



## The RCCDE learning in understanding the concept of seawater invertebrates in tabuhan island bangsring banyuwangi, indonesia



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### Article Info

#### Article History:

Received 05 July 2022

Revised 29 September 2022

Accepted 19 October 2022

Published 30 November 2022

#### Keywords:

RCCDE model

Marine invertebrates

Tabuhan island

Concept understanding



### ABSTRACT

This research is essential to empower the understanding of the concept of invertebrate material that is difficult to observe because its habitat is in seawater. This research aims to reveal the effectiveness of the Reading Concept Map Connection Discussion Evaluation (RCCDE) learning model on students' conceptual understanding of Seawater Invertebrates. This type of research is a quasi-experimental, one-group pre-test and post-test design. The research data were analyzed using the N-gain score. The analysis results showed that the class average N-gain score was 0.71, which was greater than the N-gain score of 0.7 ( $g > 0.7$ ). This means that the RCCDE model is effective for students in understanding the concept of seawater invertebrates because it has high criteria. The individual average normalized gain analysis results found 20 students with a high standard of  $g > 0.7$  and 14 students with a gain score of  $0.3 > g > 0.7$ . On the medium criterion, there were no students with a score of  $g > 0.3$ . This shows the effectiveness of the RCCDE syntax in empowering concept understanding. Students play an active role in learning activities to find their problems and look for answers until they find answers and solutions.

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**Citation:** Hikamah, S.R., & Hariyanto. (2022). The RCCDE learning in understanding the concept of seawater invertebrates in tabuhan island bangsring banyuwangi, indonesia. *JPBIO (Jurnal Pendidikan Biologi)*, 7(2), 229-241. DOI: <https://doi.org/10.31932/jpbio.v7i2.1809>

### INTRODUCTION

Seawater invertebrates are wild animals living in marine waters, from shallow to deep waters (Hikamah, 2021b, 2021a). Related to this habitat, understanding the concept of marine invertebrates requires direct observation of specimens (Nugroho et al., 2017; Oktavia, 2018; Supratman et al., 2018; Tangke, 2010; Wahyuni et al., 2009). The observation helps obtain optimal understanding.

One of the goals of education is so that learners or students can understand the concepts they are learning. In general, understanding the concept refers to the cognitive process dimensions of Bloom's Taxonomy; namely knowledge (C1); understanding (C2); application (C3); analysis (C4); evaluation (C5); and creation (C6) (Amer, 2015; Ramayanti et al., 2018). From the understanding of Bloom's Taxonomy concept above, it has been revised and collaborated with the following four knowledge: 1) factual knowledge; 2) conceptual knowledge; 3) procedural knowledge; and 4) metacognitive knowledge (Amer, 2015; Tutkun et al., 2012; L. O. Wilson, 2016). Concept understanding is the reciprocal relationship between these factors. This allows these factors to work together, support, and complement one another.

The category of understanding includes knowing and understanding something he sees so that someone can express his understanding using his terms. Achieving optimal understanding requires the ability to capture the meaning and significance of a concept. Literally understanding the concept is interpreted as a person's ability to recognize and relate one concept to another based on the knowledge that has been possessed and obtained from previous learning experiences (Adhani & Rupa, 2020; Muqorrobin, 2016). Broadly speaking, understanding the concept includes interpreting, exemplifying, classifying, summarizing, concluding, comparing, and explaining (Hikamah et al., 2022; Muqorrobin, 2016; Wilson, 2016). The fact is that marine invertebrate material is a material that is difficult to understand because of its habitat in seawater, so it is not easy to see and study.

One of the parameters of learning success, among others, is understanding the concept (Vosniadou, 2019). Some indicators of concept understanding include the ability to express the concepts that have been studied, the ability to give examples of the concepts that have been studied, and the ability to relate the various concepts that have been studied (Adhani & Rupa, 2020; Hikamah et al., 2022). Expectations from learning are that all students can understand the concepts they are learning.

Based on previous research studies, the reality in the field is that many students still have a low conceptual understanding. Misconceptions are still common, especially among students at private universities in the Jember area. This gap is hoped to be overcome by applying the RCCDE learning model to optimize the understanding of seawater invertebrate concepts. This model has advantages because before learning. The students read the material and loaded the concept map. The students connect the concept map prepared with the specimens observed during the field study and continue with discussions so that the concept of invertebrates can be mastered.

This study aims to determine the effectiveness of the RCCDE learning model in understanding the concept of marine invertebrates, with the question: Does the RCCDE learning model affect students' understanding of marine invertebrate concepts on Tabuhan Bangsring Island?

## RESEARCH METHODS

### Research Design

This type of research is a quasi-experimental, one-group pre-test and post-test design. This study aims to reveal students' conceptual understanding of marine invertebrates by learning the Reading Concept Map Connection Discussion Evaluation model (RCCDE). The syntax of this model includes: 1) reading; students must read seawater invertebrate material which will be discussed at the next meeting, and 2) making a concept map from the material that has been read; 3) connections; connecting the material that has been studied and has been written on the concept map with the specimens found during the field study, in this study are specimens of marine invertebrates on the coast of Tabuhan Bangsring island; 4) discussions; students discuss in groups regarding the specimens found with the concept map that has been done previously; 5) evaluation;

students evaluate the results of the learning carried out. The study began with a pre-test, followed by implementation of the RCCDE model by conducting direct observations or field studies on seawater invertebrates on the Tabuhan Bangsring Island Underwater coast in Banyuwangi, Indonesia; at the end of the study, a post-test was carried out. The design of this study is presented in Table I.

**Table I.** Design of the Implementation of the RCCDE Model on Understanding the Concept of Seawater Invertebrates

T <sub>1</sub>	X	T <sub>2</sub>
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(Sugiyono, 2011)

Information:

T<sub>1</sub> : Pretest

X : Treatment: the use of the RCCDE model with a field study on the coast of Tabuhan Island Bangsring Underwater, Banyuwangi, Indonesia

T<sub>2</sub> : Post test

### Population and Samples

The population 182 of this study was students of the Biology Education Study Program at a private university in Jember City, East Java, Indonesia. The sample used in this study were students who took the Invertebrate Zoology course in the odd semester of the 2021/2022 academic year, totaling 34 people. The determination of this sample is based on the needs analysis results of students who took the Invertebrate Zoology course in the previous academic year, namely the odd semester of 2020/2021. The analysis revealed that the most challenging material for Invertebrate Zoology for students to learn was marine invertebrates because these animals are difficult to find due to their habitat in marine waters.

### Instruments

This study uses a conceptual understanding test instrument. The instrument is in the form of multiple-choice questions consisting of 50 questions. Before using the questions, the validity and reliability of the items were tested, and the validators were carried out by two experts from the invertebrate zoology course and an education expert. The statistical test results were declared valid and reliable, and the validation results were declared very valid by the validators. The question as an instrument is equipped with a grid of questions containing the Subject Learning Sub-Achievements and indicators, questions, answer keys, and assessment rubrics. Each question gets 2 points, so the maximum score is 100.

### Procedures

This research was carried out based on observations on understanding the concepts of students who took the seawater Invertebrate Zoology course in the previous semester. In this material, 55% of students have common conceptual understanding, 25% have moderate conceptual understanding, and 20% have high concept understanding. Based on this, research was conducted using the RCCDE learning model.

The research was started by doing a pre-test via a google form. The next activity assigned students to read material related to marine invertebrates. The readings were compiled into a concept map. In the next activity, students carried out field studies on Tabuhan Bangsring island, Banyuwangi. They explore the beach looking for specimens in the morning, starting at 04.30 – 08.00. The specimens found are taken and collected on the beach. Next, students make

Connections, which is connecting the concept map that has been compiled with the specimens found. The results of this connection are also discussed in groups on this beach. The following learning activity is to evaluate the learning process that has been carried out from the beginning to the results of the discussion. The study ended at 11.15 am by conducting a post-test using a google form.

### Data Analysis

The data from this study were analyzed quantitatively using the class average normalized gain score (N-gain score), which is the actual class average gain divided by the maximum possible class actual average gain, with the formula(Hake, 1999):

$$g = \frac{\%(gain)}{\%(gain)_{max}} = \frac{\%(post-test) - \%(pre-test)}{100 - \%(pre-test)}$$

Students are categorized as understanding the concept, determined based on the value of the N-gain score. Concept understanding is categorized as high if the value of  $g > 0.7$ ; understanding of the concept is categorized as moderate if the value of  $g$  is between  $0.3 > g > 0.7$ ; and understanding of concepts is categorized as low if the value of  $g < 0.3$ . The category of understanding this concept is presented in Table 2

**Tabel 2.** N-gain score criteria

N-gain score	criteria
$g > 0.7$	high
$0.3 > g \geq 0.7$	middle
$g \leq 0.3$	low

(Hake, 1999)

Therefore, the data obtained are normally distributed, proceed with the normalized analysis of individual averages. The analysis is carried out by comparing the class average normalized gain with the individual average normalized gain. Suppose the individual's N-gain score is  $>$  the class average N-gain score. In that case, this means that students with low scores during the pre-test experienced an increase in scores that were smaller or equal to students who got high scores during the pre-test. Suppose the individual's N-gain score is the class average N-gain score. In that case, this means that students with low scores during the pre-test experienced a greater increase in score than students who got high scores during the pre-test. The comparison of the class average normalized gain with the individual average normalized gain is presented in Table 3.

**Table 3.** Comparison of the class average N-gain score with the individual N-gain score

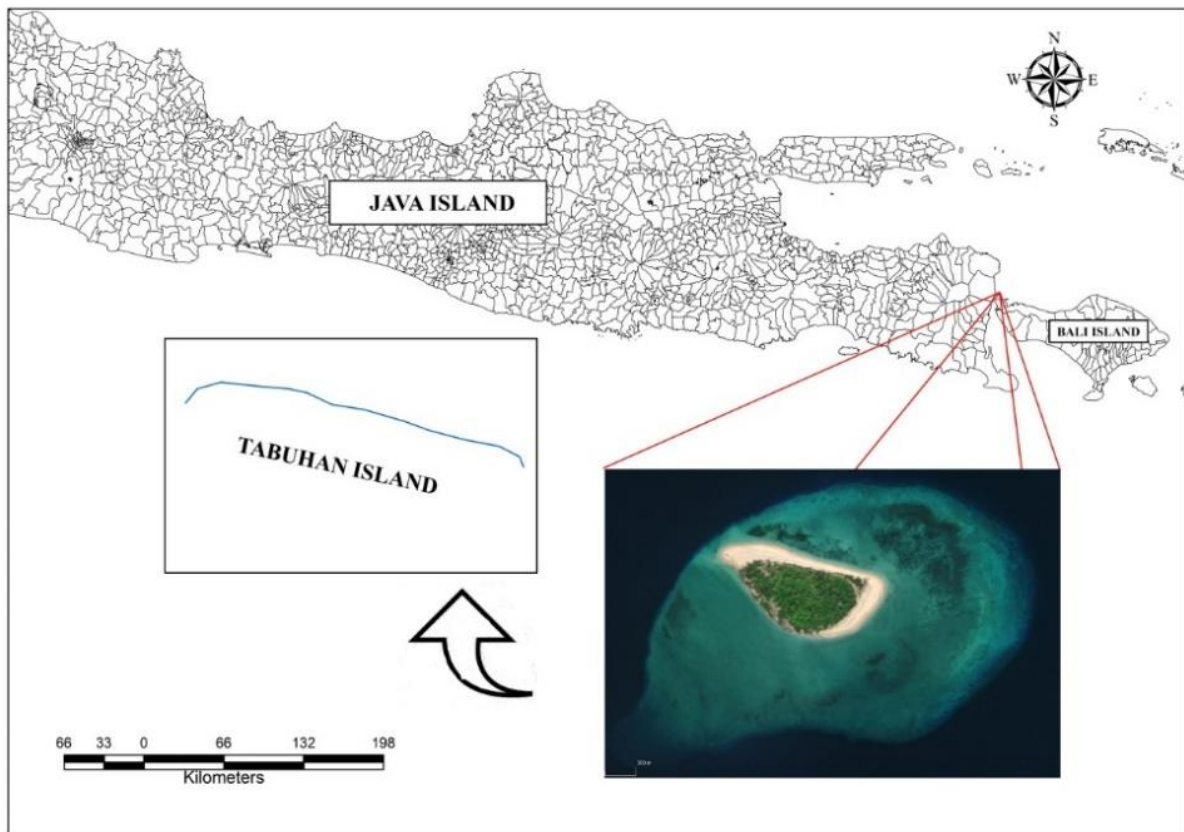
N-gain score comparison	N-gain score comparison	Conclusion
1	Individual N-gain score $>$ Class average N-gain score	students with low scores during the pre-test experienced an increase in scores that were smaller or equal to students who got high scores during the pre-test
2	Individual N-gain score $<$ Class average N-gain score	students with low scores at the pre-test experienced a greater increase in scores than students who got high scores at the pre-test

(Parno, 2015).

## RESULTS

### Research Site Map

The location of research on marine invertebrates was carried out on the coast of Tabuhan Bangsring Underwater Island Banyuwangi, East Java, Indonesia. The location map is presented in Figure I.



**Figure I.** Map of Tabuhan Bangsring Underwater Island Banyuwangi, Indonesia (Hikamah, 2021a).

### RCCDE Learning Process

The learning process using the RCCDE model is carried out as presented in Table 4.

**Table 4.** Learning using the RCCDE Model

RCCDE	Student Activities	Lecturer Activities	Description
<i>Syntax</i>			
<i>Reading</i>	Students read references related to marine invertebrates	Giving assignments to students to read marine invertebrates	Reading references, carried out outside of learning hours
<i>Concept Map</i>	Students write a map concept related to seawater invertebrates that they have read (example map concept, Figure 2).	Giving assignments to students to create a map concept written by hand	Creating a map concept carried out outside of learning hours
<i>Connection</i>	It connects the map concept that has been written with specimens found on Tabuhan	Accompanying students to look for specimens and	Held at Tabuhan Island Beach Bangsring Underwater Banyuwangi,

	<p>Island Beach Bangsring Underwater Banyuwangi, Indonesia (examples of specimens found in Figure 3), (examples of connection in Figure 4).</p>	<p>connecting the material studied previously with the specimens found.</p>	<p>Indonesia</p>
<p><i>Discussion</i></p>	<p>Students in groups discuss the results of the connection that has been made, group representatives present in front of the class, and members from other groups ask questions, give suggestions, and make corrections.</p>	<p>It is accompanying students in discussions, providing reinforcement, and revising students' answers that are not quite right.</p>	<p>It is carried out in the classroom during learning hours.</p>
<p><i>Evaluation</i></p>	<p>Evaluate the learning process that has been carried out from the beginning to the results of the discussion.</p>	<p>Assist students in conducting evaluations and providing reinforcement.</p>	<p>It is carried out in class, during learning hours after discussion.</p>

An example of a concept map that students have prepared is presented in Figure 2.

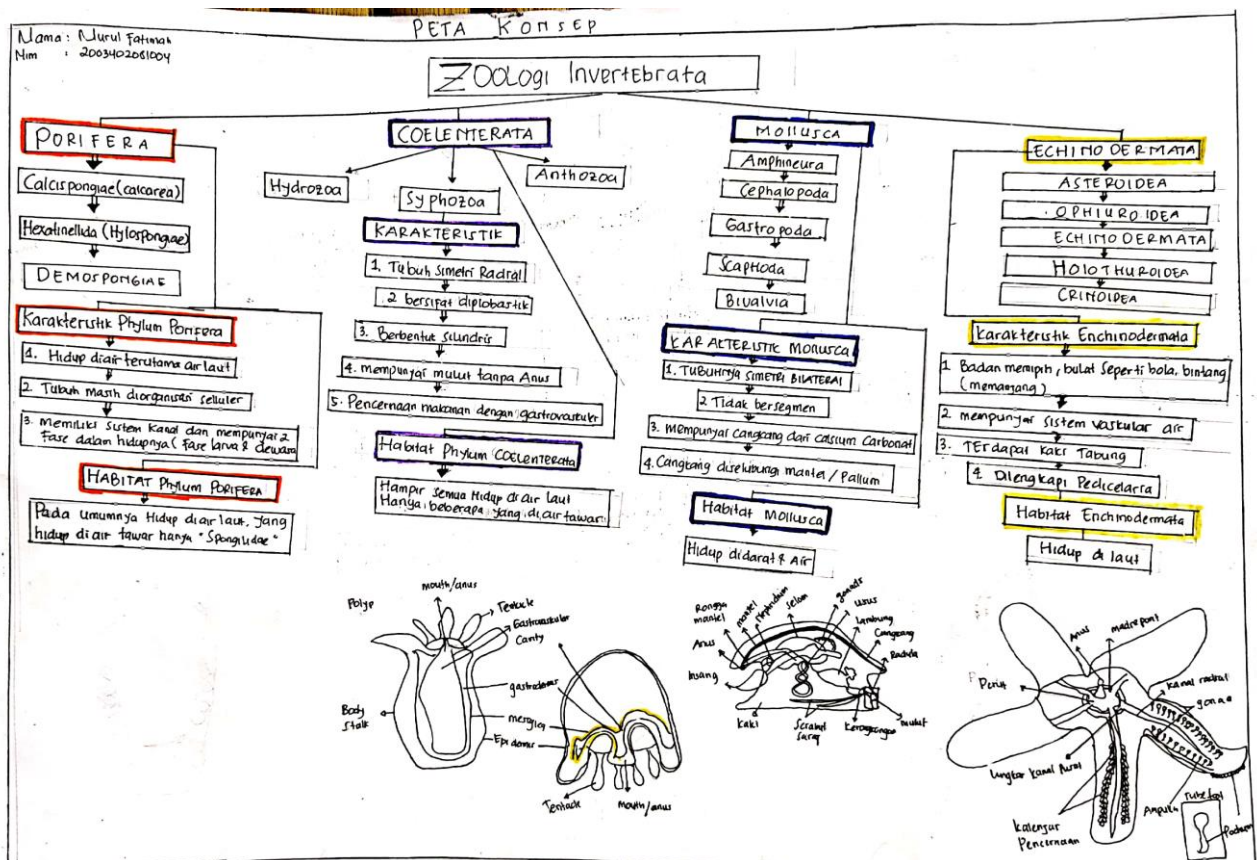


Figure 2. Seawater Invertebrate Map Concept

For example, the specimens found during the field study are presented in Figures 3a and 3b.



**Figure 3a.** Specimen found, from class Mollusca.

**Figure 3a.** Spesimen recovered from class Echinoderms

Connection activities between map concepts that have been compiled with specimens found in the field are presented in Figures 4a and 4b.



**Figure 4a.** Students explore the beach, looking for specimens



**Figure 4b.** Students connect the map concept that has been compiled with the specimens found in the field

### Pre Test and Post Test Results - Effectiveness of the RCCDE Model on Understanding the Concept of Seawater Invertebrates

This study's pre-test and post-test were carried out online using Google Drive. Analysis of the pre-test results data obtained before the learning was carried out using the RCCDE model and the post-test results after the RCCDE model learning to understand the concept of seawater invertebrates received an N-gain value of 0.71. The results of the analysis are presented in Table 5.

**Table 5.** Results of N-gain analysis

Action	Pre-test mean score	Posttest mean score	N-Gain	Category
Learning Using the RCDE Model	60.24	88.44	0.71	High

Source: Personal Documents

The analysis of the class average N-gain score obtained a value of 0.71. This means that the N-gain score of the research results is greater than the N-gain score of 0.7 or  $g > 0.7$ . Based on the

analysis results, it can be concluded that the application of the RCCDE learning model in the Invertebrate Zoology Course learning, especially on marine invertebrate material, is in high criteria.

### Individual N-gain Score Results

The analysis of the average normalized individual N-gain score obtained a value of  $g > 0.7$  for a total of 20 students, and this means that the deal is within the high criteria. In addition, it received a value of  $0.3 > g \geq 0.7$  for a total of 14 students; this means that the value is in the medium criteria. In this study, no deal was found at  $g \leq 0.3$ . The normalized individual N-gain score data are presented in Table 6.

**Table 6.** Individual N-gain Score Results Data

Individual N-gain score	Number of Students	Criteria
$g > 0.7$	20	High
$0.3 > g \geq 0.7$	14	Middle
$g \leq 0.3$	0	Low
Total	34	

Source: Personal Documents

### Comparison of Class Average N-gain Score with Individual N-gain Score

The analysis results inform that the data is normally distributed; therefore, a comparison test was conducted between the class average normalized gain and the individual average normalized gain. The results of the analysis found that the individual N-gain score value  $>$  the class average N-gain score found 20 students; this means that students with low scores during the pre-test experienced an increase in scores that were smaller or equal to students who got the high score at the time of the pre-test. Individual N-gain score the class average N-gain score was found by 14 students; this means that students with low scores during the pre-test experienced a higher score increase than students who got high scores during the pre-test. The comparison data of the class average N-gain score with the individual N-gain score can be seen in Table 7.

**Table 7.** Comparison of the N-gain score of the average class with the N-gain score of the individual

Individual N-gain score	N-gain grade average score	Individual N-gain score (number of students)	Conclusion
$g > 0.7$	0.71	20	Students with low scores during the pre-test experienced an increase in scores that were smaller or equal to students who got high scores during the pre-test
$0.3 > g \geq 0.7$		14	Students with low scores in the pre-test experienced a more significant increase in scores than students who earned high scores in the pre-test

## DISCUSSION

The implementation of marine invertebrate learning on the Tabuhan Bangsring Underwater island beach has been carried out according to the planned RCCDE syntax. When reading, students read material related to marine invertebrates from various sources. Good reading can help students retain text (Anjulo et al., 2017; Hayashi, 1999; Saori, 2022). Other studies reveal that

excellent and correct reading can improve writing competence (Bai & Wang, 2020). Therefore, reading the material before learning helps students understand it well.

The material that students have read is poured into the form of a concept map. The freedom of students to express their understanding in the form of a concept map, according to their talents, interests, and culture, can optimize student understanding so that student's understanding of concepts is in the high category (Hirschfeld & Gelman, 1994). In addition, the skill of expressing one's thoughts through a concept map is a shortcut to success in studies because speed reading and making concept maps can win students over in mastering the material and retaining the memory of the subject matter (Buzan, 2006).

Connection is an essential syntax in this learning model because the concept map that has been studied previously is connected with the findings of students in the field, namely seawater invertebrates on the beach. This can strengthen the understanding of concepts for students. Previous research has shown that learning biology outdoors has a positive cognitive and neurocognitive impact on long-term memory compared to learning indoors (Fägerstam & Blom, 2013). This learning combines the theory that has been compiled in the form of a concept map with the actual conditions of the animals so that students understand the concepts they are learning.

Discussion is the stage of exchanging ideas and exchanging experiences between students. The experience is obtained from the results of the previous connection. At this stage, students complete their conceptual understanding from information obtained from discussion partners, so the RCCDE model is very effective in empowering the understanding of marine invertebrate material concepts because it gains a complete understanding both from concept maps, field studies, connections, and discussions, so that answers are found—moreover, solutions to problems or things that were not understood when making the concept map. Previous research has informed that group discussions are good for improving speaking skills, critical thinking, communication skills, and understanding of concepts (Fikrina et al., 2021).

Evaluation is the final stage of the RCCDE model; at this stage, students, together with the course lecturer, evaluate all learning materials and all processes that have been carried out. The results of the learning evaluation inform that this model makes it easier for students to understand the concept of marine invertebrates and provides significant insight because they see the animal habitat firsthand; this model adds knowledge because after observing directly, they discuss it with their friends.

Previous research using the RCCDE model informed that the model affected the cognitive learning outcomes of junior high school (SLTP) students on the following materials: the excretory system (Unay et al., 2019), the respiratory system (Laili et al., 2019), the digestive system human (Isro'i et al., 2021), air pollution (Syaifullah et al., 2020). In addition, this learning model can also improve the cognitive learning outcomes of junior high school students on the following materials: the respiratory system (Jamaliyah et al., 2020), the interaction of living things with their environment (Wulandari et al., 2021), and global warming (Sholeha et al., 2020). The study's results using a similar learning model, namely Reading-Questioning-Answering (RQA), can improve students' understanding of concepts (Sagala et al., 2019). Good understanding of concepts is the key for students to master quality knowledge, which can affect students' critical and creative thinking skills (Sagala et al., 2019), as well as students' communication skills (Hikamah et al., 2021).

All the syntax created in the RCCDE model supports successfully understanding students' concepts. This is because this model has a mutually sustainable syntax and supports each other in understanding the concept. This learning model is also a learning model using a constructivist approach; therefore, this learning model is student-centered, and students play an active role in

learning activities so that they find their problems look for answers until they find answers and solutions (Aljohani, 2017; Olusegum, 2015; Sulistyowati, 2019).

## CONCLUSION

N-Gain calculation data, which shows an average score of 0.71, indicates an increase in students' understanding of The Concept of Seawater Invertebrates after learning with the RCCDE model. The RCCDE learning model is one of the constructivist learning models. Students who have read invertebrate material and write down the material they have learned into a concept map are then connected to the specimens found during field studies. The results are discussed with their friends and evaluated with the course lecturers. The results of this study inform that the RCCDE learning model effectively understands the concept of marine invertebrate material. This is because the syntax of this model is mutually sustainable and supports one another so that students can understand the concepts they are learning. The author recommends that the RCCDE model needs to be investigated in other learning materials.

## ACKNOWLEDGMENT

The author's thanks go to Mr. Saman Hudi, S.Ag., M.Si. As the head of the Institute for Research and Community Service, Jember Islamic University, who has permitted to conduct research; Mr. Arifin Nur Budiono, S.Pd., M.Sc., as the Dean of FKIP who has approved researchers to carry out research; Mr. Sukirno, as the head of Bangsring Underwater management, who has given permission and helped provide facilities and infrastructure during the researchers carrying out this research: Brother Agung Prasetyo, S.Pd., and Nur Laila Avika Rahmawati, S.Pd., who have helped researchers during the implementation this research.

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