assessment; 2) finding the average of each criterion (M1); 3) finding the average of each aspect (M2) in validation sheet; and 4) finding the average total (M3) of the validator rating, then determining the validity of each average (M1, M2, M3) in comparison with the specified category of validity.

Validity category used is adapted from Bloom, Madaus, and Hasting [15] as follows:

$3.5 \leq Mi \leq 4{,}0 \leftrightarrow$ very valid
$2.5 \leq Mi \leq 3{,}5 \leftrightarrow$ valid
$1.5 \leq Mi \leq 2{,}5 \leftrightarrow$ fairly valid
$0.5 \leq Mi \leq 1{,}5 \leftrightarrow$ less valid
$Mi \leq 0{,}5 \leftrightarrow$ invalid

Description:
Mi = model validity, for i=1,2,3

M_1= validity for each criterion
M_2 = validity for each aspect
M_3 = validity for total aspects

The developed product reaches valid point if the minimum value of M3 is fairly valid and M2 value of every aspect is at least valid. If it cannot fulfill, then revision is required as validator's instruction, while re-validation and re-analysis are conducted until it reaches valid category.

To discover the reliability of the developing Product Assessment Sheet, then it uses a method adapted from Emmer & Miller [16]**:**

$$\textit{Percentage of agreementnt} = \left[1 - \frac{A-B}{A+B}\right] \text{x}100\%$$

Next step is the value of Percentage of Agreement used to acquire R value:

$$R = \left[1 - \frac{A-B}{A+B}\right] \text{x}100\%$$

Description:
A= the maximum value of validator
B= the minimum of validator
R= reliability coefficient
The model of assessment sheet is reliable if reliability coefficient (R) ≥ 0,75 [17]

2.2 The Practicality of The Developed Learning Model

The practicality of the developed model is obtained by: 1) recapitulating the observation result of the model implementation into table related to its aspects and criterion; 2) finding the average of every aspect from each meeting (T_1); 3) finding the average of each aspect for *n* meeting (T2); 4) finding the average of total aspects (T3); and 5) determining the implementation of each aspect or whole of the model developed by comparing T2 or T3 with the specified categories.

The category of implementation is analyzed by Bloom, Madaus & Hasting [15] as follows:

$1.5 \leq Ti \leq 2{,}0 \leftrightarrow$ fully implemented
$0.5 \leq Ti \leq 1{,}5 \leftrightarrow$ partly implemented
$0.0 \leq Ti \leq 0{,}5 \leftrightarrow$ not implemented

Description:
Pi = validity of model implementation, for *i* = 2,3
T_1= validity of each aspect of implementation
T_2 = validity of total aspects of implementation
T2 = validity of total aspects of the model

The level of implementation from the developed learning model is regarded as efficient if the minimum value of T_i is in the category of partly implemented which does not need to be revised. Otherwise, revision is needed on the aspects that are less and re-observing the revised model until the minimum value of T_i reaches partly implemented category.

To discover the reliability from the observation form of the Implementation of the developing model, then it uses the formula of Percentage of Agreement [18] as follows:

$$\textit{Percentage of Agreement} = \frac{Agreement\ (A)}{Disagreement\ (D) + Agreement\ (A)} \text{x}100\%$$

Description:
A= the frequency amount of agreement between two observers
D= the frequency amount of disagreement between two observers
R= reliability coefficient
The attitude scale establishes three aspects, specifically of cognitive, affective, and conative. The items of attitude scale are expressed in positive or negative form. The attitude scoring on the environment is based on the questionnaire using Likert scale. Likert scale in this research is 4 scale, that is Strongly Disagree (STS), Disagree (TS), Agree (S), and Strongly Agree (SS). Scale score is determined through normal distribution (Shaw & Wright, 1967).

Changes in students' attitude to the environment is achieved if it reaches the least average score of 5% before and after learning.

III. Results and Discussion

The findings obtained at each phase of the learning model development of environmental education integrated with pair check and guided inquiry method is explained below:

3.1 Phase 1. Preliminary Investigation

The activities that have been undertaken in phase 1 are: 1) conducting Training Needs Analysis (TNA) activities related to environmental education implementation in junior high schools in Gowa Regency; 2) conducting preliminary activities at SMPN 1 Sungguminasa regarding the applied model and lesson tools.
The implementation of need assessment from this research has been conducted at 19 junior high schools that spread to six districts in Gowa Regency. The selected of 19 schools considers representative samples from total of 81 junior high schools in Gowa Regency spread over 18 districts. The analysis result of need assessment which has been conducted is summarized in the following table:

Table 1. The Analysis Result of Need Assessment

No.	Measured Aspect/Criterion	Percentage
1.	Respondents' experience of teaching Science in Junior High School	
a.	Over 10 years	62
b.	Less than 10 years	38
2.	Response to the students' activeness in learning process	
a.	Active students	77
b.	Passive students	23
3.	The use of creative method to enhance students' activeness	
a.	Suggesting to implement creative method	64
b.	No suggestion	36
4.	The appropriate implementation of environmental education in Junior High School	
a.	Local Content	11
b.	Integration	49
c.	Self-development activities	42
5.	Several materials of environmental education which are also taught in Science Subject	
a.	Waste	43
b.	Pollution	81
c.	Forest Reservation	57
d.	Coastal Abrasion	30
e.	School Cleanliness	87
6.	The Urgency of developing environmental education in school	
a.	Needed to Very Needed	98
b.	Less Needed to Fairly Needed	2
7.	The need for environmental education learning to be integrated into Science Subject	
a.	Needed to Very Needed	64,1
b.	Not Needed	35,9

3.2 Phase 2. Designing

In this phase 2 or design phase, there has been produced several documents such as: (1) the initial design of integrated model of Pair Check-Guided Inquiry (IPC-GI); (2) the initial design of learning tools for IPC-GI model; and (3) the initial design of supporting instruments to obtain the required data in the development process.

3.2.1 The Design of IPC-GI Model

In relation to the design of IPC-GI model, a book model of learning model has been produced. It consists of Chapter I Model Rationale, Chapter II Supporting Theory Models, Chapter III Integrated Model of Pair Check and Guided Inquiry (IPC-IG Model), Chapter IV Learning Implementation Guidance using IPC-GI Model.

Pursuing this further, in the rational part of the model, it describes the significant reasons of the development of IPC-GI model. It also includes several matters that become the main consideration or the foundation of the development of learning model which integrates pair check and guided inquiry method. Moreover, the findings of the research are also presented to support the need of development.

Three models are discussed here in particular, pair check, guided inquiry, and IPC-IG model. Specifically, the components for IPC-GI model consists of five elements such as: (1) syntax; (2) social system; (3) interaction principle; (4) supporting system; 5) instructional and companion impact. As in the implementation guidance section is designed to explain the planning, class organizing, helping students, handling individual situation, handling group situation, and assessing. In the section which discusses the evaluation also covers model's type, assessment mode, and application in learning.

3.2.2 The Design of Learning Tool

The design of learning tool is limited to a single subject such as energy in living system. In this subject according to the Curriculum 2013, it has several basic competencies: analyzing the concept of energy, various energy sources, and changes in energy form in everyday life including photosynthesis (KI 3) and presenting experimental results on the changes of energy form including photosynthesis (KI 4) .

For more applicable design of this learning tool, then the designed form will be in lesson plans (RPP), students' discussion sheet (LDPD), and students' book. RPP is designed by following the phases of IPC-GI learning. This lesson plan consists of the components of school and class identity, core competencies, basic competencies, indicators of competency achievement, learning objectives, learning materials, learning models and methods, learning resources, instructional media, learning activity steps, and evaluation instruments.

It is designed to simultaneously involve indicators of competency achievement, objectives, materials, models and learning methods, learning resources, media, learning steps for five meetings plus one meeting for final test. This is also designed to integrate environmental education contents which are relevant to Science Subject, specifically for energy in living system material.

In line with that, for the purpose of learning effectiveness, the lesson plan (RPP) is supplemented by designing students' discussion sheet (LDPD) which considering the learning phases in the IPC-GI model. Each meeting is adjusted to indicators of competency achievement in RPP. While students' book is designed by focusing on the needs of the science subject's main material, that is energy in living system by integrating relevant materials of environmental education.

3.2.3 The Design of Research Instrument

The final session of this research activity is aimed to see the quality of the developing learning model. For this purpose, several instruments have been designed to support data filtering. The instruments designed include three types such as, validity, practicality, and effectiveness.

The instrument of validity generated in the design phase defines the aspects of assessment and indicators of each aspect for the instruments as follows: (1) the assessment sheet of IPC-GI model; (2) the validation instrument of the IPC-GI model assessment sheet; (3) the validation instrument of observation format of IPC-GI model implementation; (4) the validation instrument of RPP; (5) the validation instrument of student's book; (6) the validation instrument of LDPD; (7) assessment sheet for teaching material mastery of science subject; (8) assessment sheet for teaching material mastery of environmental education; 9) assessment sheet of questionnaire scale for students' attitude toward the environment. Equally important, practicality instrument is designed in the observation form of model implementation. For effectiveness instrument, there are several phases: (1) a mastery test of Science's teaching material; (2) a mastery test of environmental education's teaching material; and (3) the scale of students' attitudes toward the environment. The design of these instruments contains a guidance aspect and content. The content aspect is based on theories that support the objects to be revealed through the instrument.

3.3 Phase 3. Realization

In the realization phase, there are several documents which later called as prototype-1 of IPC-GI model including: (1) IPC-GI model book; (2) instructional tools in accordance with IPC-GI model in the form of RPP, students' book, and students' discussion sheets (LDPD); and (3) instruments for measuring model's quality.
The main thing achieved at this stage are the learning phases of IPC-GI model which described as follows:

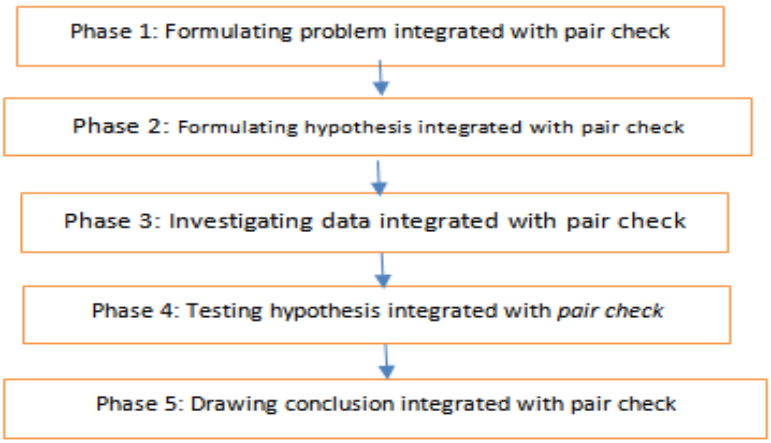

Figure 1. Learning Phases of the IPC-GI Model

3.4 Phase 4. Testing, Evaluating, and Revising

3.4.1 The Result of Instrument's Development

Table 2. The Instrument's Validity and Reliability

No.	Instrument	Validity	Reliability
1.	Instrument of Validity		
a.	The assessment sheet of IPC-GI model	3,44 (valid)	0,9107
b.	Observation sheet of learning implementation	2,87 (vaid)	0,8941
2.	Instrument of Practicality		
a.	Observation Sheet of IPC-GI model implementation	3,52 (very valid)	0,9375
3.	Instrument of Effectiveness		
a.	Achievement test of Science Subject	3,33 (valid)	0,8571
b.	Achievement test of Environmental Education	3,33 (valid)	0,8571
c.	Questionnaire for Students' Attitude toward environment	3,54 (very valid)	0,8571

Table 3. Validation Test of Learning Tools

No.	Instrument	Validity	Reliability
1.	RPP (lesson plan)	3,90 (very valid)	0,9886
2.	Students' Book	3,46 (valid)	0,8625
3.	LDPD (students' discussion sheet)	3,41 (valid)	0,8640

3.4.2 The Assessment Result of IPC-GI Model

Based on the analysis of theoretical validity assessment result by three experts, it obtains the value of model validity as 3.36 in valid category. The reliability value of model R = 0.9017 which is greater than 0.75.

3.4.3 The Assessment Result of IPC-GI Model Implementation

Table 4. Test of Model Implementation

Learning Activity	**Percentage (%)**	**The Average of Observation**	**Qualification**
Trial I			
Syntax	94,29	1,83	Fully implemented
Social Component	95,00	1,83	Fully implemented
Reaction Principle	92,00	1,84	Fully implemented
Supporting System	86,67	1,77	Fully implemented
Total	91,99	1,82	Fully implemented
Trial II			
Syntax	100,00	1,89	Fully implemented
Social Component	95,00	1,80	Fully implemented
Reaction Principle	96,00	1,88	Fully implemented
Supporting System	100,00	1,90	Fully implemented
Total	97,75	1,87	Fully implemented

3.4.4 The Result of Learning Management

Table 5. The Result of Implementation Analysis

Learning Management Activity	**Percentage (%)**	**The Average of Observation**	**Qualification**
Trial I	96	3,45	Good
Trial II	99	3,57	Very Good

3.4.5 The Assessment of Model Effectiveness in Trial I

Table 6. Test of Model Effectiveness on Trial 1

No.	Instrument	Pre-test	Post-test	Gain Score	The Achievement of Learning Mastery (KKM) (75) classical (%)
1.	Learning Achievement of Science Subject	40,00	78,62	0,64 (fair)	82,76
2.	Learning Achievement of Environmental Education	45,00	76,00	0,57 (fair)	75,86
3.	Students' Attitude toward Environment	44,98%	50,44%		

3.4.6 The Assessment of Model Effectiveness in Trial II

Table 7. Test of Model Effectiveness in Trial II

No.	Instrument	*Pre-test*	*Post-test*	*Gain Score*	The Achievement of Learning Mastery (KKM) (>75) classical (%)
1.	Learning Achievement of Science Subject	32,11	77,27	0,67 (fair)	87,5
2.	Learning Achievement of Environmental Education	36,00	81,00	0,70 (high)	87,5
3.	Students' Attitude toward Environment	49,39%	76,93%		

IV. Conclusion

Based on the result of data analysis and discussion, it can be concluded that: (1) several phases of learning model development through educational design approach: a) preliminary investigation phase; b) design phase; c) realization phase; d) test, evaluation, and revision phase modified by incorporating elements of the model proposed by Joyce et al (2009) specifically syntax, social system, reaction principles, supporting system, instructional and companion impact. It also considers the stages of educational product development in the form of three aspects of quality that is validity, practicality, and effectiveness. They can be used to develop a learning model by integrating pair check and guided inquiry method which known as integrated learning model of pair check and guided inquiry (IPC-GI). The steps of IPC-GI model consists of problem formulation integrated with pair check, formulating hypothesis integrated with pair check, investigating data integrated with pair check, testing hypothesis integrated with pair check, drawing conclusion integrated with pair check. (2) IPC-GI learning model has met the validity, practicality, and effectiveness requirements.

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