

The Effectiveness of Using Chard Media and Peer Tutors Through Direct Teaching Hydrobiology Online Lectures

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ABSTRACT

This study aims to obtain empirical information about the effectiveness of using media charts and peer tutors in hydrobiology on-line lectures. The study used an experimental method with a randomized control-group pretest-posttest design. The students participating in the Hydrobiology course in the odd semester 2020/2021, with a total of 58 people, were divided into two classes, namely, class A and class B. Before the experiment, a pretest was conducted with the basic concepts of Hydrobiology to be taught. The results of the pretest scores were analyzed and the differences were interpreted using t-test statistics, and the results showed that there was no significant difference in the pretest scores between class A and B (significance value $0.359 > 0.05$). The results showed that the use of chard media and peer tutoring through direct on-line lecture teaching (treatment group), was effectively used to improve learning achievement (N-gain) compared to classes that used group discussions (control group), with indicators: N The total gain in the treatment class was higher than the N-gain in the control group. The learning management is also explained.

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1. INTRODUCTION

Hydrobiology is a course of 3 credits that must be followed by students of the Biology Education Program in semester VII (odd), with the main target that students can integrate concepts and theories that have been obtained from other courses and apply them to Hydrobiology. Student learning outcomes for the odd semester 2020-2021 through online lectures are generally very low, with the average final score indicator for written and practical exams only ranging from 13.89 - 58.33 with an average of $39.38 \pm SB$ 10.13 from a score range of 0. -100. The weakness in general for students is the lack of ability to explain

messages contained in chard media (pictures, graphs, charts or graphs and data in tables) of a phenomenon that occurs in the waters or from practical activities both orally and writing.

Media chard in Biology in general and in Hydrobiology studies in particular is mostly a summary of a description of the concept, outline or stages of a process in a particular material concept which is converted in the form of a visual summary. Students to be able to explain the main idea or message of a chard well, the condition is that they first master the concept of the material, so that in turn by just looking at a chard media, students are able to capture the scope and explain the main material in it. Therefore, the ability to explain the main idea or message contained in chard media is one of the main indicators that students have mastered a material concept.

Dual Coding theory signals that someone will learn better when the learning media used is the right mix of verbal and non-verbal channels (Najjar, 1995). Dual coding are two separate but connected cognitive processes through a multimodal system; A person will remember a concept and interpret it in two ways, through mental images or verbal representations (Paivio, 2013). The image superiority effect developed from the concept of multiple coding implies that it is easier for a person to remember information in the form of images (Fink et al., 2012). The results of Baadte & Meinhardt-Injac (2019) research show that information in the form of images can provide a semantic representation of words that need to be remembered, so that images can complete information and make it easier for someone to remember objects.

The skill of explaining/interpreting a chard is one of the science process skills (Nur, 2011). In addition, analyzing the information displayed in a chard and then using the interpretation of the results of the analysis to predict and make decisions is one of the knowledge and skills that is classified as numeracy literacy (Nuraini, 2021). Science process skills and numeracy literacy are two things that are very urgent to be trained on students as prospective educators.

The strategies adopted by lecturers in giving online lectures during the Covid-19 pandemic are group discussions; each group of students prepares their respective papers and power points (PPT) which are distributed in the WhatsApp Group at least two days before the lecture schedule, and then a question-and-answer discussion is held. The result is that it has not been effective in improving student learning outcomes, especially the limited skills of most students to explain both orally and in writing the message contained in a chard displayed through ppt. Only a small number of students can show performance as expected. This also shows that the group work formed in order to prepare the paper and power point material to be presented has not been going well. One of the obstacles experienced in online learning during the current COVID-19 pandemic is that lecturers are not free to supervise, provide corrections and direct guidance on lecture activities.

The solution to overcome the problem of lecture results is the need for emphasis on training students to convey the main idea or main message in their own words contained in a chard media guided by peer tutors in each group. The learning strategy applied is to combine the application of the direct instruction model with group work guided by peer tutors and question-and-answer discussions. The application of the learning strategy starts from the lecturer who is in charge of the course modeling how to explain the message contained in a chard based on the background description of the subject matter, students doing limited exercises with direct guidance from the lecturer, followed by further training through group work with peer tutors; students who have high abilities are given the responsibility to be tutors to their groupmates who have low abilities (Ullah, 2018).

According to Peter (2016), there are basically two types of peer tutors, namely, incidental peer tutors and structured peer tutors. Whenever students are in school or when students outside of school are playing, working or studying together, one of whom guides the other is considered an incidental peer tutor. On the other structured peer tutoring refers to peer tutoring who is implemented in certain cases and for certain subjects, following a structured plan prepared by the teacher. According to Ihekwoaba et al. (2020), spontaneously structured peer tutoring is used by experienced teachers who are able to plan well in advance and are accustomed to combining tutor and tutee appropriately to get good results. Furthermore, Peter (2016) categorizes several variations of structured peer tutoring, including cross-age

peer tutoring, peer-assisted learning strategies, reciprocal peer tutoring, age peer tutoring, and classroom peer tutoring. However, for the purpose of this study, only peer tutoring was used, ie the whole class was divided into several small groups consisting of 4-5 students, of which there was one student who was known to excel and excel compared to his group of friends.

A number of studies on the use of chard media and other visual media that are in line with this study include, among others, Ogan and George (2016) conducted experimental research on the effect of using chard through demonstration and collaborative learning approaches on measurement learning using chard. Olatoye (2017) with his research on Biology learning; skeletal system in mammals with three treatments, namely students who are taught to use chard media, real objects, and the use of video. Ahmad and Odewumi (2020) conducted a survey research showing the positive impact of visual learning devices on high school students' Biology learning outcomes. In addition, research on the use of peer tutoring strategies has been carried out, among others, by Najabat et. al. (2015), Peter (20016), and Ullah et. al. (2018) examined student achievement through learning using peer tutoring strategies compared to conventional learning. Greenwood et. al. (1992) through experimental research, compared the average student learning outcomes of Biology through the strategy of class peer tutors with reciprocal peer tutors. Watcharapunyawong (2018) reports his research through his quasi-experimental study on the effect of on-line peer tutoring on the English grammar achievement of first-year undergraduate students. Furthermore, Olajide (2019) examines the effect of field-trip and peer-tutoring learning strategies on mastery of basic science process skills in junior high schools. Alegre et. Al. (2020) examines the comparison of mathematics academic achievement between primary and secondary education students through peer guidance strategies. Carlana and Ferrara (2021) conducted an experiment with 1,059 students who were divided into two groups: a treatment group of 530 students who received on-line tutoring by volunteer tutors from students and a control group of 529 students who were not mentored during the COVID-19 pandemic.

Based on the results of the research on the use of chard media and peer tutors, no research has been found that integrates the use of chard media with peer tutoring learning strategies through on-line lectures so that researchers are interested in assessing the effectiveness of using chard media and peer tutors through direct teaching online lectures. -line courses in Hydrobiology. The effectiveness of using chard media in combination with class peer tutors and question and answer through direct teaching on-line lectures (treatment group), can be seen by comparing the learning outcomes (N-gain) with the control group's N-gain, namely students who are taught on-line with Lecture strategy used so far is group discussion and question and answer.

The research problems discussed in this study were formulated as follows: (1) how was the achievement of learning outcomes (N-gain) for the treatment group students and the control group students? (2) how is the difference in N-gain between students in the treatment class and the control class; (3) how is the N-gain difference between tutor students (peer tutors) and their friends, both inter and between treatment and control classes. The research objectives achieved were to obtain empirical data about (1) the achievement of N-gain in the treatment group students and in the control group students; (2) the difference in N-gain between students in the treatment class and the control class; (3) the difference in the N-gain of Tutor students (peer tutors) with their friends, both between and between treatment and control classes.

2. METHODS

This research uses an experimental research method with a Randomized control-group pretest-posttest design (Fraenkel et. al., 2009):

O X O

O : observation from pretest and posttest

X : treatment variable: Use of Media Chard and peer tutoring and Q&A

X₁ : control variable: Group discussion and Q&A

The sample in this study was 58 students who took the odd semester of Hydrobiology course 2020/2021 divided into two classes, namely, class A and class B each totaling 29 people based on data from the Center for Technology, Information and Communication (PUSTIK) Halu Oleo University. The instruments used in this research are: The written test instrument used in the pretest and posttest which was compiled based on the basic concepts of the Hydrobiology course and has been used by researchers for several years. This test instrument had previously been tested to get the sensitivity of the items. The analysis used the Test Analysis Program (TAP) software version 12.9.23 for the multiple choice form test, and the MS Excel program using the Cronbach formula for the short essay form test. Prior to the experiment, a pretest was first performed, then the results were analyzed and the differences were interpreted using t-test statistics. The results of the difference test showed that there was no significant difference in the pretest score between class A and B (significance value $0.359 > \alpha = 0.05$).

Tabel 1. Mean \pm SB Calculation Results and Test Results Differences in Pretest Results for Class A and Class B students

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	pre_A	28.5517	29	11.57456	2.14934
	pre_B	25.5862	29	12.80769	2.37833

		Paired Samples Test							
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference		t	df	Sig. (2-tailed)
					Lower	Upper			
Pair 1	Pretest_a Pretest_b	-2.9655	17.1412	3.1830	-9.48577	3.5546	-.932	28	.359

Based on the draw, class A students become the treatment group whose lectures apply the strategy of using chard media and class peer tutors and question and answer through direct teaching, while class B students become the control group whose lectures are as applied so far, namely group discussion and question and answer methods. . Students in the treatment group (A) who have a record of high achievement in other subjects they have attended, are selected as peer tutors in their class, while students with low achievements become friends. After the selection of a class peer tutor, then an hour-long training is carried out which provides an orientation on the functions and responsibilities of each class peer tutor in order to guide their group mates.

Based on the Hydrobiology Semester Lecture Plan (RPS) from the Department of Biology Education FKIP Halu Oleo University, the same material is taught on-line to both groups of two different lecturers at the same time via the Zoom application. At the end of the lecture, posttests and in-depth interviews were conducted with class peer tutors to obtain information on the benefits and perceived barriers of acting as class peer tutors during lectures. In addition, for the control group students, sociometry was carried out, namely each group member gave a score that should not be the same to their group friends based on academic ability and group work participation during lectures.

Students who get the highest score from the sociometric results are referred to as unstructured Peer Tutors in processing and analyzing research data.

The research data were analyzed using a mixed methods model using qualitative and quantitative approaches. A qualitative approach is used to describe the learning management carried out; starting from the stages of planning, organizing, implementing, and evaluating learning using chard media and peer tutors through direct on-line lectures. Quantitative approach is done by using descriptive quantitative and inferential analysis. Quantitative descriptive analysis includes calculating the N-gain of each student and categorizing it based on Hake (1998), and presenting it in an image in the form of a graph to facilitate discussion. Furthermore, the data on the results of the N-gain calculation for each study group were analyzed statistically inferentially using the SPSS version 20 application on-line to test the significance of the differences in N-gain between students in the treatment group and the control group, including: a) Testing the requirements of statistical analysis using the normality test of population data distribution using the Kolmogorov-Smirnov test; (b) calculating Paired Differences Samples Test data from the treatment and control groups. If the calculation results get the test probability value (sig.) ≤ 0.05 ; means that there is a significant difference in N-gain between the treatment group and the control, on the contrary if the calculation results get a test probability value (sig.) > 0.05 , it means that there is no significant difference in N-gain between the treatment and control groups (Table 1).

3. FINDINGS AND DISCUSSION

The findings of this study are presented in the form of two analyzes, namely: descriptive analysis and inferential analysis.

3.1. Descriptive Analysis

The N-gain category analysis in the treatment group and control group is presented in Figure 1.

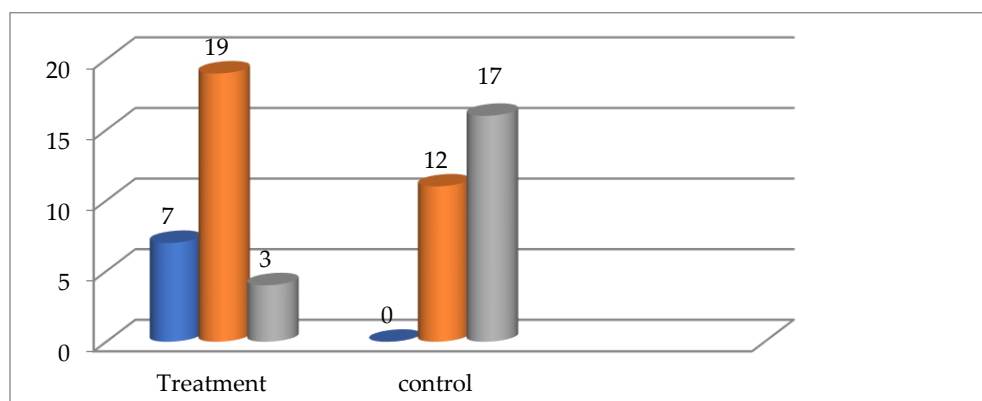


Figure 1. Composition of N-gain in the control class and treatment class

Based on Figure 1., it appears that in the treatment class the number of students who achieved the high category N-gain was seven people (12.07%), and in the control class it was not found. In addition, the number of students who achieved N-gain in the medium category was also more in the treatment class, namely 19 people (32.76), while in the class there were 12 people (20.69%). N-gain in the low category is more in the control class, which is only three people (15,7%).

3.2. Inferential Analysis

3.2.1. Data Distribution Normality Test

The normality test for the distribution of population data using the Kolmogorov-Smirnov test is presented in Table 2.

Table 2. Distribution of data based on Kolmogorov-Smirnov test at significance $\alpha = 0.05$

		Unstandardized Residual
N		29
Normal Parameters ^a	Mean	.0000000
	Std. Deviation	.20829699
Most Extreme Differences	Absolute	.121
	Positive	.121
	Negative	-.115
Kolmogorov-Smirnov Z		.654
Asymp. Sig. (2-tailed)		.786
a. Test distribution is Normal.		

Based on the normality test for the distribution of population data using the Kolmogorov-Smirnov test in Table 2; obtained the value of $\text{sig.} = 0.786 \geq 0.05$, which means the data is normally distributed.

3.2.2. Hypothesis test

3.2.2.1. Test the difference in paired t-test total N-gain between the treatment group and the control group

Test Results The difference in paired t-test total N-gain between the treatment group and the control group is presented in Table 3.

Table 3. Test Results The difference in paired t-test total N-gain between the treatment group and control group

		Paired Differences					
		95% Confidence Interval of the Difference					
		Std. Error				Sig. (2-	
Pair 1							
treatment	.2843862	.2288180	.0424904	.1973485	.3714239	6.693	28
- control							.000

Based on the test results in Table 3; shows that the value of $\text{sig.} = 0.000 \leq 0.05$, which means that there is a significant difference in the mean N-gain of the total treatment group compared to the control group. The mean N-gain of the total treatment class was $0.52 \pm \text{SB } 0.22$ > the mean N-gain of the total control class was $0.32 \pm \text{SB } 0.19$, which means that the mean N-gain of the treatment group students was better than control group students.

3.2.2.2. The results of the analysis of the difference between the paired t-test N-gain between :

- a. Class Peer Tutors (peer tutors in the treatment group) with Unstructured Peer Tutors (peer tutors in the control group)

Table 4. The results of the analysis of the difference in paired t-test N-gain between Class Peer Tutors and Unstructured Peer Tutors

		Paired Differences							
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference		t	df	Sig. (2-tailed)
					Lower	Upper			
Pair 1	Tutor a – tutor b	.3112500	.2695201	.0952897	.0859256	.5365744	3.266	7	.014

Based on the test results in Table 4; obtained $\text{sig. } 0.014 \leq 0.05$, which means that there is a difference in the N-gain of class peer tutors compared to the N-gain of unstructured peer tutors. The mean N-gain of class peer tutors (0.58) is higher than the N-gain of unstructured peer tutors (0.44).

- b. Class peer tutors with friends in the control group

Table 5. The results of the analysis of the difference between paired t-test N-gain between Class Peer Tutors and Friends in the control group

		Paired Differences							
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference		t	df	Sig. (2-tailed)
					Lower	Upper			
Pair 1	tutor_b – teman_b	.17000	.12294	.04347	.06722	.27278	3.911	7	.006

Based on the test results in Table 5; obtained sig. $0.004 < 0.05$, which means that there is a difference in the N-gain of class peer tutors compared to the N-gain of peers in the control group. The average N-gain of peer tutors (0.58) is higher than the average N-gain of control group classmates (0.32)

c. Class peer tutors with friends in the treatment group

Table 6. The results of the analysis of the difference between paired t-test N-gain between Class Peer Tutors and friends in the Treatment group

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
Pair					Lower	Upper			
1	tutor_a - teman_a	.25889	.19082	.06361	.11221	.40556	4.070	8	.004

Based on the test results in Table 6; obtained sig. $0.004 < 0.05$ which means that there is a difference in the N-gain of class peer tutors compared to the N-gain of friends in the treatment group

d. Friends of the treatment group with Friends of the Control Group

Table 7. The results of the analysis of the difference in paired t-test N-gain between friends in the treatment group and friends in the control group

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
Pair					Lower	Upper			
1	temana - temanb	.23625	.26333	.09310	.01610	.45640	2.538	7	.039

Based on the test results in Table 7; obtained sig. $0.039 < 0.05$, which means that there is a difference in the N-gain of the treatment group compared to the N-gain of the control group. The mean N-gain of the treatment class friends (0.39) is higher than the average N-gain of the control class friends (0.32).

The results of the use of chard media and peer tutors through direct teaching are proven to be effective in increasing student learning outcomes (N-gain). This can be seen from the results of the analysis of the difference in the N-gain of the treatment class which is higher than the N-gain of the control class, namely students who are taught on-line with the lecture strategies used so far, namely group discussion and question and answer. A number of studies have reported the effectiveness of using chard in learning, including Shabiralyani et al. (2015) reported that using visual aids as a teaching method stimulates thinking and improves the learning environment in the classroom, as well as effectively replaces a monotonous learning environment. Ogan & George (2016) reported, students who were taught with chard/graphs using a demonstration approach had the highest learning gains in conceptual understanding of measurement compared to two groups of students, namely the group

taught using the collaborative learning approach and the group taught using the conventional approach.

In line with the findings of Ogan & George (2016), the advantages of using chard and peer tutors in this study are most likely because they are supported by the application of direct teaching; the teacher first provides a model (demonstrates) how to present a message from a chard, which allows students to apply the objectives of the presentation with exactly the behavioral principles that the lecturer wants students to learn, providing learning experiences such as exercises that can be monitored and can be given feedback, as well as paying special attention to how the behavior in the classroom by providing reinforcement (reinforcement). Social learning theory of behavioral modeling by Albert Bandura; Most of the learning experienced by humans is obtained from modeling, imitating the vicarious behavior and experiences (successes and failures) of others. According to Bandura (Arends, 2007 and Woolfolk, 2008), observational learning is a four-step process, namely: (1) students (read students) must pay attention (attention) to critical aspects of what is to be learned; (2) the learner must retain/store or remember the behavior, (3) the learner must be able to produce or perform the behavior; and (4) motivated to repeat the behavior.

The test results show that there is a significant difference in the mean N-gain between peer tutors (structured) in the treatment class and peer tutors (unstructured) in the control class. Likewise, from the results of the difference test with friends from the control group, the mean N-gain of structured peer tutors is significantly different from the average N-gain of their friends in the control class. In addition, the results of testing the difference in the mean N-gain between peer tutors (structured) and their friends in the treatment class show that the mean N-gain of structured peer tutors is higher than the N-gain of their friends in the treatment class. This finding is in line with the research results of Greenwood et al. (1992) who reported that students taught with whole-class peer tutors (students divided into small groups) were more effective at improving student achievement than reciprocal peer tutors. In addition, Najabat et al. (2015), Olajide (2019) also reported the results of his research on improving student achievement when taught using peer tutors. Carlana and Ferrara (2021) reported that providing online tutorials is an effective tool to help students during the COVID-19 pandemic, improving in addition to academic outcomes as well as psychological well-being and the development of students' socio-emotional skills.

The superiority of the learning outcomes of class peer tutors (structured) compared to their friends in the treatment group and peer tutors (unstructured) and their friends in the control group may be due to the fact that apart from having a record high average achievement in other subjects that they have attended, which is mainly due to the responsibility given as a tutor so that they are more motivated to prepare and help their group mates. The results of interviews with class peer tutors in the treatment group obtained information that the role of their friends in general was only limited to helping browse and conveying material related to assignments to tutors, less involved and expecting a lot of class peer tutors in the preparation of papers and ppt presented.

Unstructured peer tutors in the control group also on average had a high record of achievement in the courses they had attended compared to their peers, however, were not given the direct responsibility of helping their friends. The results of Petrus (2016)' research show that the success of students studying through peer tutors throughout the class may be due to structured procedures (the selection of tutors from students who are known to have advantages compared to their friends), direct and competitive training with other groups in the class. the same one.

4. CONCLUSION

The use of chard media, a combination of peer tutor collaboration, through direct on-line lectures, is effectively used to improve learning achievement. Media chard a combination of peer tutor collaboration and question and answer through direct teaching can be the main solution used to motivate learning and activate students in on-line lectures in the Biology Education department in general and Hydrobiology courses in particular.

The success of using chard media, a combination of peer tutor collaboration and question and answer through direct teaching to motivate learning and activate students in on-line lectures, is likely to be much influenced by the perfection of the model displayed by the lecturer before students do limited and advanced training/independently, as well as providing reinforcement for each student's work. Therefore, it is recommended that in implementing this lecture strategy, lecturer readiness as a model and providing reinforcement is absolutely necessary.

The limitations of this study are experimental research with a sample size of 29 people each in the treatment class and control class which is still relatively lacking, and the use of the WhatsApp application in the test process is considered less efficient. Therefore, it is suggested that these two things need to be a concern for the next similar researchers.

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