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The Development of Collaborative Learning Talking Chips Based On Brain-Based Learning (BBL) for The Junior High School Science in The Agroecosystem Area

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ABSTRACT

Agroecosystem area has abundant natural resources, but these natural resources cannot be utilized as learning resources needed in the learning process of students becoming passive, comfortable and power-efficient in remembering students. Learning involving students is done by learning Brain-Based Learning (BBL) collaborated with Talking Chips type collaborative learning model. The purpose of this study is to obtain a development process, obtain a valid model, and obtain a Talking Chips learning model based on Brain-Based Learning (BBL) that is practical for SMP learning in the Agroecosystem area. This research was conducted in SMP Negeri 9 Jember with research subjects of class VII B in the academic year 2018/2019. The type of this research was (research and development), using 4-D model Thiagarajan, but only used 3 stages define, design, and develop. The technique of collecting data is by collecting product validation data, test methods, interviews with teachers, questionnaire teachers and students and observations. The data analysis technique consisted of product validation analysis, analytic analysis with N-gain and learning retention, and practicality analysis. The product validation results, which are 89.33%, are categorized as very valid. The effectiveness of learning outcomes is 0.78 with a high category while the retention results obtained based on the learning retention analysis are 89 with a high category. The results of practicality obtained from the teacher questionnaire response was 98%, the category was very good and the questionnaire student responses were 96% with a very good category.

INTRODUCTION

Indonesia is an agricultural region that relies on the agricultural sector or being known as agroecosystem area. The Agroecosystem area has a total area of around 70.20 million ha. The area is divided into several groups, including land, fields, paddy fields, ponds, and grasslands [1]. The area has a lot of abundant natural resources. The potential of natural resources provided by nature can be used as a varied learning resource. Learning resources in the area of agroecosystem consist of paddy fields, ponds, gardens, farms in which there are various living things, interdependence and interacted in daily life. The existing living things consist of animals, microorganisms and plants that can be utilized in learning [2].

The potential of agroecosystem area consisting of living creatures in the form of animals, microorganisms and plants need to be fully utilized so that in the learning process students will play an active role through contextual learning by utilizing the existing potential [3]. In fact, most teachers still use the lecturing method, demonstration, and question and answer [4]. This is in line with the results of the questionnaire in which junior high school teachers in Jember Regency especially in science learning still use inquiry learning models, Problem Based Learning, STAD, Conventional and Discovery Learning.

This will make students passive, lazy and lack of memory because students only memorize it without any objects to be observed directly. In line with the results of interviews with teachers who stated that the learning outcomes achieved by students were not maximal and learning retention was also low, this becomes common problems faced by teachers. Learning retention can be improved by involving students in each learning activity. By overcoming these problems, a teacher is required to carry out a learning process that can make students play an active role in the teaching learning process. Students can have good learning outcomes and learning retention if the curriculum and the learning model being used are in accordance with the character possessed by students.

A learning that involves students can be done with various approaches. One of them is Brain-Based Learning (BBL) approach. Brain-Based Learning (BBL) approach considers something natural for the brain and the way the brain works can be influenced by the environment and the existing experience [5]. BBL (Brain-Based learning) approach will be successfully done if it is collaborated by using a collaborative learning model. One of collaborative learning models that can be collaborated with Brain-Based Learning approach is Talking Chips collaborative learning model. The Talking Chips learning model is a learning model that was first developed by Spencer Kagan. This learning model has a jingling button type that emphasizes on a special structure designed to be able to influence the pattern of students' interaction [6].

Talking Chips collaborative learning model has a character that each group member in a discussion has the same opportunity to contribute and listen to the opinions from other group members. The advantage of Talking Chips learning model in learning process is that it includes equal opportunities for students to be active in group discussions. But in the Talking Chips learning model it also has weaknesses, the weaknesses of this model are that it takes a long time and how to control all student groups discussion so that the discussion goes well.

The background described above is the basis for the need to develop a learning

model that is based on the conditions and character of different students. Therefore a development research is done entitled **"The Development of Collaborative Learning Talking Chips Based On Brain-Based Learning (BBL) for The Junior High School Science in The Agroecosystem Area"**. The research aims to obtain the development of Talking Chips learning model based on Brain-Based Learning (BBL), obtain a valid Talking Chips learning model based on Brain-Based Learning (BBL), and obtain a Talking Chips learning model based on Brain-Based Learning (BBL)) which is practical for science learning for junior high school students in the Agroecosystem area.

METHODOLOGY

The research type is a research and development. The stages of the development model in this study used 4-D model, but only three stages were used, define, design, and develop. The research was conducted at the Biology Education Study Program. Model development trials were done at Junior High School 9 Jember. It was done in September 2018/2019 academic year. The research subject of this development was students of class VII B Junior High School 9 Jember. This research belongs to a research and development. The stages of the development model in this study used a 4-D model, but only 3 phases were used; define, design, and develop. In the development stage, a limited trial was conducted with 9 students in one class consisting of three students with low cognitive level, 3 students with moderate cognitive level, and 3 students with high cognitive level.

Define stage consists of front-end analysis, student analysis, task analysis, concept analysis and formulating learning objectives. The design stage consists of the preparation of benchmark reference tests (pre-test and post-test), media selection, format selection, and initial design. The develop stage consists of a) model validation by experts and users, b) revisions from experts and users, c) limited trials involving 9 students, d) revisions, e) field tests with all students.

Data collection techniques are by collecting product validation data, tests, interview with teachers, teacher and students response questionnaires, and observation. The analysis technique used consists of product validation analysis, effectiveness analysis with N-gain and learning retention, as well as practicality analysis.

Table 1. Criteria of Coefficient Level

Coefficient level	Criteria
0,7 > g: High	High
0,3 ≤ g ≤ 0,7	Medium
g < 0,3	Low

a. Development process of Talking Chips collaborative learning based on BBL.

The results in the process of developing this model consist of the results at the define, design and develop stages.

b. Product validation analysis of Learning Model.

Product validation of Talking Chips collaborative learning model based on BBL consists of syllabus validation, RPP validation, pre-test questions validation, post-test and retention conducted by experts (lecturers) and users (teachers). Product validation is in the form of quantitative data and qualitative data. The data from the validation results will be analyzed by using the following formula.

$$\text{Va} = \frac{TSe}{TSh} \times 100$$

Table 1. Validation criteria for Talking Chips collaborative learning model based on BBL

Score Achivement (skor)	Validity Category	Description
84<x <100	Very valid	Very good and ready to use
68<x 84	Valid	Products can be used, but minor revisions must be made
52<x <68	Valid enough	Can be used, but the revision rate is greater
36<x<52	Less valid	Can not be used, must be revised on a large scale
20<x<36	Invalid	Cannot be used, the overall revision must be made

c. Effectiveness analysis of Learning Model

The effectiveness of Talking Chips collaborative learning model based on BBL was obtained from the pre-test, post-test data, and student learning retention results which are calculated by using N-gain analysis and the following learning retention formula.

$$\text{Percentage of response} = \frac{posttest\ score - pretest\ score}{Ideal\ score - pretest\ score}$$

Table 2. Normalized-gain criteria

Coefficient level	Criteria
0,7 > g: High	High
0,3 ≤ g ≤ 0,7	Medium
g < 0,3	Low

Meanwhile, the learning retention data were obtained from the results of the delay test conducted 2 weeks after the post-test by using the following formula.

$$\text{R} = \frac{M3}{M2} \times 100\%$$

Table 3. Criteria for students' retention

Retention (R) %	Category
R ≥70	High
60 < R < 70	Medium
R ≤ 6	Low

d. Practicality analysis of Learning Model.

The results of the practicality of Talking Chips collaborative learning model based on BBL were obtained from teacher and students response questionnaires given after the implementation of the learning model development process. The results of the questionnaire can be measured by the following criteria.

$$\text{Percentage of response} = \frac{Number\ of\ respondents'\ answers}{The\ highest\ number\ of\ respondents\ score} 100\%$$

Table 4. Practicality Criteria of Talking Chips collaborative learning model based on BBL

Score Achivement (%)	Validity Category	Description
84<x <100	Very good	Very good and ready to use
68<x 84	Good	Products can be used, but minor revisions must be made
52<x <68	Good enough	Can be used, but the revision rate is greater
36<x<52	Less good	Cannot be used, it must be revised on a large scale
20<x<36	Bad	Very unusable

RESULTS AND DISCUSSION

The development process of a learning model that consists of Define, Design, and Develop stages is described as follows:

a. Define stage result,

The results of the Define stage consisted of front-end analysis by distributing need assessment questionnaires of the 7th grade SMP / MTs teachers of Science MGMP in Jember Regency, totaling 32 respondents. The results of front-end analysis revealed about what learning model that the teacher usually uses and the percentage of teachers in knowing about BBL is 18.75%, while the teachers who do not know about BBL are 78.12%.

The second stage is the student analysis which revealed about the daily test score of the material before the model development is still below KKM. The results of the student analysis were also obtained from interviews with teachers indicating that the average student score had not been obtained maximally.

The task analysis stage is the provision of Student Worksheets (LKS) that contain questions and observations of direct objects that are adapted to the material of Living Things Classification. The concept analysis stage is in the form of a concept map about the living things classification material. The stage of formulating objectives is adjusted to the Basic Competencies (KD) used; KD 3.2 and KD 4.2

b. Design stage result

The results of the Design stage consist of benchmark reference tests in the form of questions given to students, the number of questions given is 10 multiple choice questions and 5 essay questions in 40 minutes. The results of the media selection is media that can optimize the use of environmental learning resources which is in the form of LKS (Student Worksheets), real plants, power points, sound, and opinion cards (chips).

The format selection results are the presentation of learning by using Talking Chips collaborative learning model based on Brain-Based Learning which is adjusted to the learning syntax and be relevant to the learning media used in achieving the existing learning goals. The results of the initial design were the initial design of the Talking Chips collaborative learning model based on BBL.

c. Develop stage result

The results of the Develop stage consist of a) validation of Talking Chips collaborative learning model based on Brain-Based Learning by experts and users b)

revisions from experts and users, c) limited trials conducted directly with real students, d) revisions will be made e) field trials with students based on the revision that has been given so as to produce a learning model that is valid, effective, and practical.

Validation Result of Talking Chips Collaborative Learning Model Based on Brain-Based Learning

a. Instrument Validation

The research instruments that will be validated include the validation sheet of the Talking Chips collaborative learning model based on Brain-Based Learning for development experts and users (teachers), syllabus validation sheets, Lesson Plan validation sheets (RPP), cognitive test validation sheets , practicality questionnaires from users (teachers) and practicality questionnaires from student responses. The obtained data from validation is in the form of quantitative data and qualitative data. The results of the instrument validation revealed that the average aspects of the instructions from the validation results were 93 with a very valid category level. The overall validation of the content aspect is 87 with a very valid category level. The overall language aspect validation is 90 with a very valid category level.

b. Product Validation

Product validation of Talking Chips collaborative learning model based on Brain-Based Learning is in the form of a learning guidebook model, syllabus, lesson plan, and cognitive tests (pre-test and post-test). The obtained data will then be analyzed to determine the validity of the learning model. The average guidebook validation of the overall learning model from experts and users is 89 with a very valid category level. The overall validation of syllabus from experts and users is 88 with a very valid category level. The average validation of the overall RPP is 88.67 with a very valid category level. The average cognitive test validation (overall pre-test and post-test) is 89.33 with a very valid category level.

Limited Test Observation Results

The limited test only involved 9 students in class VII B which were heterogeneously selected based on their cognitive level; high, medium, and low categories. The following are the results of qualitative data from the observer sheet.

Table 5. Results of qualitative data from the observer

No	Sources	Indicators	Critics and suggestions
1	Subject Teachers	Introduction	1) It is better if the teacher explains the techniques or how the students work on the LKS before entering the main activities, and convey the rewards that will be given at the end so that students are motivated to learn seriously.
2	Observer	Time	1) Pay attention in organizing the learning time
		Media	2) Be better to use LCD to

No	Sources	Indicators	Critics and suggestions
			make students understand deeper

Based on the critics and suggestions from the subject tEachers and observers, it appears that there needs to be an improvement that must be added to the large group test. The learning process by using Talking Chips collaborative learning model based on BBL can be applied in large classes with revisions in the following table. The revised table of Talking Chips collaborative learning model based on BBL in the limited test is described in the following table.

Tabel 6. Revision Result of Talking Chips collaborative learning model based on BBL in limited test

No	Limited Test	Large Group Test
1	At this meeting, students are only asked to do the worksheet directly and there is no delivery of rewards before the main activities	Before working on LKS, students are given an explanation of how to work and tell about rewards before the main learning
2	In the Talking Chips learning activity, the time was too long	At the Talking Chips stage, students are given time to discuss and give opinions so that they can use efficiently the learning time
3	The learning process did not use LCD	The learning process uses LCD as media

Effectiveness Result of Talking Chips Collaborative Learning Model Based on Brain-Based Learning

The effectiveness of the Talking Chips collaborative learning model based on BBL on learning outcomes and learning retention can be measured by experimental design using only one class for the data collection process in the form of student grades. The N-gain data from the effectiveness of student learning outcomes (pre-test and post-test) is 0.78 with a high category. Data result about the effectiveness of the learning model was also obtained from learning retention measurements carried out 2 weeks after the post-test. The question given is the same questions. The learning retention data of students in class VII B Junior High School 9 Jember can be seen in Table 4.9 below.

Table 7. Student Learning Retention Results

Retention	Class	Total of Students	Average	Category
	Field test	32	89±11,85	High

Practicality Result of Talking Chips Collaborative Learning Model Based on Brain-Based Learning

The practicality of Talking Chips collaborative learning model based on BBL is obtained from student and teacher response data. The obtained results are as follows.

Table 8. Practicality Questionnaire Data Results of Teacher Responses to Learning Models

No	Indicators	Percentage (%)	Category
1	RPP Instructions	95	Very good
2	Achieved the Competence and	100	Very good

	Learning Objectives		
3	Students' response	93	Very good
4	Difficulty level in Implementation	100	Very good
5	Time management	100	Very good
	Teacher response Percentage	98	Very good

In addition to the teacher response questionnaire data above, there is also student response data found in the table as follows:

Table 9. Practicality Questionnaire Data of Student Response

No	Indicators	Total of Students	Average	Category
1	Interested in learning	32	97%	Very good
2	Usability in learning	32	94%	Very good
3	Interested in the next learning	32	98%	Very good
Students' average response		32	96%	Sangat baik

The discussion consists of the development process of learning model, the validity of Talking Chips learning model based on BBL in the form of product development validation consisting of validation, products, effectiveness of learning models, and practicality of learning models and field test results or the implementation of Talking Chips collaborative learning model based on BBL for Science Junior High School in the Agroecosystem Area.

The discussion on the development process of Talking Chips collaborative learning mode based on BBL begins with the Define stage covering front end analysis by distributing questionnaires to Jember Science MGMP teachers. Then, it was obtained 32 respondents (teachers) from the questionnaire result, data collection techniques with interview and observation. The results of questionnaires for teacher needs (need assessment) revealed that there were several teachers who knew about collaborative learning and had used collaborative learning models in teaching and learning activities. However, most teachers often use cooperative learning models such as Discovery Learning, Problem Based Learning, Conventional, and STAD. The reason teachers use the model is that the learning model is easy to apply and can be accepted by all students. But with this model, it turns out that it still cannot improve student learning outcomes, this is in line with the results of the interviews.

Based on the results of the interview, it was obtained information that the lack of students' interest in learning to read, the level of students in absorbing material is not the same, there are students who dare to ask and there are also students who are still ashamed to ask questions, students are embarrassed to express opinions and cannot make their own questions so that it caused their learning outcomes less optimal and the learning retention is still low. Another thing that can cause low learning outcomes and retention is lack of optimization from the use of learning resources.

The second stage is the students' analysis consisting of several activities such as, analyzing the level of students' academic ability. This study used students who are still junior high school as the subject of research, with a cognitive level that is in the stage of formal operations. The formal operation stage is the stage where a child has begun to think beyond concrete experience, and a child is able to think abstractly,

idealistically and logically [7].

The third stage is task analysis based on Basic Competence (KD) and indicators to be achieved and adjusted to the curriculum, the revised 2013 Curriculum 2016 edition [8]. The assignment given to students is in the form of questions accompanied by a picture of Living things Classification, from these questions students are also given real plants and preserved vertebrate animals to be able to answer the worksheets given. The real plants used are plants around the school environment. The benefits of real plants used in learning are to provide motivation and stimulate students to be able to remember information that has been previously obtained and provide new information [9]. Whereas for animal preservation is taken from the collection in the science laboratory.

The fourth stage is concept analysis, in this concept analysis stage, the stage aimed to analyze the concepts that are relevant for later to be taught and in accordance with the learning model that will be developed. The identified concept analysis will later be made systematically and relevant, and then will be associated with other concepts [10].

The last stage is the fifth stage of formulating learning objectives. The formulation of learning objectives is adjusted to the KI and KD in the revised K13 2016 edition. The purpose of learning is about the Classification of Living things. The formulation of learning objectives must be adjusted to the ABCD format; Audience, Behavior, Condition and Degree). A = Audience belongs to students who become the target because in this case students who learn, B = Behavior is a form of things that can be achieved by students after the learning process, C = Condition is a condition that students use doing the test and D = Degree is a student achievement in achieving behaviors in the learning process [11].

The second stage in the development process of Talking Chips learning model based on BBL is the Design stage. The first step in this stage is the preparation of benchmark reference test that serves to measure student learning outcomes before and after the implementation of the developed learning model developed [12]. The benchmark reference test used is in the form of test questions about 15 questions with 10 multiple choice questions and 5 essay questions, these questions have cognitive levels from C1-C5 with the time allocation to work for 40 minutes.

The second step is the media selection, the function of the media itself is to provide convenience in delivering material so that the delivered material is not too verbalistic and able to overcome the limitations of space, time and sensory power [13]. The third step is the format selection, format selection is a step to choose the format adapted to the learning model that will be used which is the Talking Chips collaborative learning model combined with the Brain-based Learning approach which has 12 principles. The fourth step is the initial design, this initial design is a syntax of combining the Talking Chips collaborative learning model with the BBL approach. The results of the initial design resistance can be seen in Table 4.2 which combines 12 BBL principles with the Talking Chips collaborative learning syntax to produce Talking Chips Learning Model Based on BBL.

The Develop stage is done to get results from the development of learning models that can be used and in accordance with the learning that will be conducted. This Develop stage consists of several steps: 1) Validation of Talking Chips collaborative learning by development experts and users (teachers), 2) Revisions based on validation by experts in the form of qualitative data (critics and suggestions), 3)

Limited trial test, this test was conducted in the direct class involving 9 students divided into low, medium, and high cognitive levels.

The learning model was validated by 2 development experts and users (teachers). The validation process itself serves to provide improvements if there are things that are lacking in order to be valid and usable [14]. Measurement of quantitative validation data is done by using a five Likert scale. The Likert Scale has several questions that reflect the knowledge, behavior and attitudes that each individual has [15]. Valid learning models are measured by the achievement of two criteria; content validity and construct validity [16]

The instrument validation consisted of instrument validation of guidebook model, validation of the syllabus validation instrument, validation of RPP validation instrument, validation of the pre-test and post test validation, validation of the teacher and student response questionnaire validation instruments. Based on the table, the average instrument validation from the validator as a whole is 90, which means that the instrument referred to a very valid category. The second validation got an average validation of the learning model guidebook by 89 in a very valid category. The results of product validation have the overall average validation of the product in the form of learning model guidebook, syllabus, lesson plan, and pre-test & post-test questions that are 89.33 which means the developed learning products are in the very valid and usable category.

The effectiveness of Talking Chips learning model based on BBL can be seen from the measurement result of the pretest and posttest by using one class or better known as the one group pretest posttest design. This one group pretest posttest design is a study that uses one class to be measured and given treatment and re-measurement is carried out after the treatment [17]. The effectiveness of the learning model obtained from the effectiveness data when it is calculated its N-gain value, the result is 0.78 and included in the high category which means that the Talking Chips learning model based on BBL is effective. The learning model is said to be effective if there is an increase experienced by students in cognitive learning outcomes [18].

Effectiveness is also measured by student learning retention, learning retention is closely related to the behavioristic theory which strongly prioritizes on the behavior changes. These behavioral changes can be measured, observed and assessed [19]. The student retention rate is 89 and belongs to the high category. High retention can be obtained from students' understanding of a material concept because in this Talking Chips collaborative learning model the researchers used learning resources directly in the form of plants and animals and LKS which then stimulated students to observe themselves. From here, students' understanding was created [20].

Talking Chips collaborative learning can increase learning retention because students in each discussion are asked to argue using a card, so that each student has experience and opportunities to be active in discussions. Besides, the BBL principle that can increase retention power is the use of music in every learning, the music used during Brain gym is pleasant music. Meanwhile, the music played when students read is instrumental music.

The practicality of the Talking Chips learning model based on BBL was obtained through teacher and students response questionnaires. Based on the student questionnaire responses which amounted to 32 students, it was found that the student response rate was 96%, which meant that the learning model was very practical. The

learning model is said to be practical if a model has been stated by experts and users (teachers) that the learning model can be developed and can produce a reality that shows results in the form of a positive response from teachers and students [21]. Based on the results of student responses, learning by using Talking Chips collaborative learning model based on BBL can make students very happy, easy to understand the material, make students brave to express opinions and be enthusiastic in learning. This is because in the development of Talking Chips learning model based on BBL, students are always trained to do Brain Gym. Brain gym is done with several movements and followed by musical instrument that is adjusted to the students' favorite music. Brain gym itself can be able to balance the work between the right brain and left brain so that students can optimize the learning activities [22].

CONCLUSION

The development process of Talking Chips collaborative learning model based on BBL used 4D research design, but only 3 stages were used, Define, Design, and Develop. Talking Chips collaborative learning model based on BBL is valid due to the existence of the syntagmatic, social system, reaction principle, support system, and instructional impact. Talking Chips collaborative learning model based on BBL is effective because it can improve students learning outcomes and learning retention. Talking Chips collaborative learning model based on BBL is practical because the results of student questionnaire responses regarding to the practicality of the learning model showed very good results.

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