

The Effect of the Talking Chips Learning Model on Students' Learning Outcomes in Environmental Change Topics

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Abstract

This study was conducted to (1) describe the learning outcomes of students taught through the Talking Chips learning model and (2) determine whether the Talking Chips learning model significantly affected students' learning outcomes on environmental change topics at SMA Negeri 10 Makassar. The study employed a quasi-experimental design using a nonequivalent control group design. The instrument used was a validated 30-item multiple-choice test administered in pretest and posttest forms. Data were analyzed through descriptive statistics, normalized gain (N-Gain), normality testing, homogeneity testing, and independent sample t-testing. The findings showed that the experimental class improved from a pretest mean of 45.54 to a posttest mean of 86.26, whereas the control class improved from 41.03 to 79.20. The N-Gain mean of the experimental class was 0.74 (high category), while that of the control class was 0.65 (moderate category). The independent sample t-test on N-Gain scores yielded a significance value of 0.003 ($p < 0.05$), indicating a significant effect of the Talking Chips learning model on students' learning outcomes. These results show that Talking Chips can strengthen participation, equalize speaking opportunities, and improve learning achievement in environmental change learning.

Keywords: Talking Chips, learning outcomes, environmental change, cooperative learning, biology education

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Introduction

Biology learning is closely related to the systematic study of nature. Therefore, biology learning is not merely a collection of facts, concepts, and principles, but also a process of discovery that helps students understand the natural world in meaningful ways. At the secondary-school level, biology learning is also expected to foster students' awareness of environmental preservation and their ability to relate science to everyday life. In this context, learning success becomes an important indicator because it reflects the extent to which instructional goals have been achieved.

Learning outcomes may be influenced by both internal and external factors. Internal factors include students' physical and psychological conditions such as health, motivation, prior ability, readiness, aptitude, and interest, whereas external factors include family, school, and community environments ([Slameto, 2010](#)). Learning outcomes are therefore not produced by a single factor alone. They are formed through the interaction between students' readiness and the quality of the learning process provided in the classroom. As noted by [Sudjana \(2012\)](#), learning outcomes function as indicators of the success of both the process and the results of instruction.

In practice, however, biology learning often still faces classroom problems that reduce the quality of student engagement. Based on initial observations conducted at SMA Negeri 10 Makassar, learning activities were still dominated by the teacher, with students tending to be passive and having limited opportunities to develop independently. This condition was reflected in the low achievement of students on environmental change material. The minimum mastery criterion (KKM) for biology was 75, yet the proportion of student achievement was still unsatisfactory, with only 25% in the high category, 35% in

the medium category, and 40% in the low category. Such findings indicate the need for an instructional model that can increase student participation and optimize the learning process.

The importance of selecting an appropriate learning model has been emphasized in many educational studies. A learning model provides a systematic pattern for organizing teaching and learning activities in order to achieve instructional objectives ([Sani, 2019](#)). Teachers are expected to select models that fit the nature of the material, the characteristics of the learners, and the time available in class ([Shoimin, 2017](#)). Through a suitable learning model, teachers can help students obtain information, ideas, ways of thinking, and opportunities to express those ideas actively ([Suprijono, 2010](#)).

One cooperative learning model that can be used to address uneven participation in group learning is Talking Chips. Talking Chips was introduced by Spencer Kagan and later became widely known in Indonesia as the *kancing gemerincing* technique ([Fathurrohman, 2015](#)). This model gives each group member an equal opportunity to contribute ideas and to listen to the opinions of other members ([Huda, 2011](#)). In practice, each student is provided with chips or cards. Every time the student speaks, one chip is placed in the center of the group. Students who have used all their chips must wait until all members have also used theirs. This procedure is designed to reduce domination by more vocal students and to encourage passive students to speak.

The Talking Chips model has several pedagogical advantages. It promotes equal participation, shared responsibility, and a relaxed classroom atmosphere while ensuring that every student has the chance to contribute ([Isjoni, 2010](#)). In addition, the model can help students express opinions, discuss ideas, and build understanding collaboratively. Nonetheless, the model also has limitations, particularly in relation to classroom management, time allocation, and the teacher's need to monitor all students carefully, especially in large classes ([Isjoni, 2010](#)).

Previous studies have provided evidence that Talking Chips can positively affect students' activeness and achievement. [Afianti et al. \(2017\)](#) reported that the implementation of the *kancing gemerincing* cooperative model increased both student activeness and learning mastery. [Nurani \(2017\)](#) found that Talking Chips supported by visual media improved students' ability to provide examples of globalization effects in their environment. [Satriani et al. \(2018\)](#) showed that the Talking Chips model produced higher science learning outcomes than conventional learning. Similar results were also reported by [Sinurat \(2018\)](#), [Bayharti et al. \(2017\)](#), and [Widyaningrum et al. \(2018\)](#), who found that Talking Chips contributed positively to learning achievement, classroom participation, and environmental awareness in different contexts.

Although a number of studies have shown the potential of Talking Chips, research on its implementation in environmental change material at the senior high school level, particularly at SMA Negeri 10 Makassar, remained limited. Environmental change material requires students not only to recall concepts, but also to explain pollution, analyze causes and impacts, and propose environmental solutions. Because of these demands, the material requires a learning environment that encourages participation and equal contribution among students. Based on this background, the present study was conducted to describe the learning outcomes of students taught using the Talking Chips model and to test whether the model significantly affected students' learning outcomes on environmental change topics at class X SMA Negeri 10 Makassar.

Method

This study employed a quasi-experimental method. According to Sugiyono (2017), quasi-experimental design involves a control group but does not fully control all external variables that may influence the implementation of the experiment. The design used in this study was the nonequivalent control group design, in which both groups were given pretests and posttests, while only the experimental class received the Talking Chips treatment.

The research was conducted at SMA Negeri 10 Makassar in the even semester of the 2020/2021 academic year. The population consisted of all students in class X MIPA, namely X MIPA 1 to X MIPA 7, totaling 246 students. The sample was determined by purposive sampling, resulting in class X MIPA 1 as the experimental class and class X MIPA 4 as the control class. Each class consisted of 35 students. The independent variable in this study was the Talking Chips learning model, whereas the dependent variable was students' biology learning outcomes on environmental change material. In this study, the Talking Chips model was understood as a cooperative learning model that encouraged each student to contribute opinions by using chips or cards during group discussion. Learning outcomes referred to students' cognitive scores obtained from the post-instruction test.

The instrument used for data collection was a learning-outcomes test in the form of 30 multiple-choice items with five alternatives. The test was administered twice: as a pretest before treatment and as a posttest after treatment. The test had previously been validated by two validators. The items were arranged based on environmental change material and were intended to measure students' cognitive learning outcomes.

Data were analyzed using descriptive statistics and inferential statistics. Descriptive analysis was used to describe the mean, minimum, maximum, standard deviation, distribution category, and learning mastery of both classes. The categories of learning outcomes were grouped into very good (93–100), good (84–92), sufficient (75–83), and low (0–74). Mastery was determined based on the minimum criterion score of 75. To examine learning improvement, the normalized gain (N-Gain) score was calculated and interpreted as high ($g \geq 0.70$), moderate ($0.30 \leq g \leq 0.70$), or low ($g < 0.30$). Inferential analysis consisted of normality testing, homogeneity testing, and an independent sample t-test on the N-Gain scores at a significance level of 0.05.

Research Results and Discussion

The pretest results showed that the initial achievement of students in both classes was still low. The experimental class obtained a mean pretest score of 45.54, while the control class obtained 41.03. Both classes were therefore still below the minimum mastery criterion before the treatment was given. In the pretest distribution, all 35 students in the experimental class and all 35 students in the control class were in the low category. These results indicate that both classes started from a relatively comparable baseline, although the experimental class showed a slightly higher average.

Table 1. Descriptive Statistics of Students' Learning Outcomes

Statistic	Experimental Pretest	Control Pretest	Experimental Posttest	Control Posttest
N	35	35	35	35
Minimum	20	23	67	57
Maximum	70	57	100	97
Mean	45.54	41.03	86.26	79.20
Std. Deviation	14.69	8.90	7.69	8.21

After the treatment, the posttest results demonstrated a notable increase in both groups, with the experimental class showing a stronger improvement. The mean posttest score of the experimental class reached 86.26, whereas the control class reached 79.20. The descriptive distribution also showed that the experimental class had 10 students in the very good category, 11 in the good category, 10 in the sufficient category, and only 4 in the low category. In contrast, the control class had only 2 students in the very good category, 5 in the good category, 17 in the sufficient category, and 11 in the low category.

This pattern suggests that the Talking Chips model produced a more favorable distribution of achievement levels than conventional learning.

The mastery data reinforce this conclusion. Before treatment, no students in either class reached mastery. After treatment, 31 students (88.57%) in the experimental class achieved mastery, while only 24 students (68.57%) in the control class did so. Thus, the Talking Chips class not only obtained a higher average score but also showed better mastery attainment across the class.

Table 2. Learning Mastery and N-Gain Results

Group	Mastery (%)	Mean N-Gain	Category
Experimental	88.57	0.74	High
Control	68.57	0.65	Moderate

The normalized gain analysis showed that the experimental class achieved a mean N-Gain score of 0.74, which belongs to the high category, whereas the control class obtained 0.65, which belongs to the moderate category. Although both classes improved, the experimental class showed a higher gain. This confirms that the Talking Chips model was more effective in supporting improvement in learning outcomes than conventional instruction.

Before conducting hypothesis testing, the prerequisite analyses were performed. The normality test results showed significance values greater than 0.05 for all pretest and posttest datasets in both classes, indicating that the data were normally distributed. The homogeneity test yielded a significance value of 0.829, which was also greater than 0.05, showing that the variance of the data was homogeneous. Because both assumptions were met, the independent sample t-test on N-Gain scores could be conducted.

Table 3. Inferential Analysis Summary

Analysis	Result	Interpretation
Normality test	Sig. = 0.200; 0.087; 0.200; 0.200	All datasets normally distributed
Homogeneity test	Sig. = 0.829	Homogeneous variance
Independent sample t-test on N-Gain	Sig. (2-tailed) = 0.003	Significant effect of Talking Chips

The t-test result showed a significance value of 0.003, which is lower than 0.05. Therefore, the hypothesis was accepted, meaning that the Talking Chips learning model had a significant effect on students' learning outcomes in environmental change topics. This finding is consistent with the descriptive pattern already presented, in which the experimental class outperformed the control class in mean score, mastery level, and N-Gain improvement.

The effectiveness of the Talking Chips model can be explained from the nature of the learning process it creates. In the experimental class, students became more active and more involved in classroom interaction. The model required every student to use chips or cards when expressing an opinion, thereby providing equal opportunities for all members of the group to participate. This finding is in line with [Huda \(2011\)](#), who explained that Talking Chips is designed to ensure that each group member contributes ideas and listens to others. It also supports the view of [Lie \(2010\)](#) that the model prevents domination by a few students while encouraging all students to take part in discussion. This interpretation is also supported by [Sarifa et al. \(2021\)](#), who found that Talking Chips improved not only students' learning outcomes but also their interpersonal intelligence, cooperation, empathy, and listening skills.

The result also supports the broader principle that student-centered learning can improve understanding and retention. Through learning models, teachers are able to organize activities that help students obtain information, think actively, and express ideas during the learning process ([Suprijono](#),

2010; [Shoimin, 2017](#)). In environmental change topics, such engagement is particularly important because students must not only remember information but also analyze causes of pollution, identify impacts, and propose solutions to environmental problems. The Talking Chips setting gives students a structure within which these forms of participation can occur more evenly. In line with this, [Öztürk \(2023\)](#), in a second-order meta-analysis, reported that cooperative learning has a moderate positive effect on student achievement.

The findings of this study are also in agreement with earlier studies. [Afianti et al. \(2017\)](#) reported increased activeness and learning mastery after the application of the kancing gemerincing model. [Nurani \(2017\)](#) found that Talking Chips improved students' ability to provide simple examples in social studies contexts. [Satriani et al. \(2018\)](#) found higher science learning outcomes in the class taught with Talking Chips than in the conventionally taught class. Likewise, [Bayharti et al. \(2017\)](#) and [Sinurat \(2018\)](#) showed that Talking Chips contributed to better achievement and classroom participation. Thus, the present study strengthens the empirical evidence that Talking Chips is effective across subjects and educational levels.

Another important point emerging from this study is that Talking Chips helps distribute responsibility within group work. Students in the experimental class were not allowed to remain silent throughout the discussion, because each student held chips that had to be used in turn. This mechanism corresponds to the cooperative principle that all members should take responsibility for the discussion process. [Afianti et al. \(2017\)](#) emphasized that Talking Chips creates a student-centered atmosphere in which discussion does not depend only on a few representatives. Similarly, [Amirta \(2010\)](#) stated that the model trains students to think actively, act actively, and express ideas, while the teacher functions more as a facilitator. Likewise, [Kumari and Umashree \(2017\)](#) reported that cooperative learning was more effective than lecture-demonstration methods in fostering students' ecocentric attitudes. These studies indicate that cooperative discussion can contribute not only to cognitive achievement but also to the development of values and attitudes related to environmental responsibility.

Although the model was effective, the implementation also revealed practical challenges. The study noted that Talking Chips requires substantial preparation and careful time management, especially because the teacher must supervise many students and manage multiple learning steps in a limited time. These difficulties are consistent with previous reports that the model can be demanding to implement in large classes and may require careful preparation and allocation of time ([Putu et al., 2016](#); [Sari, 2017](#)). For this reason, successful implementation depends not only on the model itself but also on the teacher's classroom management skills and readiness to organize cooperative activities effectively.

In contrast, the control class was taught through conventional learning, in which the teacher played a more dominant role and students were more passive. [Djamarah \(2010\)](#) described conventional learning as a process largely dominated by the teacher as the transmitter of knowledge, while students mainly act as recipients. The lower posttest mean, lower mastery percentage, and lower N-Gain score of the control class in this study illustrate the limitations of such a one-way approach when students are expected to analyze environmental problems actively.

Overall, the findings show that the Talking Chips learning model is not only associated with higher learning outcomes but also with a more interactive and equitable learning process. In environmental change learning, this model can help students understand concepts more deeply because they are encouraged to discuss, explain, and negotiate meaning collaboratively. Consequently, the Talking Chips model can be considered a relevant alternative for biology teachers who wish to improve classroom participation and learning outcomes, particularly in materials requiring active discussion and shared understanding.

Conclusion

Based on the results of the study, two main conclusions can be drawn. First, the learning outcomes of students taught by using the Talking Chips learning model showed better improvement than those of students taught by conventional learning. The experimental class obtained a posttest mean of 86.26 with 88.57% mastery, while the control class obtained a posttest mean of 79.20 with 68.57% mastery.

Second, the Talking Chips learning model had a significant effect on students' learning outcomes in environmental change topics at class X SMA Negeri 10 Makassar. This conclusion is supported by the independent sample t-test on N-Gain scores, which yielded a significance value of 0.003 (< 0.05). Therefore, the Talking Chips model can be recommended as an instructional alternative to improve learning outcomes and classroom participation in biology learning.

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