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Is conceptual learning based on conceptual change text (CTT) effectively applied to PGSD students' science classes?

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Abstract For Elementary School Teacher Education (PGSD) students, the introductory science concept course is part of the compulsory course. The understanding of PGSD students in basic science concepts will affect the quality of learning in the classroom. This research was conducted in odd semesters with 60 students who attended lectures on basic science concepts, and the sample selection was made randomly. To collect data on the effectiveness of the implementation of CCT, instruments used in the form of cognitive and clinical test questions have gone through validation and reliability tests. Students were divided into two groups in the study: the experimental group using CCT-based contextual learning as teaching materials and the control class using ordinary teaching materials. Based on the *N-Gain* data found in the field, there was a significant difference between the experimental and control groups; the control class had an *N-Gain* value of 0.54, while the experimental class was 0.81. The data revealed that learning using CCT successfully increased students' understanding of concepts in the material cycle and created a better environment compared to the control class. However, based on interview data, both experimental and control class students were interested in learning the concept of the energy cycle and environmental pollution, and there was no significant difference.
Keywords: Conceptual Change Text (CCT), Contextual, Misconception, Energy Cycle and Environmental pollution.

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INTRODUCTION

The basic concept of science is one of the compulsory subjects for elementary school teacher education students (PGSD). Elementary school teacher education students (PGSD) also received material related to the environment, namely the energy cycle and environmental pollution. Many concepts studied in this material include biogeochemical cycles, water cycles, nitrogen cycles, carbon cycles, and environmental pollution. Understanding students' concepts of energy cycle material and environmental pollution is a very important issue to know, and this is because how understanding the concepts possessed by students will affect the actions, they will take on phenomena related to energy cycles and environmental pollution that they encounter in the field. The knowledge construction process will affect the understanding of the concepts that students receive (Stender et al., 2018). How students understand the natural phenomena they encounter using the knowledge they have will affect the competence of students (Supena et al., 2021) (Sukmawati, 2019). When a student is able to explain a phenomenon with an understanding of the concept he has, the student is able to apply the knowledge he has, and this ability becomes a provision for teaching at school.

Based on the reality research found in the field, it is still found that many students do not build well between their knowledge and phenomena that exist in real life (Vanpatten et al., 2021). Likewise, research on chemistry education shows that the curriculum does not adequately provide a connection between real life and scientific knowledge, thus presenting too many facts that are difficult for students to understand (Lazenby et al., 2019). Based on the data obtained by researchers, there are still many students who have misconceptions and find it difficult to explain the concepts of the biogeochemical cycle, water cycle, nitrogen cycle, carbon cycle, and environmental pollution. In the concept of the biogeochemical cycle, students have difficulty in explaining the chemical reactions that occur in the water, nitrogen and carbon cycles; there are still many errors in writing the stages of each cycle.

The difficulty of students in explaining chemical reactions in the biogeochemical cycle is certainly closely related to the ability of basic chemical concepts that students have, besides that when students incorrectly order the stages of the water cycle, nitrogen cycle and carbon cycle, misconceptions will occur, and this must be addressed immediately considering that students are candidates' teachers who will certainly teach the concepts they understand to their students. In the concept of environmental pollution, students understand phenomena related to environmental pollution that is often found in the field, but it is still difficult to relate them to scientific concepts that occur in environmental pollution. With the problems found in the field, students need appropriate learning resources that can help students understand the concepts they are learning. In addition, the concept of environmental pollution is a concept that is very close to everyday life; besides, the impact of environmental pollution is also easy to explain. The explanation of the concept that is supported by the media or good learning resources will make it easier for students to understand a concept. Media that presents scientific concepts will certainly make it easier and help students.

To overcome this problem learning with a context-based approach helps to contribute to the lives of students and helps them to gain a better understanding of the natural environment around them (King & Henderson, 2018). Based on the understanding that students have in contextual learning, it can help connect theoretical knowledge with phenomena in the real world (Benarcki et al., 2020). There have been many studies that have shown success in conducting contextual learning (Shahzad et al., 2021). In contextual learning, supporting media are needed that are able to instil the concept well. Conceptual learning equipped with CCT-based teaching materials (Conceptual Change Text) promises mutually supportive collaboration. CCT is a teaching material based on a conceptual change approach and is designed to improve alternative conceptions. The application of CCT is carried out with a question posed to students to determine the students' prior knowledge. Thus, students are asked to explicitly create conceptual conflicts or cognitive conflicts (Potvin P., 2021).

The use of CCT is an alternative conception strategy for students. Then the alternative conception is given with the reason why this alternative conception is much more scientific than the previous concept. So that students feel the need to improve their conceptions (Chen et al., 2021). In the final stage of CCT, the lecturer prepares discussion activities so that students understand scientific knowledge. The effectiveness of using contextual learning with the help of CCT has proven its benefits (Vetezka et al., 2022).

The concept change module is based on constructivist learning philosophy. Constructivism in learning is a philosophy based on the idea that the process of forming individual knowledge is the result of psychological activity supported by the process of experiential learning. In other words, the individual learning process is carried out by individuals in their own way. On this basis, it can be concluded that students naturally acquire and form knowledge through their own experiences.

Constructivism in learning shows that 1) knowledge is built by students themselves, both personally and socially, 2) knowledge cannot be transferred from lecturers to students unless it is reasoned through their own activities, and 3) active students continue to construct so that the concept is always changed to be more detailed, complete and in line with scientific concepts, and 4) the lecturer only helps provide convenience and conditions so that the student development process can take place (the lecturer acts as a facilitator).

In the case of cognitive conflict, students face three choices, namely: (1) retaining the original intuition, (2) modifying part of the intuition through the assimilation process, and (3) changing the intuitive point of view to adapt it to new knowledge. When the student decides on the third option, the concept will change. For the process of conceptual change, learning involves generating and rearranging concepts that students brought before learning. The process of negotiating meaning does not only occur in the activities of these individuals but also arises from individual interactions with others through peer-mediated guidance. Incorporating a new concept into the student's mind to replace the student's initial concept is usually called conceptual change. Special treatment is needed to accept the new concept and replace the student's original concept. Only when students are willing to accept the changes presented

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in the learning process will students' conceptual changes occur because students are the only ones who decide whether the learning process can occur.

The novelty in this research is the use of CCT with contextual learning for prospective elementary school teacher students on science material so that the difficulties experienced by students while learning can be supported by emphasizing the correct concept. The material for the energetic cycle and environmental pollution in PGSD students was chosen because, based on findings and research, misconceptions are still found in understanding the concept of the energetic cycle and environmental pollution (Tanti et al., 2020; Sukmawati et al., 2021). One of them is pollution due to tofu waste which can increase COD levels in the waters (Sukmawati et al., 2021). The misconceptions experienced by students include errors in determining the bioenergetic cycle, the water cycle, the nitrogen cycle, and the carbon cycle.

METHOD

This study used a quasi-experimental research method with 60-second semester students as research subjects who were grouped into two classes, namely the experimental class and the control class. The selection of the control class and the experimental class was carried out randomly namely representatives from each class took the lottery paper that had been prepared. Then after the two representatives have been chosen, the students who are grouped in the experimental class are labelled E1 to E30, while the control class is labelled C1-C30. All students involved took part in learning the theme of the energetic cycle and environmental pollution in the experimental class using a CCT-assisted contextual approach model, while the control class followed learning using a contextual learning model without using CCT (Sukmawati et al., 2020). All students who were involved in both the control class and the experimental class were willing to provide their data for this study.

The instrument in the form of questions was first carried out with a limited trial to test the validity and reliability of the instrument using excel. The number of participants in the trial was limited to 15 students in the validity test using Pearson correlation (rtable 0.514) and calculated using excel with the following equation.

$$r_{xy} = \frac{n\sum XY - \sum X \sum Y}{\sqrt{\left[n\sum X^2 - \left(\sum X\right)^2\right]\left[n\sum Y^2 - \left(\sum Y\right)^2\right]}}$$

where *r* is peason r correlation coefficient and *n* are number of samples. The validity of the instrument processed using excel shows the data that the questions used are all valid with the following values Table 1 bellow.

Table 1. Summary of Validity Test

No	r_{xy}	r_{tabel}	Status
1	0.74	0.514	Valid
2	0.77	0.514	Valid
3	0.58	0.514	Valid
4	0.77	0.514	Valid
5	0.81	0.514	Valid

Furthermore, the valid questions were further tested, namely the reliability test using Cronbach's Alpha using excel with the following equation.

$$r_{11} = \left[\frac{k}{(k-1)}\right]\left[1 - \frac{\sum \sigma_b^2}{\sigma_t^2}\right]$$

where r_{11} is coefficient reliabilty, *k* is the number of valid questions, σ_b^2 is the variant of item and σ_t^2 is the variant of total score. Furthermore, the reliability value is categorized from Guilford that the reliability is very high ($0.80 \le r_{11} \le 1.00$), high ($0.60 \le r_{11} \le 0.80$), moderate ($0.40 \le r_{11} \le 0.60$), low

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($0.20 \leq r_{11} \leq 0.40$), very low/unreliable ($0.00 \leq r_{11} \leq 0.20$). The reliability values obtained from the data are Table 2 bellow.

Tabel 2. Hasil Uji Reliabilitas Cronbach Alfa

Reliability Coefficient	Interpretation
0.78038	High

To collect data in this study, students' understanding tests were carried out using the pretest and posttest methods and conducted interviews with research participants. Interview activities are carried out to explore further the reasons why students answer a problem with the conception they have and provide solutions to the problems experienced by students. Before conducting clinical interviews, a pretest was conducted first to students after participating in the lesson. The cognitive test is in the form of 5 essay questions containing contextual analysis that is related to the understanding of the concepts that students have that have gone through validation and reliability tests. The cognitive test questions used are structured as indicators of students' contextual understanding as in questions (1) in the form of students' conceptual understanding of the concept of biogeochemical cycles, (2) questions containing students' understanding of concepts related to water cycle material, (3) questions containing questions about students' understanding of concepts related to the nitrogen cycle, (4) questions about students' understanding of concepts related to the carbon cycle, (5) questions about students' understanding of concepts related to environmental pollution.

After the questions are compiled, the next step is to test the validity and reliability to test the quality and feasibility of the questions, which is done by conducting a limited test of the instrument and then analyzing it. Based on the limited trials conducted, the questions were declared valid and had high reliability so that they were appropriate to be used as instruments in this study. After the cognitive test in both classes has been obtained, then each student is grouped into three namely upper class, middle class, and lower class. The grouping is based on the cognitive test scores of students in the experimental class and the control class. The upper-class group has a range of values (81-100), the middle class (60-80), and the lower class (0-59). The next stage is a clinical interview with 15 questions related to understanding the biogeochemical cycle, water cycle, nitrogen cycle, carbon cycle, and environmental pollution (Sukmawati et al., 2020, 2021).

Quantitative data were obtained from the results of the pre-test and post-test of students for the material on the bioenergetic cycle and environmental pollution. The following are the steps for processing and analyzing pre-test and post-test data:

1. The value of pre-test and post-test is the value of each student divided by the total score, then multiplied by 100 to be converted into a scale value of 100.
2. To find out whether the diversification ability of students in characterizing the material of the bioenergetic cycle and environmental pollution has increased, then a significant difference test was conducted on the post-test data if the value of sig. (2-tiled) < 0.05 then there is a significant difference between the experimental and control class learning outcomes. Previously, a normality test was conducted to determine whether the data were normally distributed. Previously, the normality test was performed to determine whether the data were normally distributed using Mancova analysis. If the graph shows a straight line, the data can be said to be normally distributed, and vice versa.
3. To facilitate data analysis and interpretation, students were categorized into high (81-100), medium (60-80) and low (0-59) categories. High group students are students who use CCT effectively, medium group are students who are less effective in using CCT and low group are students who have not been able to use CCT effectively.
4. The increase in students' expression level abilities for each indicator is *N-Gain* (normalized gain) or ($<g>$). The *N-Gain* calculation aims to avoid possible conclusions by eliminating the effect of guessing factors (guessing) and the effect of achieving the highest score (ceiling effect). Furthermore, after knowing the value of the class average *N-Gain* and its standard deviation, then an effect size analysis (d) is carried out with the following interpretation: weak (if d value: 0 - 0.20), low (if d value: 0.21 - 0.50), sufficient (if d value: 0.51 - 1.00), strong (if d value > 1.00).

Some students from both the experimental class and the control class did not all take part in clinical interviews; this is because learning takes place online, so only a few students are willing to take part in interviews. Even so, each experimental and control class had representatives in the upper, middle

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and lower groups who were willing to be interviewed. The interview activity lasted about 10-20 minutes using 15 questions that previously had a limited test to determine the quality of the interview instruments used, cognitive test assessment guidelines and interviews were carried out based on the concepts learned by students (Ungtrakul et al., 2020) as shown in Table 3 bellow.

Table 3. Assessment and interview guidelines

Concept	Cognitive Problem	Interview
Biogeochemical cycle	1	1,2,3
Water cycle	2	4,5,6
nitrogen cycle	3	7,8,9
carbon cycle	4	10,11,12
Environmental pollution	5	13,14,15

The results of the interviews and cognitive tests produced were processed and analyzed using SPSS version 25. At the beginning of the study, the experimental and control class students learned the concept of the energy cycle and environmental pollution. Cognitive test data obtained from the study, the pretest and posttest values from the experimental and control classes were grouped, then processed to determine the *N-Gain* value of each class as shown in the following equation, then the *N-Gain* data was interpreted as shown in Table 2.

$$N - gain = \frac{\text{Posttest Score} - \text{Pretest Score}}{\text{Maximum Score} - \text{Pretest Score}}$$

The analysis of the results of the pretest and posttest obtained from the research, both the experimental class and the control class were analyzed and interpreted into three categories, namely high, medium and low categories (Hake, 1999)

Table 4. Criteria for *N-Gain*

N-Gain Value	Category
N-Gain > 0.7	High
0.3 ≤ *N-Gain* ≥ 0.7	Moderate
N-Gain < 0,3	Low

when the *N-Gain* value is high, it means that the treatment is effective, if the *N-Gain* value is moderate, it means the treatment is less effective, and for low *N-Gain*, the treatment given is not effective.

RESULTS AND DISCUSSION

Result

The data from the pretest and posttest results for the experimental and control classes can be seen in Table 5. In this table, the pretest, posttest, and *N-Gain* values for each class are presented.

Table 5. Posttest Pretest Results and *N-Gain* Experimental and Control Classes

Class	Pre	Post	*N-Gain*
Experiment Class	67.67	94.73	0.81
Control Class	51.60	75.43	0.54

Based on the data in Table 5, the experimental and control class students were grouped based on the pretest scores obtained and then categorized based on the group scores obtained as shown in Table 6. At the beginning of the study, the experimental and control class students were given pretest questions that had been tested for validation and reliability. The purpose of giving these questions is to determine the students' initial abilities before being given treatment. Based on the grouping of students' abilities at the beginning of learning as in Table 6.

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Table 6. Grouping of Respondents Initial Test

	High Group (81-100)	Medium Group (60-80)	Low Group (0-59)
Experiment Class	11	11	8
Control Class	0	8	22

In the initial assessment, it can be seen that there are differences in the initial abilities of the experimental and control classes in the high and low respondent groups. While in the student group, the medium group did not have a significant difference. If seen, the ability of the experimental class is more evenly distributed in each group and is different from the control class, which tends to be the majority in the low group. In addition to the pretest results, the posttest results are also grouped based on predetermined criteria so that changes in the composition of each criterion are seen in both the experimental and control classes as shown in Table 7.

Table 7. Grouping of Respondents in Final Test

	High Group (81-100)	Medium Group (60-80)	Low Group (0-59)
Experiment Class	28	2	0
Control Class	11	13	6

Based on the learning outcomes of the experimental and control classes, to determine the significance of the differences between the two classes, a different test was carried out as shown in table 6. The table shows that the value of Sig.(2-tiled) is 0.000, this indicates that there is a significant difference between the experimental class and the experimental class. control class.

Table 8. Independent Samples Test

		F	Sig.	t	df	Sig.(2-tiled)
Value	Equal variances assumed	10.563	0.002	5.897	58	0.000
	Equal variances not assumed			5.897	42.534	0.000

This is followed by Mancova analysis to determine the linearity of the data held. Based on Figure 1. It can be seen that the trend of a straight line shows that the data is linear.

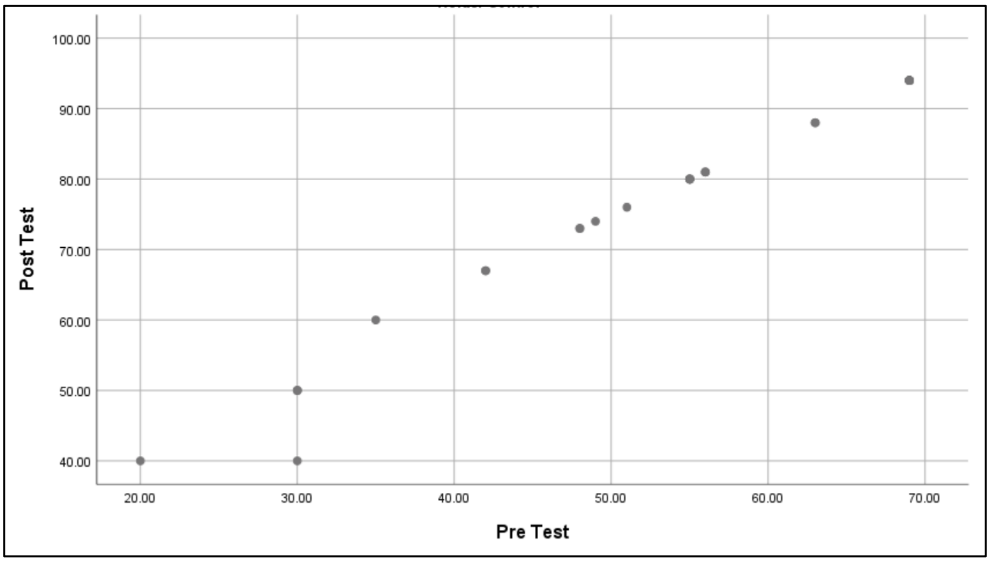

Figure 1. Mancova Test Results

Based on the *N-Gain* data of each student, it was further analyzed to determine the average *N-Gain* value of the experimental and control classes as shown in Table 9.

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Table 9. Experimental and Control Class *N-Gain* Test

Class			Statistic	Std.Error
N-Gain_Persen	Eksperimen	Mean	81.24	4.28
		Std. Dev	23.44	
	Kontrol	Mean	54.14	3.32
		Std. Dev	18.20	

Furthermore, to determine the effectiveness of the research conducted, it is continued by conducting an effect size analysis with the following equation.

$$d = \frac{\overline{x_1} - \overline{x_2}}{\sqrt{\frac{s_1^3 + s_2^3}{2}}}$$

Based on these calculations according to the *N-Gain* value and standard deviation, the effect size value in this study is shown in table 5.

Table 8. Value Effect Size

Variable	Score
St. Dev	20.82
Effect Size	1.28
Category	Strong

Discussion

Student pretest and posttest scores

The value of pre-test and post-test is the value of each student divided by the total score, then multiplied by 100 to be converted into a scale value of 100. Based on the scores obtained by each class, there is a significant difference between the classes experiment and control. After learning, it can be seen from the scores obtained by students, the experimental class has more students who use CCT effectively than the control class. Even in the experimental class, there were students who were able to answer the questions correctly and the score obtained was 100, namely as many as 17 students. Meanwhile, in the control class, there were no students who were able to correctly answer all the questions given.

Classification of Student Abilities

In the experimental class, most of the students had a good understanding because they learned to use CCT, as many as 28 students were included in the high category when viewed from the scores obtained (81-100), the rest of the students entered the medium group as many as 2 students with a range of values (60-80) students in this range still have concepts that have not been understood so that they are still wrong in answering questions. For the low group (0-59) in the experimental class there were no students in that group. In contrast to the experimental class, in the control class, students in the high group (81-100) were only included in 13 students. In the high group, the level of understanding of the concept in carrying out learning is more effective when compared to the medium and low groups. In the low student group (60-80) there are 11 students in the control class who fall into that category. As for the low group in the control class there are 6 students included in it. Students who fall into this low group actually experience a change from the previous value, but it's still not significant, such as student number 8 in the control class who scored 20 at the pretest and 40 at the posttest.

Value N-Gain and Effect Size

Based on the research data in table 7, the data in accordance with the requirements come from a normally distributed population with uniform variance. The *N-Gain* values for both the experimental and control classes are presented, which have a significant difference between the experimental and

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control classes. In the experimental class, the application of CCT with contextual learning was effectively used in the learning process of the PGSD class the concept of the energetic cycle and environmental pollution with an *N-Gain* value of 81.24 or 0.8124 (high category) while the control class using conventional learning resulted in an *N-Gain* of 54, 14 or 0.5414 (Medium category). Students in the experimental class are able to use the concepts taught and can apply them in calculations to solve problems. One of the important things for students to be given CCT-based reading materials related to understanding concepts is that it can increase students' ability to understand the concept of energy cycles and environmental pollution (Seo et al., 2021). Conventional learning is more focused on the teacher, and students tend to only pay attention and accept, not demanding active students. This makes it difficult for students to understand the concepts given because they are not used to being trained by reading books about understanding the concept of the energy cycle and environmental pollution; this can be seen when students have difficulty solving problems related to understanding the concept of the energy cycle and environmental pollution (Li, Y., & Schoenfeld, AH, 2019).

Data from students' pretest cognitive test results are the basis for conducting interviews with students; these interviews are used to help students overcome problems encountered in learning the energetic cycle and environmental pollution (Sukmawati et al., 2021). And it was carried out in the experimental class, based on the posttest results obtained by the experimental class in table 7. It can be seen that none of the students in the experimental class was in the low group, while based on the results of the experimental class pretest, eight students were included in the low group. Good communication is very important in the teaching and learning process (Kim, J, 2020). Efforts to build knowledge are realized through mutually beneficial cognitive interactions between the components of the subject matter, teachers and students (Zhang, L. J., & Zhang, D., 2020). In this case, the lecturer acts as a messenger in the interaction between the subject, students as the recipient of the message, and the subject is the message delivered. One of the factors that support the success of teaching students' new knowledge and skills is the use of CCT-based teaching materials that are compatible with the material on the energy cycle and environmental pollution. In addition, the application of CCT-based contextual learning will make the teaching and learning process effective and efficient, or in other words, quickly and or easily achievable goals.

The results of data analysis processed using SPSS version 25 showed effectiveness for each class, indicating that the experimental class was much more effective when compared to the control class; this can be seen from the *N-Gain* value of the experimental class with a value of 81.24 the value is classified in the effective category. The combination of CCT and contextual on the subject of energetic cycles and environmental pollution is able to overcome the difficulties encountered by students, misconceptions and difficulties in understanding concepts can be resolved during the learning process (Wati Sukmawati et al., 2021). At the beginning of learning, students did the pretest. The results of the experimental class pretest were analyzed. Then students who entered the group with moderate concept understanding were not given guidance so that the difficulties they encountered could be solved at the interview stage. In the experimental class, the support for CCT-based teaching materials used is also quite effective in helping students' problems in learning (Sukmawati et al., 2021). Moreover, the text used is contextual so that students better understand the concepts being taught. In addition, contextual learning also provides students with provisions in overcoming problems in the surrounding environment so that they are able to apply their knowledge to solve problems.

In addition to the *N-Gain* value, to measure the effectiveness of the CCT-based contextual learning treatment in the experimental and control classes there is a significant difference, this can be seen from the effect size value which is measured by a value of 1.284 with the meaning that there is a strong difference between the learning outcomes of the experimental and control classes.

Inferensial Test

To find out whether the diversification ability of students in characterizing the material of the bioenergetic cycle and environmental pollution has increased, then a significant difference test was conducted on the post-test data if the value of sig. (2-tiled) < 0.05 then there is a significant difference between the experimental and control class learning outcomes. Previously, a normality test was conducted to determine whether the data were normally distributed. Previously, the normality test was performed to determine whether the data were normally distributed using Mancova analysis. If the graph shows a straight line, the data can be said to be normally distributed, and vice versa.

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In the application of CCT in learning in the experimental class, during interviews, students realized the misconceptions they experienced so that they misunderstood or understood the concept. Interviews were also conducted not only in one direction but in two directions so that the researchers ensured that students had understood the actual concepts, which resulted in new concepts that were correct and easier to understand so that the actual understanding possessed by students could be explored properly (Förtsch et al., 2018). That is why the effectiveness of learning in the experimental class is much higher than in the control class. The learning process carried out by a teacher is an important factor that affects the quality of student output (Alauddin et al., 2017). When the learning process is really considered and adjusted to the needs, even minimal input can produce quality output. As seen from the results of interviews conducted in the experimental class, eight students belonging to the low group, when given treatment in the interview and learning, experienced significant changes so that none of the students in the experimental class was in the low group, even 5 of the eight low groups moved to the high group. An example of understanding students' final concepts about the water cycle is shown in

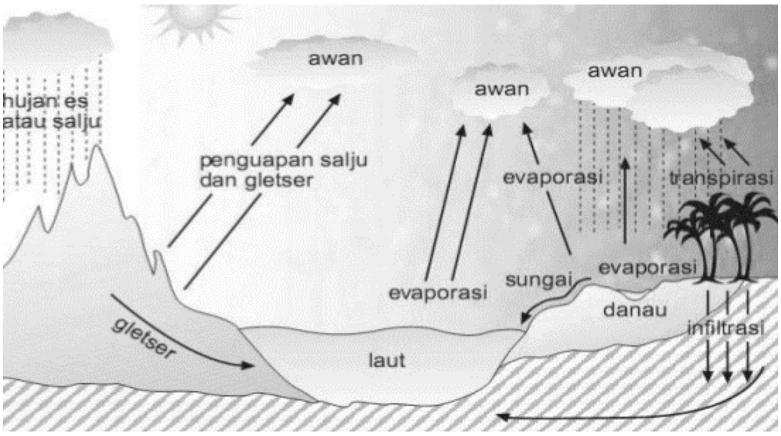

Figure 2. The Water Cycle Understood by Students After Treatment

In contrast to the experimental class, learning in the control class takes place using a contextual learning model; it's just not accompanied by CCT-based teaching materials, but teaching materials in the form of modules commonly used in science basic concepts lectures. Posttest results are used only to determine the initial ability of students; no diagnosis or treatment is carried out, so students learn as usual. Based on the results of student grouping, in the experimental class, most of the students were in the moderate group, so the learning process experienced by students greatly influenced students in exploring the correct concept (Xu & Chen, 2020). Moreover, student dissatisfaction related to the initial concept they experienced could not be resolved during the learning process as in the experimental class.

The application of CCT in ongoing learning has the potential to be applied to other concepts; this is because CCT has a very large contribution in exploring the factual knowledge possessed by students (Förtsch et al., 2018). In the application of CCT, there are four criteria to be successfully applied to students. The four conditions are dissatisfaction, meaning that students feel dissatisfied with their understanding of the concept; intelligent, meaning a new concept that is easy for students to understand and understand; plausible, meaning that the new concept must make sense and be believed by students to be true; fruitful, meaning that a new concept can not only answer one problem but can also be used to deal with new conditions encountered in the environment. In learning that lasts for two credits in the experimental class, students can clarify the new concepts they find so that understanding these concepts will be better stored in the students' memory.

CONCLUSION

Based on the research conducted, it can be said that the instrument developed in the study is a valid and reliable instrument with a high category (0.78038) so it is feasible to be used in this study. Student learning outcomes in the experimental and control classes were assessed on a scale of 0-100 with categories (0-59) in the low group, (60-80) in the medium group, and (81-100) in the high group. In the experimental class, most of the students were in the high group (28 students) while the rest were

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in the medium group (2 students). While the control class was more evenly distributed in the high group (13 students), the medium group (11 students), and the low group (6 students). Based on the pretest and posttest values, it can be seen that the effectiveness of contextual learning using CCT is more effective when compared to non-CCT teaching materials, this is also supported by the experimental *N-Gain* value of 0.81 while the control class is 0.54. In addition, the effectiveness of the experimental class is also seen from the results of the effect size analysis with a value of 1,284 which means that there is a strong difference between the learning outcomes of the experimental class and the control class.

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