Cooperative Learning Model Design Based On Collaborative Game-Based Learning Approach As A Soft Scaffolding Strategy: Preliminary Research

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***Abstract*—This research was aimed to describe the implementation and development needs of cooperative learning model design based on collaborative game-based learning approach at school and to design cooperative learning model based on collaborative game-based learning approach as a soft scaffolding strategy based on needs. The study was conducted in three private high schools in Bandar Lampung. The research method applied is a survey method with cross sectional design using questionnaire. The development included preliminary research and gathering the data, planning, and designing the product. The preliminary study results showed that we needed to develop a learning model design based on collaborative games to create a more conducive atmosphere and to reach learning outcomes more optimally. Model development design was conducted through study of literature. Cooperative learning model initial design based on collaborative game-based learning approach was succesfully developed named BIGSAGGIR, including the main syntax of Building, Identifying, Guiding, Simulating, Analyzing, Generalizing, and Giving Reward. (*Abstract*)**

Keywords— cooperative learning model; collaborative game-based learning approach; soft scaffolding (key words)

I. INTRODUCTION

Physics learning outcomes is a crucial component which should be achieved optimally when the teacher held a lesson in class. According to [1], sometimes teachers think that they have explored the abilities of students to understand the concept of certain material through the teaching which they apply, but the reality is not so. The way to improve the student's science process skill, as in [2], the teacher should have a learning process including the steps of controlling variables, defining operational variables, formulating hypothesis, formulating model, interpreting data, and experimenting. As stated in [3], the learning process is closely related to the learning model. The reality showed that one of the learning model often applied by the teachers is cooperative learning model. Cooperative learning model is defined as a model which guides students work in team to complete the task decided by the teacher [4], while as in [5], cooperative learning model is an active method which require appropriate teaching and learning stages. References [6] and [7] describe that cooperative learning model can improve team-work skill. Cooperative learning model can be implemented through some learning syntaxs including positive interpendence, individual accountability, face-to-face promotive interaction, appropriate use of collaborative skill, dan group processing [8]. So, it means that cooperative learning model is defined as a learning model which requires students to work either in a group to accomplish tasks that have been determined by the teacher based on certain stages.

Researchers lead the study to the development of cooperative learning model because cooperative learning can offer a learning situation that is fun for all students, all students can have equal opportunities, competition between groups can strengthen the friendship, the spirit of working together can be increased, and all students can explore the capabilities and creativities [9]. However, according to [10], to direct the learning in the classroom toward cooperative learning, one of the keys is planning to obtain optimal learning objectives. There are several things that need to be considered in planning a learning model to be applied in the classroom, especially for cooperative learning model, they are: tasks completed by the student, the form of reward that will be given to a group that showed a positive performance, and assessment of the achievements of every student at every learning phase [11]. By knowing what is happening in the classroom, the teacher will understand things that affect the interaction between the students with the knowledge and learning, so teachers would be more adept at designing a better learning system [12].

One approach that can be taken into consideration in designing a cooperative learning model is collaborative game-based learning approach. Game-based learning is defined as a learning strategy that focuses in the achievement of learning goals in particular of the learning content delivered through playing techniques [13]. Game-based learning requires

students to be actively involved and participate in the learning process. Currently, the game is rarely implemented by teachers as one of the strategies to attract the attention of students. In fact, according to [14], playing may be one of the reasons why students want to learn and can provide the opportunity for students to express, explore, and change their conceptual understanding. The implementation of game-based learning also needs to consider about the teachers' pedagogical abilities and the appropriate assessment tools. Reference [15] revealed that the game context in learning process will make students involved and participate in learning.

In this article, researchers will use a collaborative game-based learning approach in the implementation of cooperative learning model. According to [16], collaborative learning is defined as learning situation that consist of more than one student in a collaborative learning environment (more than one game) that requires the involvement of student roles to achieve certain goals. Reference [17] stated that the collaborative game-based learning involves the use of a multi-player game design to develop collaborative learning among students involved in learning. Through the process of collaborative learning in a collaborative learning environment, it will assist students in generating new ideas to complete the learning task [18].

Reference [19] stated that the game has the potential to provide a high positive impact on the learning process. Through playing activities, students can get the chance to see the situation from many perspective, it is one of the concepts of learning theory of constructivism [20]. To design a game based learning, teachers need to understand the students' everyday knowledge [21]. Reference [22] stated that the activity of playing a role has been widely applied in the science classroom because it can help students learn complex things. Collaborative game-based learning approach which is combined with a cooperative learning model will get optimal results if they are supported by an effective learning environment. Reference [23] provides a list of characteristics or requirements of an environment said to be an effective learning environment, such as (1) provide an opportunity to achieve high intensity of interaction and feedback, (2) have a clear learning goals and procedures to achieve them, (3) can motivate all the participants involved in that environment, (4) provide a challenge and motivate students to complete tasks, (5) create a direct engagement atmosphere between students with tasks prescribed, (6) provides tools, property, or instruments which are accordance with students' tasks, and (7) avoid distraction and discruptions factors that can ruin the students experience. Games designed for the learning process should be educative. The main characteristic of an educational game is consisted of the essential learning content. The game must be able to motivate students [24]. However, any form of the game that will be designed, game can attract students to participate. There are some main steps which are very important that there should be on a learning game, such as seeking information, choosing the appropriate information, developing a discussion strategy, resolving conflicts, and improving ability to take a decision and have a negotiation. Then reference [25] added that a game can be described through six following process, (1) a player must take a role or assumes itself as other characters that suit the environment, (2) players must perform a task that has been instructed, automatically definitely all of those will show progress, (3) the player will learn the ' new vocabulary' in rules and the game character, (4) the player interacts with the environment, (5) players do not have judgment system directly to absorb information based on a player's perspective.

Researchers also focus in the development of effort to provide a strategy for Physics teachers at school to provide soft scaffolding for students through interaction that will take place during the model implemented later. According to [26], scaffolding is divided into two types, soft and hard scaffolding. Example of the soft scaffolding type in the classroom is when the teacher has an interaction and conversations with students who need help [27]. Thus, soft scaffolding will have a role as a support to all students who have difficulties in learning process. We also have to remember that the type of support needed by students must be related to the student needs and difficulties of when learning takes place [28]. However, to apply the correct and consistent scaffolding is very difficult for a large class with a number of students who have differential difficulties. Researchers will focus in the development of model design that lead to attract the attention of students through a task, directing students to a lot of debate, discussion, simulation, and then help the student to complete an assigned task. One soft scaffolding strategy through the development of this learning model is very relevant example of a strategy called modeling is already widely used by other researcherss. Modeling is widely used to demonstrate the student's assignments expected in accordance with the needs of students [29], to present a learning step, to attract students to continue to interact in a problem or task given [30].

Based on the explanations above, researchers intends to develop a cooperative learning model based on collaborative game-based learning approach in learning physics to achieve more optimal learning outcomes. The purpose of development research is to describe the implementation and development needs of cooperative learning model design based on collaborative game-based learning approach at school and to design cooperative learning model based on collaborative game-based learning approach as a soft scaffolding strategy based on needs.

II. METHODS

A. *Participants*

Researchers conducted a needs analysis of model design development from the perspectives of three teachers and twenty students in three private high schools in Bandar Lampung.

B. *Procedures*

This study was conducted using research and development method. In this development research, we present cooperative learning model design based on collaborative game-based learning approach in high school physics learning as a soft scaffolding strategy. The development procedures conducted

refered to [31], including the steps of: (1) preliminary research and gathering data, (2) planning, and (3) developing the initial product.

The development of the initial product was conducted through the study of literature. The prototype of cooperative learning model developed in this study was designed based on the model framework belongs to [32], which includes theoretical rational, syntax, the principle of interaction, the social system, the support system, and the impact of learning.

C. Assessment Measures

Methods of data collection and needs analysis were carried out using survey method with cross sectional design by distributing questionnaires to teachers and students in three private high schools in Bandar Lampung. The data was obtained using questionnaire. The questionnaire of the teachers needs consisted of 31 items and 18 items for students. Data analysis techniques were conducted by: (1) coding data, (2) making a tabulation based on the classification made, (3) giving score to each item, (4) processing the total scores, (5) calculating the percentage of each item, (6) calculating the average percentage of questionnaires, (7) visualizing the data, and (8) interpreting the overall percentage.

III. RESULTS AND DISCUSSION

This development research was conducted up to the third stage of the research procedures in [9], it was developing the initial product. Researchers analyzed the needs of models design development. Results of the teacher needs analysis were shown in Table 1.

TABLE I. RESULTS OF THE TEACHER NEEDS ANALYSIS

Observation Aspect	Results
Teachers opinion about the implementation of cooperative learning model based on game-based learning approach.	67% of teachers often plan a learning model before entering the classroom and apply the model has been designed.
	67% of teachers often use the cooperative learning model, but only 33% of teachers who ever applied the cooperative learning model based on game.
	The games had ever implemented consisted of 67% varied games and 33% not varied games.
Teachers viewpoint when teaching physics.	All teachers often feel confused about what kind of the learning model they have to use in physics learning process in the classroom.
	67% of teachers often face difficulties to make the class condition become conducive and fun.
	Only 33% of teachers always feel happy and get spirit when they will teach in the classroom.
	67% of teachers agreed that for this recent time, the conventional learning by providing a broad range of material (concept + application) would be more meaningful than a fun learning (using the game) with less the core concept.
	All teachers argued that they often apply conventional learning in conveying difficult materials of physics.
Teachers opinion about the development needs of cooperative learning model based on game-based learning approach as soft scaffolding strategy.	All teachers agreed that cooperative learning model can facilitate teachers in teaching physics materials to students and learning will be more effective.
	No teachers argued that students will feel bored in learning when teachers use cooperative learning model based on game.
	All teachers believed and agreed that students achievements can be improved when teachers use cooperative learning model based on game.
	Only 33% of teachers ever personally designing cooperative learning model based on game.
	No teacher who had experience in designing their own model of cooperative learning based on game as a soft scaffolding strategy.
	All teachers found difficulties in designing their own cooperative learning model based on game.
	All teachers agreed if researchers develops a cooperative learning model based on collaborative game (more than one game).
	All teachers agreed if researchers develops a cooperative learning model based on collaborative game. (more than one game) as a soft scaffolding strategy.
	All teachers indicated their willingness to implement cooperative learning model based on collaborative game which has been developed.

Based on the analysis in Table I, it can be concluded that required development of cooperative learning models based on game-based learning approach as a strategy of soft scaffolding for students. Meanwhile, for the analysis of the students needs were shown in Table II.

TABLE II. RESULTS OF STUDENTS NEEDS ANALYSIS

Observation Aspect	Results
Students opinion about the implementation of cooperative learning model based on game-based learning approach.	All students stated that their teachers often ask them to make groups with friend while learning.
	75% of students said they are always present in learning Physics.
	Only 40% of students stated that Physics is a fun lesson.
	65% of students said that studying in groups can increase motivation to learn physics.
	35% of students did not like working in groups for provoking.
	40% of students admitted that they are easily bored when learning Physics.
	65% of students said that learning physics really needs a high concentration.
	65% of students felt happy and fun to work in teams or groups and they argued that studying in groups can help them to solve the problem.
	65% of students said that studying in groups make them easier to understand physics materials.
	75% of students said that learning physics while playing a game in a group can make them unbored.
	75% of students agreed that learning physics while playing a game in a group can make them happier.
	75% of students admitted that learning physics by discussing is more fun than learning by doing exercises.
	40% of students admitted that their teachers always ask them when they were in trouble.
	40% of students admitted that their teachers always help them to solve the problem during the learning process.
	90% of students said that the teachers gave assignments in every topic that must be completed by

Observation Aspect	Results
	each group through a discussion.
	All students admitted that they always do the task given by the teacher.
	All students stated that their teachers never gave a reward to the best group.

Based on the analysis in Table II, it can be concluded that most of the students were very happy when the learning Physics was collaborated with gaming. Determination of the number of the items on the questionnaire for teachers was based on the cross sectional method used. The researchers was trying to uncover the factors that contribute to the implementation of cooperative learning model based on game-based learning approach. Factors used by researchers were the viewpoint and knowledge of teachers about cooperative learning model based on game-based learning approach. Based on the teacher needs analysis, it can be concluded that teachers' viewpoint and pedagogical could affect the process of implementing the model implemented by the teacher.

Cooperative learning model based on collaborative game-based learning approach that will be developed is more hands-on learning game oriented so that students will participate directly in the classroom as a team or group, it is based on the results of needs analysis. So, the game will be included in the activity is not virtual learning game, but it prefers to games that are real. Then, after the researchers got the conclusion regarding to the development needs, researchers went to the next procedure. It was developing the initial products. The stages have been done by researchers to produce a cooperative learning model based on collaborative game-based learning approach as a soft scaffolding strategy were described as follows.

In the first stage, which was constructing the framework, researchers created a framework to explain how learners can study well through the model will be developed. Of course, the framework was supported by data from preliminary research and literature studies.

In the second stage, which was conducting literature studies, researchers explore some references related to the theory that could support the model will be developed.

In the third stage, which was developing the model syntax, researchers conducted some processes including identifying characteristics of the model, defining the syntax framework of operational models, making a chart of operational models, describing each step in the syntax model, identifying the characteristics of games that will be loaded in learning, designing learning activities based on the approach used, then mapping the activity in each syntax. Researchers developed a syntax that focuses on base of collaborative game-based learning approach.

In the fourth stage, which was identifying the principle of interaction, researchers categorized the activities and types of interaction that should be done by teachers at each syntax designed. Interaction which should be raised by teachers was very important in supporting the learning process that takes place.

In the fifth stage, which analyzing the social system, researchers identified the system and environment such as what would appear through the developed model.

In the sixth stage, which analyzing the support systems, researchers identified any components that can support the successful implementation of the developed model. The support system was meant here could be the learning devices which is suitable with the model successfully developed.

In the seventh stage, which analyzing the impact of instructional, researchers identified the impacts that will arise if the instructional model successfully applied. The results of this instructional impact will certainly be proven empirically by the data on student learning outcomes. However, researchers have not reached the stage of implementation of the model yet.

Overall, the steps being taken by researcher would never been separated from the efforts to provide a scaffolding strategy for students. Finally, after going through these stages, the main syntax successfully developed including: Building, Identifying, Guiding, Simulating, Analyzing, Generalizing, and Giving Reward. The model design successfully developed was named BIGSAGGIR models that can be seen in Fig. 1. The reason in determining the syntax as it has previously described, based on the basic syntax of the cooperative model expressed in [33]. According to him, the syntax of cooperative learning model consists of six phases that can be seen in Table III.

TABLE III. COOPERATIVE LEARNING MODEL SYNTAX

Syntax	Teacher Activity
Step 1: Outlining the learning purposes and prepare learners.	Explaining the learning purposes and prepare learners to get ready in studying.
Step 2: Presenting informations.	Presenting informations to students verbally.
Step 3: Organizing students in groups.	Giving explanations to the students about how the formation group and help the group carry out an efficient transition.
Step 4: Helping the teams work and learn.	Helping groups to complete the tasks.
Step 5: Evaluating	Examining the learners knowledge about the materials when they presentate the learning results.
Step 6: Giving reward	Preparing the way for giving appreciation of the efforts done by learners.

(Suprijono, 2009)

The similarities of the model syntax successfully developed with the existing syntax of cooperative learning model can be seen in Table IV.

TABLE IV. THE SYNTAX ANALOGY OF BIGSAGGIR MODEL AND THE EXISTING COOPERATIVE LEARNING MODEL

The Existing Cooperative Learning Model	BIGSAGGIR Model
Outlining the learning purposes and prepare learners.	• Building (outlining the learning purposes, building preparadness of learners to study, and motivate learners)
Presenting informations.	• Identifying (showing phenomena and identifying the problems)
Organizing students in	• Guiding (guiding the learners to make

The Existing Cooperative Learning Model	BIGSAGGIR Model
groups.	groups)
Helping the teams work and learn.	• Simulating (simulating the hands-on learning game) • Analyzing (analyzing the relationship between games and the material contents)
Evaluating	• Generalyzing (generalyzing and communicating)
Giving reward	• Giving Reward (giving reward and appreciation)

The model successfully developed focuses on collaborative game-based learning approach. The approach exactly emphasizes the collaborative game load on student learning activities. The complete draft of BIGSAGGIR model successfully developed is presented as follows.

A. Rational

Understanding the concept of physics is an important part of the learning objectives of Physics. It means that students achieve these goals. The students' achievements often become speculative for every teacher. Applied learning models can be a significant influence. Learning tends to be boring and monotonous would make students do not give a positive response in learning. One that can be ice breaking in learning is cooperative model with a collaborative game approach. The results showed that not all teachers are able to design an educational game for learning in the classroom. This cooperative learning model was developed as an effort to help teachers create a conducive learning atmosphere and achieve the expected learning goals especially associated with the soft scaffolding strategy for students. Thus, students not only perform activities of scientific learning, but also students can explore their ability to discuss and simulate what have been learned.

B. Theoretical Framework

This model is expected to help students acquire a learning experience to increase conceptual understanding the material being learned. Researcher lead to the development of cooperative learning model because cooperative learning can offer a learning situation that is fun for all students, all students can have equal opportunities, competition between groups can strengthen friendship, spirit of working together and participate to be increased, and all students can explore the capabilities and creativity. The game has the potential to provide a high positive impact on the learning process. Through playing activities, students can earn the chance to see the situation from many perspectives, it is one of the concepts of learning theory of constructivism. Activities based on a collaborative game-based learning approach can be designed in such a way by the teachers to give positive effect significantly to the learning achievement if it has been packed in cooperative learning models, so can produce a soft scaffolding strategy for students.

C. Learning Model Syntax

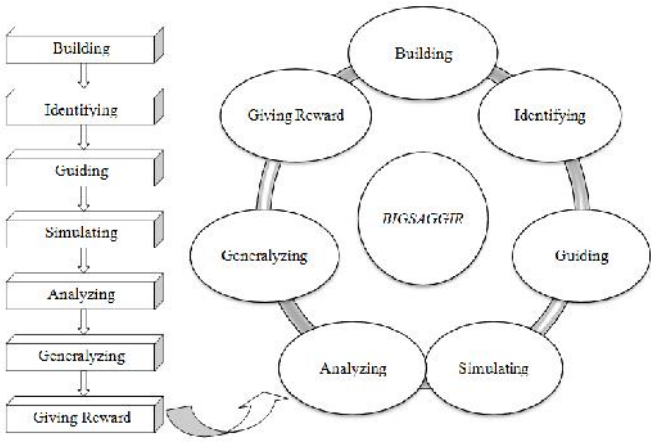
Phase 1: Building

In this phase, there are three core activities, such as outlining the learning purpose, motivating, and giving apperception related to the materials that will be discussed. At this stage, students will build the initial perception of the context of the material. The student activity is only activating all the senses to build a readiness to learn, while the teacher activity is explaining the learning purpose to students and raise students' motivation and readiness to learn.

Phase 2: Identifying

In this phase, the activity is presenting phenomena and identify problems. The students are guided by the teacher to identify the problems where the answer will be found through the games. The student activitiy is using senses in every activity that is presented by the teacher, for example listening to what is conveyed by the teacher and thinking it logically, observing the phenomenon shown by the teacher, by asking questions. While, the teacher activities is providing information through verbal presentations, audio, and visual. The information provided is not information that is only enrich the knowledge of students, but also can stimulate learners to discover the problem or phenomenon to be found the answer after the students followed the learning process. The information provided must also be associated with learning topics being discussed.

Fig 1. BIGSAGGIR Model Syntax



Phase 3: Guiding

In this phase, the activity is making groups. So, the teacher will act as a guider to provide instruction and guidance to the students related things to do. The student activity is following the instructions and directions given by the teacher as well as playing an active role in an opinion if there is something that does not fit in the formation of the group. This step is very meaningful to build critical social attitudes of learners to establish a partnership. While, the teacher activities are giving instructions and clear direction to the students in groups. Instructions and directions can be presented verbally. Groups can be formed in accordance with the agreement between teachers and learners. If the formation of groups is based on

the policy of the teacher, then the teacher can combine learners based on the capabilities. At this stage, the teacher should explain the characteristics and rules of the game that will be played by learners. Teachers must ensure that all students have a grasp of the information presented by the teacher. Teachers also have to explain what students have to do in group.

Phase 4: Simulating

In this phase, the core activity is simulating the hands-on learning games that have been agreed. Had the teacher wanted to try the students understanding of the rules of the game, the teacher can do trial in advance. If all learners already know, the game can be started again from beginning. If there are students who do not understand, then the teacher should explain the rules of the game. Activities of students at this stage are to simulate the game and play without any burden, but still based on the task to be performed by students. While the teacher activities are overseeing and controlling all activities of students. Teachers must ensure that all learners can actively participate in the learning process. Therefore, the game created should be able to reach the number of learners in the classroom. Game created must reach capabilities, characteristics, pleasure and knowledge of learners.

Phase 5: Analyzing

In this phase, students will be guided to analyze and relate the games played with the material being learned. The student activity is analyzing the relationship between games with the material contents. The proses of analyzing can be guided by the teacher through discussion, questions and answers between groups, to giving the next task. Students must work in groups. The analysis procedure must be remained by the teacher so that the students focused on the discovery of the answer to the initial problem formulation. The analysis result can be descriptive or mathematical analysis that can enhance students' knowledge both factual knowledge, conceptual, procedural, and metacognition. While the teacher activities are as facilitators and mediators. The teacher should provoke students to demonstrate their skills in analyzing and inferenting. The teacher should also do an elaboration. The analyzing process should be up to the discovery of the answer to the problem formulation specified in Phase 2 (Identifying).

Phase 6: Generalyzing

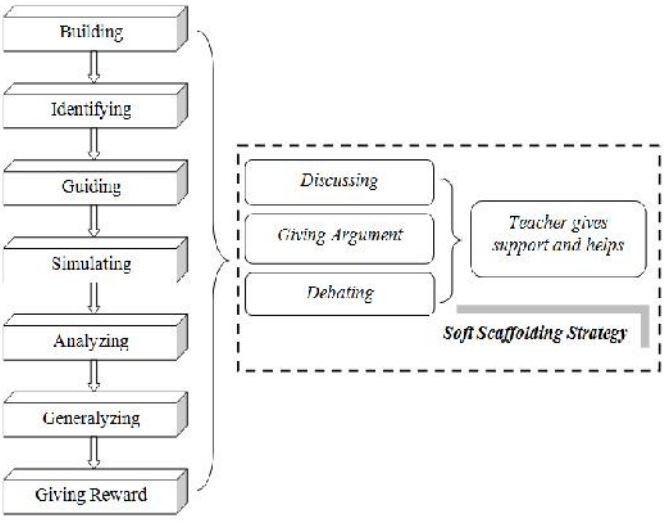
In this phase, the core activities are generalizing and communicating. The student activity is generalizing the material concept. After the students analyze, they must take the understanding of the concept in general and conclude what is gained during lesson. Students should also be able to relate the concept of the material with a game that has been played. After they are able to generalize, each group must communicate what the group discussion results. The communicating activities can be in making a display, supported by verbal media, audio, and visual. While the teacher activities is examining the students knowledge about a variety of learning materials when the groups present their result.

Phase 7: Giving Reward

In this phase, the core activity is giving reward and appreciation. The teacher should give an appreciation and reward for the best groups based on specific characteristics. Appreciation and reward can be a point for groups, grades, prizes, and others. Teachers can explore when you want to give appreciation.

The relationship between BIGSAGGIR model with a soft scaffolding strategy will developed can be seen in Fig. 2. Thus, the soft scaffolding strategy created by the researcher will be based on three activities, such as discussing, giving arguments, and debating. The model design developed will try to encourage all students to actively involved in learning activities and interact each other. The final target of soft scaffolding strategy is providing support and assistance through direct communication when learning takes place.

Fig 2. The Soft Scaffolding Strategy in BIGSAGGIR



D. The Principle of Interaction

In BIGSAGGIR, the teacher act as guider and facilitators, the teacher in charge of determining the games rules must be obeyed by students. Students will act as the executor who will carry out the tasks that have been instructed. Learning devices will act as the sources to make the process of generalization and acquisition of the final draft will be accepted by students. So, in the implementation of BIGSAGGIR model, the learning process will be student-centered, the teacher only provides instruction and assistance to students. Learning devices provided by the teacher will act as link for students to relate the game played with the concept of the material contents being learned. The interaction between teachers, students, and learning devices is an active interaction and mutually contribute to each other. However, the larger role is students.

E. The Social System

The social system which will be established through the BIGSAGGIR model is actually the same as the cooperative model of social system in general. The philosophy of constructivism especially social constructivism is a basic of the development of this BIGSAGGIR model. This model emphasizes the construction of knowledge based on the perspective of the students in a group learning environment through collaborative gaming activities, so that each individual can play an active role with its own responsibilities as well as each individual will strengthen the knowledge gained through group learning environment based on collaborative game. The collaborative game meant is hands-on learning game consisted of more than one game. The learning group of this model is a cooperative learning group in which there exists a sense of friendship, so that the discussions and the information exchange created can run conducive until find the answer to every problem has been determined from the beginning of activities.

F. The Support System

The support system is a required system so BIGSAGGIR model can be implemented optimally. Support systems required in the implementation of this learning model BIGSAGGIR including: the teacher's pedagogical competence as a guider, conducive rooms, the teacher's competence in developing appropriate learning tools. The teacher's pedagogical competence is a capability how the teacher can teache and provide guidance to students, because the teacher must be able to control the class when the teacher implement this BIGSAGGIR model. The teacher proficiency in attracting the students attention is one of successful key to implement the BIGSAGGIR model. The conducive room is also one of the very important supporting factors. Without adequate learning space, then the game can not be played freely and flexible by the students. While learning devices means any component of the devices that support the continuity of the learning process, ranging from the competence standard and basic competence maps, syllabus, learning implementation plan, student worksheets, media, handbooks, and a conducive learning environment.

G. The Instructional and Nurturant Effects

The instructional effect gained is the students ability in mastering the learning material either cognitive, affective, and psychomotor domain. While the nurturant effect that appear is positive values in motivating students to learn. With the application of the model BIGSAGGIR, hopes will grow a sense of fun and enthusiasm on students when they learn physics.

IV. CONCLUSION AND SUGGESTION

Had successfully developed a cooperative learning model design based on collaborative game-based learning approach. The learning model is named BIGSAGGIR which the main syntaxs are Building, Identifying, Guiding, Simulating, Analyzing, Generalizing, and Giving Reward. BIGSAGGIR model was designed with procedures developed by the researcher themselves, using the framework of Sudiarta (2005). The model design successfully developed based on the results of preliminary research which indicate that we need to develop a design of learning model based on collaborative game as a soft scaffolding strategy to create a more conducive atmosphere in classroom and achieve the learning goals optimally. Hopefully in the next research, there will be the next step in validating the design model so the model can be implemented.

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